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IESE

FRAUNHOFER INSTITUTE FOR EXPERIMENTAL SOFTWARE ENGINEERING IESE

ANNUAL REPORT

2008

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 information systems and medical devices 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 57 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

60 YEARS OF CREATING THE FUTURE

Dear readers,

We are sure that you have noticed it already: Our annual report has a new design. Straightforward, modern, and progressive is how we want to present ourselves in light of a "round" anniversary. On 26 March 1949, that is, about 60 years ago, the Fraunhofer-Gesellschaft was founded at the Bavarian Ministry of Economic Affairs. With this new organization, the founding members intended to support applied research and thus help to ensure that Germany will be fit for the future. Today, more than 15,000 employees worldwide are working with much know-how and enthusiasm on projects that will bring progress to us all.

Software is a central issue for the progress being made in our daily lives, which are increasingly permeated by computer technology. For us software engineers, the year 2008 held another anniversary: The term "Software Engineering" was first coined exactly 40 years ago – coincidentally, at a NATO conference in the German city of Garmisch. Four decades later, this research area – which used to be interesting mainly in academic circles – has made it all the way into our homes: Fraunhofer IESE has received the first award for its scientific research in the area of "Ambient Assisted Living" as a "Selected Landmark 2008" in the context of the initiative "Germany – Land of Ideas".

Moving forward, making progress, designing the future: All of this is hardly possible without the willingness to change. As a consequence, our business area "Telecommunication, Telematics and Service Providers" will soon no longer be identified as such; nonetheless, our competencies in this area will continue to be accessible to our partners and customers. In parallel to this change, we are successively expanding our range of services offered with additional, innovative application areas. Accompanied by extensive investments, for instance into a high-performance photovoltaics system, Fraunhofer IESE will

promote research into software platforms for energy management systems in the year 2009, under the working title "e-Energy". Software technology in the service of environmental conservation, convenience, and feasibility is embarking on the road from the solar cell to the Internet of Energy!

This annual report once again reflects the versatility of software-related technologies and their applications. Learn more about safe systems in plant and vehicle manufacturing, discover strategies for more efficient medical technology applications through usability, or get information about state-of-the-art developments aimed at a networked, citizen-oriented public administration.

Last but not least: While the automotive industry is still talking about one of its most severe crises, the first conference "Digital Commercial Vehicle Technology" at the Fraunhofer Center in Kaiserslautern was a major success and has earned us another award as "Selected Landmark 2009". Software and systems engineering thus also as a way out of the crisis? There is much that would suggest this. Find out for yourself – on the following pages!

Wishing you stimulating and informative reading –



Dieter Rombach



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.

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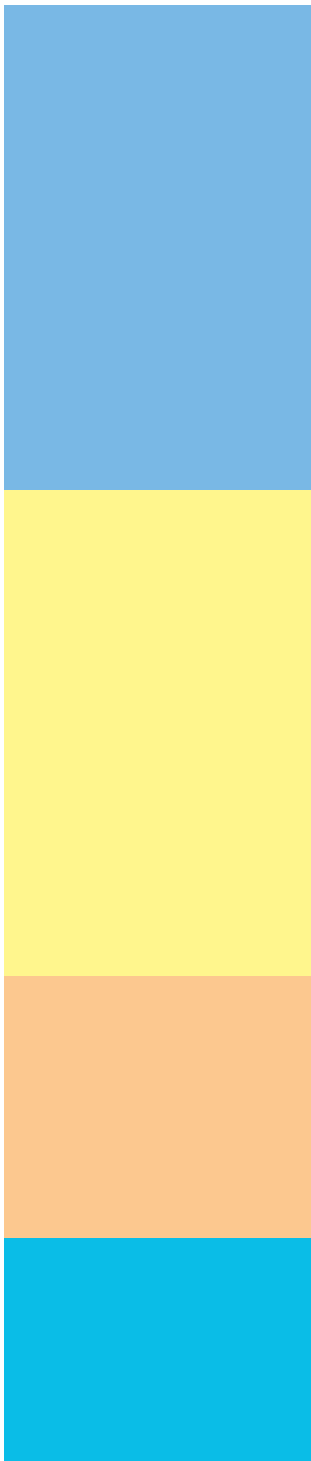
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HIGHLIGHTS IN 2008

ANNUAL CONFERENCE ON DIGITAL COMMERCIAL VEHICLE TECHNOLOGY

On 22 October, almost 150 design engineers, developers, and decision makers met at the Fraunhofer Center in Kaiserslautern for the 1st Annual Conference on “Digital Commercial Vehicle Technology”. This professional conference with high-level speakers covered a detailed presentation of the Fraunhofer Innovation Cluster as well as a wide range of specialized topics. Operational demands, diagnosis systems, simulation processes, and software technology in commercial vehicles were the core topics of this conference, which was organized jointly by the Fraunhofer Institutes for Experimental Software Engineering IESE and for Industrial Mathematics ITWM for experts from research and industry. For the innovative conference and the accompanying technical exhibit, the Fraunhofer Center received the 2009 “Selected Landmark” award in the contest “365 Landmarks in the Land of Ideas”.

Modern commercial vehicles are just as unthinkable without software technology as industry and business are without commercial vehicles – this is what all the welcome address speakers agreed upon at the opening of the conference. Rhineland-Palatinate Minister of Economic Affairs Hendrik Hering emphasized especially the central importance of the innovation cluster “Digital Commercial Vehicle Technology” (DNT) for the state of Rhineland-Palatinate and noted that this cluster is a text-book implementation of applied and thus business-relevant research.

In the technical part of the conference, companies presented results of their application projects in clusters and explained the current technological challenges. The research institutes presented results from preliminary research, which will be available for transfer projects into industry within the near future.

Commercial vehicle technology enables mobility!

The solution competence of the Fraunhofer institutes was also illustrated in an accompanying technical exhibit by means of demonstrators and examples. “I have rarely experienced such good opportunities for exchanging experience with interesting discussion partners!” was the enthusiastic reaction of one participant from the supplier industry. Prof. Dieter Rombach and Prof. Dieter Prätzel-Wolters expressed their conviction that this first annual conference would constitute the starting point for a series of events in the area of commercial vehicle technology that would be strongly noted Germany-wide in academia and industry. The directors of two of the cluster’s major partners, the Fraunhofer Institutes for Experimental Software Engineering IESE and for Industrial Mathematics ITWM, predicted a positive future for the innovation cluster.

The goal of this innovation cluster, which is funded by the state of Rhineland-Palatinate and by the Fraunhofer-Gesellschaft, is to strengthen the research and development competence of the partner companies. In this collaboration, work on research projects and industrial application projects is done by coordinating the topics. The Fraunhofer institutes in Kaiserslautern, ITWM and IESE, closely collaborate with leading industrial partners. Active partners include Bosch, Daimler, John Deere, Keiper, Lösi, MBtech, Schmitz Cargobull, GE Transportation Systems, and VOLVO. Additional interested companies are invited to participate in the innovation cluster..

Further information:

www.nutzfahrzeugcluster.de

22/10/2008

KONFERENZ

Prof. Dr.
Ulrich Buller

Vorstand der Fraunhofer-Gesellschaft





PRACTICE-ORIENTED RESEARCH IN NETWORKS WITH VIERforES AND SPES 2020

The year 2008 was characterized by a clearly visible spirit of optimism in the German research environment, with Fraunhofer IESE getting involved in two strategic network projects. On the one hand, these are characterized by a large degree of interdisciplinarity – resulting from the realization that tight interaction between a wide variety of technical disciplines in industrial practice also makes it indispensable to intensify interdisciplinary collaboration in academia as well. On the other hand, one cannot deny the special practical relevance of the extensive consortium projects: They deal with problems that in many cases have not been resolved yet today but that are solvable, and which are especially urgent in our modern everyday life with its strong orientation towards information and communication technologies. The technical focus is on the so-called embedded systems, which contain more than 90% of all microprocessors produced worldwide – with increasing tendency. The aim of the interdisciplinary top research projects VIERforES and SPES 2020 is therefore especially vigorous research on selected aspects of these systems, which are about to pervade every corner of our lives. State-of-the-art technologies must also take into account human and social facts if they want to really remain “ahead”.

The research project VIERforES - Virtual and Extended Reality for Highest Safety and Reliability of “Embedded Systems” was officially launched on 4 September 2008 in Magdeburg with a collaboration agreement being signed by Prof. Klaus-Erich Pollmann, President of Otto-von-Guericke University Magdeburg; Prof. Michael Schenk, Institute Director of Fraunhofer IFF; Prof. Helmut Schmidt, President of the University of Kaiserslautern, and Prof. Peter Liggesmeyer, Institute Director of Fraunhofer IESE. The Federal Ministry of Education and Research (BMBF) provides 7.5 million euros worth of support in the context of the initiative “Top Research and Innovation from the New German States”.

Today, computer technology rules our daily lives. “Embedded systems” increasingly control and monitor devices whose daily use we take for granted. In order for the integrated software to function properly, researchers from Magdeburg and Kaiserslautern are now jointly working on concepts intended to help manufacturers perfect their products. The aim of the scientists is to make technical devices safer and more reliable.

Pooling innovation power for maximum research efficiency

In developing safer and more reliable technology, the scientists want to make use of the advantages offered by virtual reality. What is actually invisible shall take shape in cyberspace in the future. In the virtual reality, one can then observe exactly how the software integrated into machines and devices behaves. The lessons learned from this research will be incorporated straight into the development process and will make DVD recorders, cars, or entire power plants safer and more reliable. The enormous need for research is particularly evident in the



areas of automotive, medical, energy, and material flow technology. Modern vehicle technology, for instance, has become unthinkable without “embedded systems”. In every car, 50 to 100 microcontrollers with far more than 1 million lines of code are performing numerous controlling and monitoring tasks, including many safety-relevant functions such as ABS. One way to better master this complexity is the use of virtual development and testing methods, which shall be investigated in the context of VIERforES.

SPES 2020

The network project “Software Platform Embedded Systems 2020” – SPES 2020 for short – was launched by the Federal Ministry of Education and Research (BMBF) as a strategic funding project in the area of embedded systems. The University of Kaiserslautern as well as Fraunhofer IESE as partners in the consortium will take over important work packages. During the project’s initial duration of three years, a total funding of 23 million euros will be available.

In Kaiserslautern, embedded systems have been highly popular in research and development for years: Acceptance into this nation-wide alliance project with a funding of 1.5 million euros is in recognition of what has been achieved so far and provides motivation to face the upcoming challenges. The working groups at the university will mainly deal with empirical evaluation of methods and processes for the safety analysis of safety-critical systems developed in a model-based way. The various departments of Fraunhofer IESE with their industry experience will complement this basic competence with their expertise proven in practical applications. The main focus

will be especially on the change of paradigms in developing embedded software – from individual programming of single systems to model-based processes, including automatic code generation and quality assurance.

The fundamental lessons learned in this manner will be incorporated into application projects from the domains of avionics, medicine, automotive technology, and automation technology. The majority of the respective industry partners are major corporations, whose research and development potential makes them particularly suitable for the amount of work expected. These also include domain giants such as Siemens AG, Robert Bosch GmbH, and the aerospace company EADS.

OPEN HOUSE AT FRAUNHOFER IESE

29 October was an important date: In the context of the national initiative "365 Landmarks in the Land of Ideas", Fraunhofer IESE received the award "Selected Landmark 2008" and then opened its doors to the general public with a colorful program consisting of guided tours, exhibits, and presentations.

Fraunhofer IESE received this award as "Selected Landmark 2008" from Deutsche Bank and the initiative "Germany – Land of Ideas" especially for its work in the area of Ambient Assisted Living systems. Following presentations on the topic of "Ambient Intelligence – Assisted Living", Dieter Bertram from Deutsche Bank handed the cup and the certificate over to the executive director of Fraunhofer IESE, Prof. Dieter Rombach, the project's consultant and former professor at the University of Kaiserslautern, Prof. Jürgen Nehmer, as well as to the leaders of the Ambient Assisted Living project, Dr. Martin Becker and Dr. Thomas Kleinberger. The honorary guests included Ministerial Councilor Dr. Rainer Jansen from the Federal Ministry of Education and Research BMBF, the Lord Mayor of Kaiserslautern, Dr. Klaus Weichel, and the Rhineland-Palatinate state secretary Michael Ebling.

Following the award ceremony, Fraunhofer IESE invited interested citizens to get an entertaining impression of the world of software research. This included visits to areas that are normally not accessible to the public. Especially the Assisted Living Laboratory, which is well-known beyond Kaiserslautern, had been received enthusiastically by many visitors – including German President Köhler, who got a first-hand look at the fascinating opportunities offered by this special kind of laboratory environment during his visit last year.

Under the motto "Experience Research Firsthand", visitors were able to get some practical experience of what the abstract term "Software Engineering" means in daily life. For example, software is one of the main things responsible for the smooth travel of millions of cars on our roads and for the truly gigantic tasks mastered by construction and com-

mercial vehicles in industry and technology. The engineers of Fraunhofer IESE provided live demonstrations at a computer-controlled testbed of how automobile manufacturers ensure functionality and safety using Fraunhofer know-how. Another alternative for visitors was to operate a model excavator and get software-supported assistance when executing difficult maneuvers.

Experience Research Firsthand!

An industrial exhibit set up inside the institute's atrium offered the opportunity to talk to software experts in an extraordinary architectural setting. In parallel, current short films from the Fraunhofer universe were shown on the big screen in the auditorium of the representative building complex. Live demonstrations of agricultural information systems in cooperation with the state of Rhineland-Palatinate were also offered; furthermore, visitors were able to watch visualization presentations on 3-D graphic systems and autonomous robots in a maze. Comprehensive information for school and university students as well as various artistic performances complemented the Open House program.

Awarded:

The Fraunhofer IESE received the award "Selected Landmark 2008" for the main research area "Ambient Assisted Living". In the picture you can see Dieter Bertram from Deutsche Bank (third from left) handling the award to Prof. Dieter Rombach, Executive Director of the Fraunhofer IESE (right). Also in the picture (from left to right): Prof. Jürgen Nehmer, University of Kaiserslautern; Prof. Christian Madler, Westpfalz-Klinikum; Dr. Martin Becker, Fraunhofer IESE; Dr. Thomas Kleinberger, Fraunhofer IESE.



NEW AT THE INSTITUTE: PROF. ALEXANDER PRETSCHNER FRAUNHOFER IS SIMPLY ATTRACTIVE!

Since 1 September 2008, Fraunhofer IESE does not only have a young top researcher “on board”, but also another new research area. Prof. Alexander Pretschner came to the western Palatinate region from ETH Zurich – an unusual move, which is yet very obvious. We have interviewed Prof. Pretschner regarding his work and his upcoming projects.

? Prof. Pretschner, you are working at the Fraunhofer Institute for Experimental Software Engineering in Kaiserslautern in the context of the research grant program “Fraunhofer Attract”. What exactly does this program stand for?

! The research grant program “Fraunhofer Attract” offers external scientists the opportunity to pursue basic research geared towards market-oriented application within a Fraunhofer institute. My focus will be on so-called “Distributed Data Usage”. As assistance in this project, I am receiving generous support from the Fraunhofer-Gesellschaft in addition to the projects I am bringing with me. Fraunhofer IESE is an ideal location for my endeavors, which are ambitious in numerous regards.

? What is the meaning of the term “Distributed Data Usage” and what is the practical relevance of this topic in information and communication technology?

! Regardless of whether we do teleshopping, visit the doctor, use the Internet to make a phone call, do online banking, or perform a search in the WWW: In all these cases, more or less personal data are generated, and data must always be provided if we want to achieve or get something. One central question arising from this is: How do I control the usage of data once I have given them out – in order to generate added value for myself, no doubt – and how do I avoid abuse, respectively uncontrolled distribution? Just think of the recent, unintentional distribution of customer data from large telecom companies or the already almost regular loss of sensitive data by the British government! This is exactly where the idea of data usage control starts off. Wherever data worth being protected are generated and processed in networked systems, distributed data usage control is indispensable. Protecting individual privacy is just as important as protecting immaterial business assets – just think of the heatedly discussed issue of copyright infringement in the media sector, which also illustrates very clearly that the end user should not be restricted too much. In addition, usage control also serves to protect secrets in general, such as university test results or contracts with partners of IESE.

? As a scientist, you have seen a lot of the world already. Your last job was at ETH Zurich. What was the main reason for your decision to come to Germany and specifically to Kaiserslautern?

? Admittedly, the support from Fraunhofer did play a certain role in deciding where to go. However, in this case, the decisive factor for me to join IESE in Kaiserslautern was the ideal interaction of basic research, empirical studies in an application context, the close proximity to industrial practice, and the possibility of embedding my research in the University of Kaiserslautern. Together with the University of Kaiserslautern and other research institutions, the institute is embedded into a research environment that is exceptionally dynamic especially in the area of IT. I think that the resulting synergy factor is an



Prof. Dr. Alexander Pretschner graduated from RWTH Aachen with a Diploma in Computer Science and from the University of Kansas with a Master of Science and then did his Ph.D. at TU München on the topic of “Model-based, functional testing of reactive systems”. After his time as an assistant professor at ETH Zurich as well as visiting professorships in Innsbruck, Trento, and Rennes, Alexander has been in charge of the working group “Distributed Data Usage” at the Fraunhofer Institute for Experimental Software Engineering (IESE) in the context of the research grant program “Fraunhofer Attract” since 1 September 2008. Furthermore, since the winter semester 2008/09, he has held the chair for “Security of Distributed Data and Systems” at the University of Kaiserslautern.

enormous advantage for a location, especially for such challenging and extensive project.

? Fraunhofer IESE performs research and development in all areas of software development, software quality management, and software competence management. What is your personal goal for your work at the institute?

! First of all, I will establish a working group at Fraunhofer IESE; plans call for a total of five full-time staff for the duration of the project. At the same time, I will begin my work as a professor at the University of Kaiserslautern in charge of the Security of Distributed Data and Systems Research Group. Intensive collaboration with the institute’s scientific departments is already on the horizon. In particular, I would like to mention the work in the areas of Virtual Office of the Future and Ambient Assisted Living. Other points of contact will include the departments for requirements engineering, usability, processes and measurement, testing, and IT security – and I am sure there that these will be joined by others, hopefully soon. I am looking forward to contributing my knowledge and my skills to exciting joint projects. My field of work, “Distributed

Data Usage”, builds so directly on the central paradigm of the networking of our digital world that one may as well call it an interdisciplinary topic. This is also one of the major reasons why it was important for me to find Fraunhofer IESE as a competent partner, a partner who represents the extensive area of software engineering in its entire breadth and has the necessary experience from the basics all the way to industrial application.

? What are the central challenges in the area of “Distributed Data Usage”?

! The central problem is that I want to control the actions of my counterpart, who is basically autonomous, or that I at least want to know if he does not adhere to an agreement. At first glance, this does not seem to be possible at all – just as nobody can stop me from crossing the street when the traffic light is red. There are quite a number of conceptual and practical problems that might evolve into stumbling blocks for entire technology areas and thus urgently require solutions. Nowadays, once you have given out your data, you normally have hardly any chance to really monitor its future usage in any reliable way. In other words: Anyone who gets a hold of these data can initially use them in whichever way he pleases. Experience has shown that prior declarations of obligation, which have long been in use in business transactions, or legal action in case of abuse only constitute limited means for avoiding damages resulting from unauthorized data usage. Current procedures, e.g., regarding secure authorization of data access, are limited to controlling access in the past and in the present. However, it is hardly possible to retroactively change the usage possibilities of data once they are in circulation, unless precautionary measures are taken. During the next five years, I want to understand how usage control might work and also, where it will not work. In particular, I want to build systems with my co-workers that are able to enforce usage control requirements in very different ways and on totally different levels of abstraction.



DENIT

Continuation

? Issues from the area of information security, such as the protection of personal or business data or the protection of intellectual property in distributed business processes, will continue to gain importance in our networked world. How do you assess the development of this area of information security and the social constraints it entails when you look at the future?

? !The issue of information security will continually gain more importance in the years to come. You can already feel this very clearly today when you look at the controversial discussions surrounding data protection issues and privacy in on-line activities. The acceptance of modern communication and information technologies significantly depends on whether users feel understood and respected and whether they are able to operate the systems in the first place! Even though individual interests may be contradictory in some cases and compromises will certainly be necessary, the social constraints for more information security are becoming obvious for everybody: Just look at the increasing awareness for the risks arising from global networking. However, not only the human factor needs to be considered, but so do the business aspects, which are no less important. In times where added value in global business transactions is characterized more and more by non-material and thus electronically tradable "goods", proper information security is an invaluable asset. Free access to information is just as important economically as, for instance, protection of intellectual property or protection from plagiarism and illegal distribution. Thus, there are economic reasons why the interest in research topics such as "Distributed Data Usage" is remarkably high, also from the part of commercial content providers. Altogether, I expect a very dynamic development of technologies, methods, and tools, whose widespread usage has basically only just begun.

THE GERMAN CENTER FOR EMERGENCY MEDICINE AND INFORMATION TECHNOLOGY

State-of-the-art research must also take into account human and social aspects if it wants to really remain "state of the art". And there is hardly any human area where high-tech gets closer to humans than the field of medical technology. Take emergency medical rescue: Every day, hundreds of medical emergencies occur in Germany that are time-critical and/or require intensive medical support. Very often, we are talking about seconds – even minor logistical, organizational, or technical problems along the usually complex rescue chain can lead to a dramatic deterioration in the patient's prognosis. State-of-the-art IT systems technology shall now help to achieve major improvements. After a 6-month preparation phase, the "German Center for Emergency Medicine and Information Technology" (DENIT) started its project work at the beginning of 2009 as one of the most important improvements in German emergency medical services.

With the German Center for Emergency Medicine and Information Technology DENIT, Fraunhofer IESE is establishing a research and development institution dedicated, among other things, to developing systems for optimized logistics and communication structures in emergency medicine. Providing the population at large with efficient emergency medical services calls for modern, state-of-the-art optimization approaches.



With its focus on research in emergency medicine logistics and systems, DENIT will contribute to investigating workflow-optimized process chains, highly reliable system architectures, as well as high-performance infrastructures for logistics and communication in emergency medical services, and will help to transfer these into emergency medicine practice. The importance of empirically validated procedures in emergency medical services is enormous: Nowadays, the role of information and communication technology is just as important in the rescue chain from the emergency physician to the hospital as that of medicine itself. Appropriate system architectures as well as demonstrably correct methods, technologies, and tools must ensure that this chain is not broken..

Software engineering for more efficient emergency medical services: IT for medical emergencies

DENIT will initiate numerous research and development activities and thus make an important contribution to the improvement of medical and social logistical structures. Design and setup of mission databases, expert systems, communication infrastructures, and telemedicine networks are only a few of the areas in which DENIT will be active. In addition, the research center will provide extensive services to industry and the public sector. These will include, in particular, technology transfer in the area of software and systems engineering and, in collaboration with other areas of IESE, the development of state-of-the-art education and training programs (simulation, e-Learning) in the application domain of emergency medical services.

In addition to Fraunhofer IESE and the Westpfalz-Klinikum Kaiserslautern, other partners will be included in DENIT during the project's runtime.

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Moscow, Russia

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 57 Fraunhofer Institutes. The majority of the 15,000 staff are qualified scientists and engineers, who work with an annual research budget of €1.4 billion. Of this sum, more than €1.2 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
- Dr. Ulrich Buller**
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Planning
- Dr. Alfred Gossner**
Senior Vice President Finances
and Controlling
(incl. Business Management,
Purchasing, Real Estate), IT
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and Legal Department



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.

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, a project funded by the German Federal Ministry of Education and Research.

The partners are

- Brandenburg University of Technology, Cottbus
- Fraunhofer Institute for Computer Architecture and Software Technology FIRST, Berlin
- Fraunhofer Institute for Applied Information Technology FIT, St. Augustin
- Fraunhofer Institute for Experimental Software Engineering IESE, Kaiserslautern
- Fraunhofer Institute for Information and Data Processing IITB, Karlsruhe
- Fraunhofer Institute for Software and Systems Engineering ISST, Berlin
- Oldenburg Research and Development Institute for Computer Science Tools and Systems OFFIS, Oldenburg
- Institute for Computer Science IV, Technical University of Munich, Munich

The mission of 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 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









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)*

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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 studies, technology consulting, and contract research for new products and services. In addition to feasibility studies, it also investigates end-user acceptance and produces market analyses and cost-benefit assessments. The Fraunhofer ICT Group comprises 14 institutes as full members and three associated members, representing a workforce of roughly 3000 employees. 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 ICT Group conducts activities within a wide range of business fields, including information and communication technologies for:

- Medicine and life sciences
- Traffic and mobility
- Culture and entertainment
- E-business
- E-government
- Production
- Digital media
- Software
- Security
- Communication systems and interdisciplinary applications

The member institutes possess considerable experience in the innovative development of new technologies, particularly mobile networks and data transmission, information security, software engineering, knowledge management and information logistics, e-learning, embedded systems, electronic commerce, virtual and simulated reality.

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
- Information and Data Processing IITB
- 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)

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FRAUNHOFER eGOVERNMENT CENTER

The Fraunhofer eGovernment Center is an alliance of nine Fraunhofer institutes offering eGovernment services for Germany and Europe on the basis of their individual competencies ranging from application knowledge and technology know-how to the development of solutions.

The services offered include consulting and evaluation services, such as technology assessments, reorganization of business processes, software development, evaluation and development of security solutions, as well as project execution, quality assurance, support in standardization, and know-how transfer. The Fraunhofer eGovernment Center is strictly manufacturer-independent.

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.

On the occasion of the 3rd National IT Summit Conference in Darmstadt on 20 November 2008, the study "Scenarios for the Future - Ideas for a Comprehensive German eGovernment Strategy" was presented. The study, to which scientists from the Fraunhofer eGovernment Center made major contributions, can be downloaded free of charge from the website of Fraunhofer IESE.

Further information:
Study "Scenarios for the Future"
www.iese.fraunhofer.de



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FRAUNHOFER TRAFFIC AND TRANSPORTATION ALLIANCE

The Fraunhofer Traffic and Transportation Alliance develops technical and conceptual solutions for public-sector and industrial customers and translates them into practical applications. It does this by identifying future developments and guiding the focus of sponsored research programs. The Alliance analyzes market requirements and develops system solutions in multi-institute collaborative projects. It also draws together and markets the expertise of its members in the field of traffic and transportation. Workgroups such as FVV-Automotive help to assure a close relationship with the sector. International research programs and contracts from around the world ensure that the member institutes maintain links to companies and research organizations involved in traffic and transportation worldwide. The Alliance's central office brings together suitable partners.

Fraunhofer IESE is a member of the working group FVV-Automotive, where it actively contributes its experiences with manufacturers and suppliers in automotive software engineering. Especially specific competencies such as mastering the safety and dependability of software are issues in high demand.

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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.

Business areas

- Ambient Intelligence
- Usability and Utility Engineering
- Communication Systems
- Networked Assistance Systems
- Smart System Integration
- "More Moore" and "Beyond CMOS"
- Communication and Entertainment
- Digital Media

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.

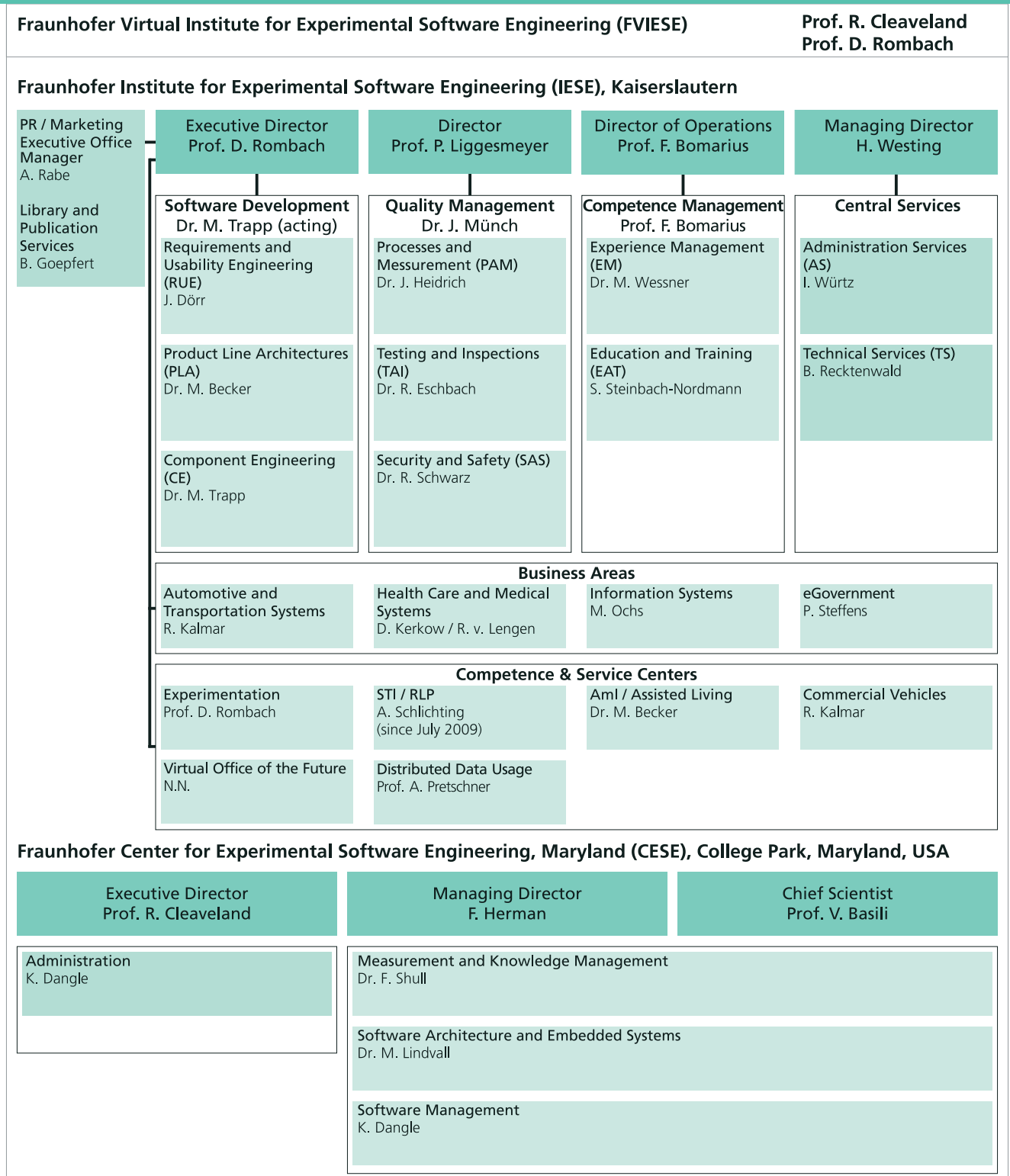
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Dr. Martin Becker

ORGANIZATIONAL STRUCTURE



The Fraunhofer Virtual Institute for Experimental Software Engineeringg

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.

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

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Directing Ministerial Councilor, Rhineland-Palatinate State Chancellery
Mainz

Brigitte Klempt

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Dr. Hans-Ulrich Wiese

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

Fraunhofer-Gesellschaft

Dr. Hans-Otto Feldhütter

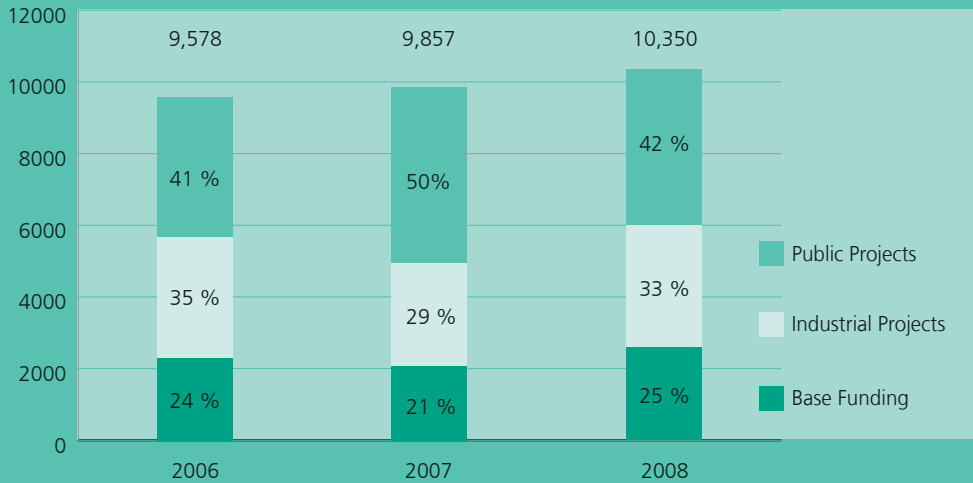
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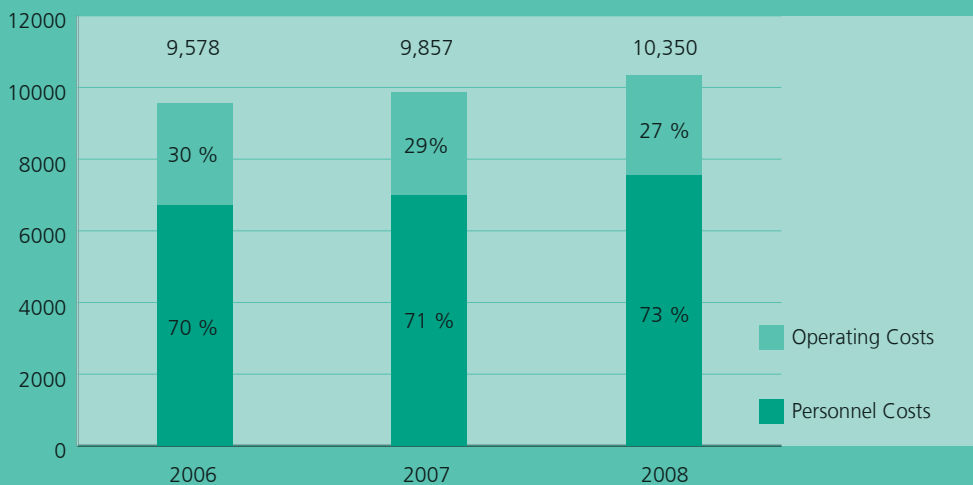
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PERSONNEL AND BUDGET

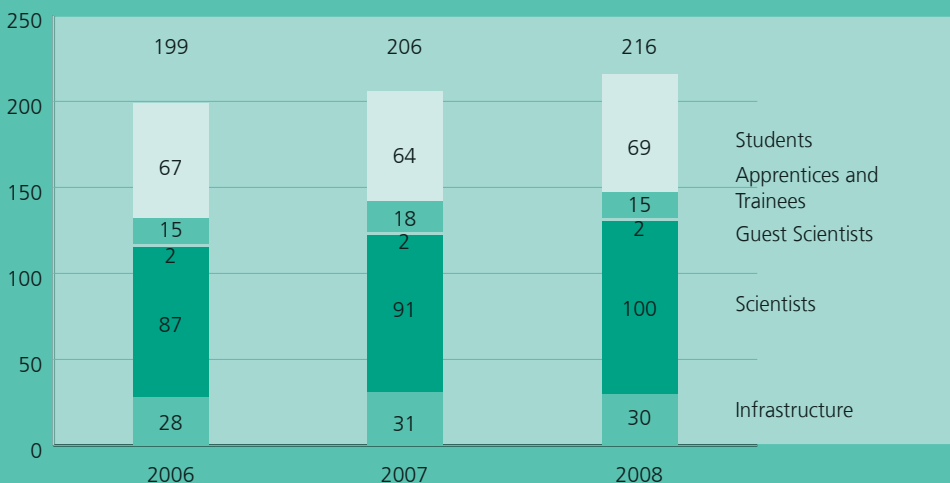
Development of Budget (in T euro).



Development of Costs (in T euro).



Development of IESE Personnel.



Development of Personnel and Budget

Fraunhofer IESE continued its planned growth in 2008, with the search for qualified personnel gaining increasing importance. The cost structure is stable; the proportion of women among the employees was 23%.

In 2009, the institute plans to further increase its scientific staff.



FRAUNHOFER CENTER FOR EXPERIMENTAL SOFTWARE ENGINEERING, MARYLAND (CESE)

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PROFILE OF FRAUNHOFER CENTER MARYLAND (CESE)

The Fraunhofer Center for Experimental Software Engineering, Maryland (CESE) in College Park, Maryland, conducts applied research and technology transfer in software engineering processes and technologies. It collaborates with private-sector companies, government agencies, and academic institutions to develop innovative, actionable approaches to address organizations' software issues.

CESE has affiliations with the University of Maryland at College Park as well as the Fraunhofer Institute for Experimental Software Engineering (IESE) located in Kaiserslautern, Germany.

CESE projects include a mixture of research efforts into new software technologies and empirical evaluations of existing tools and processes, and service-provision contracts to assist clients with software development or acquisition issues. Project customers include government agencies such as the Department of Defense and NASA and companies such as Boeing, Motorola, DaimlerChrysler, ABB, Nokia, Robert Bosch, and Fujitsu. CESE also supports small- and medium-sized software companies through its close cooperation with the Maryland Department of Business and Economic Development.

Competencies

- Measurement and Knowledge Management
Contact: Dr. Forrest Shull
- Software Management and Process Improvement
Contact: Kathleen Dangle
- Software Architecture and Embedded Software
Contact: Dr. Mikael Lindvall
- Software Verification and Validation
Contact: Prof. Rance Cleaveland

Business Areas

- Aerospace
Contact: Frank Herman
- Defense
Contact: Kathleen Dangle, Frank Herman
- Automotive
Contact: Prof. Rance Cleaveland
- Medical
Contact: Dr. Mikael Lindvall

PROJECTS IN PROGRESS

Software Architecture Tools and Methodologies

During 2008 CESE continued its long-standing collaboration with IESE on the software-architecture analysis and evaluation (SAVE) technology. The SAVE tool has been applied by both CESE and IESE to software architectures of partners and customers, and CESE has in the past used the tool as part of the NASA technology infusion program that transitions promising laboratory tools into practice within NASA. One noteworthy development in 2008 with respect to this technology was the submission of a USA patent application for the core algorithms used by SAVE to infer software architecture from source-code files. As far as can be determined, this represents the first joint patent application filed by Fraunhofer USA and Fraunhofer-Gesellschaft.

CESE also continued its NASA-supported research on using run-time information to conduct software-architecture analysis. The new techniques rely on the collection of information obtained while an application is running and comparing this information with specifications regarding expected behavior given by developers. A prototype tool based on the preliminary results of this project was used in 2008 to detect issues in a communication platform used by NASA's Messenger mission to the planet Mercury; this work was done in close collaboration with the Johns Hopkins University Applied Physics Laboratory, which provides development assistance to NASA on its space-exploration, satellite, and missions-operations programs.

Making More Use of Software Inspections Data at NASA

In 2008, CESE continued its research in the area of software inspections with the National Aeronautical Space Administration (NASA). In this research grant, we apply empirical methods to improve software developed for NASA on an organization-wide basis. CESE began development of a prototype Inspection Dashboard tool that leverages NASA's existing knowledge regarding software defects to improve strategies for ensuring software quality. This work sets up a crucial infrastructure component in NASA's ability to use its institutional knowledge.

Despite the numerous and well-documented benefits from inspections, this practice can be difficult to implement on projects. There is a learning curve involved, meaning that it takes some time for developers to understand how to effectively find defects on their own in software work products. And, for moderators who are trying to set up inspection processes and get people to take part, there is little guidance on what types of people are important to get involved and how much direction to give them.

A long history of experience and experimentation has produced a significant body of knowledge concerning the proven effectiveness of software inspections. Data and experience from many years and many types of organizations have shown that a properly conducted inspection can remove between 60% and 90% of the existing defects. Today, software inspections have become an integral part of the Verification and Validation (V&V) activities for software development projects. While the technology as such is established, and incorporated

into the standard software development procedures of many organizations, there are potential benefits of software inspections that are often not yet fully recognized.

To address these difficulties, previous work at CESE has focused on a perspective-based approach. In research funded by the National Aeronautics and Space Administration (NASA), we empirically investigated whether there was any quantifiable improvement above the already-recognized inspection benefits due to the perspective-based approach to inspections. Various studies, run both by ourselves and by independent researchers, found improvements for individuals (i.e., inspectors find more potential defects during their individual preparation for the inspection meeting) and for teams (i.e., teams whose members prepare using assigned perspectives find more defects in the overall inspection process). Further work at NASA involved helping teams across the Agency to facilitate the use of our results in a number of different contexts. Collecting data regarding the use of perspective-based inspections on projects was crucial for the success of this effort.

Best Practices Clearinghouse

The Acquisition Best Practices Clearinghouse (BPCh) is an innovative approach to improving the acquisition and development of software-intensive systems. The BPCh is designed to help programs select and implement proven acquisition, software development, and systems engineering practices appropriate to individual programmatic needs.

Research has shown that existing best-practice resources are not widely utilized for a number of reasons, e.g., the existence of multiple conflicting lists, skepticism on the part of personnel, inadequate data on costs and benefits of the recommendations, and lack of support for situation-specific practice selection. The BPCh overcomes these problems by adopting a

novel, evidence-based approach that links to existing resources describing how to implement various best practices, rather than recreating the information. BPCh provides value-added descriptions of the practical results (both good and bad) of applying the practices in various contexts, from which users can learn about the results expected in their environment. All evidence stored is contextualized, so that users can be guided to the lessons relevant to their program, type of problem, or specific environment.

Recommendations from the BPCh are vetted by government, industrial, and academic representatives. However, users also have access to the source materials from which the vetted recommendations are built, allowing users to be supported as soon as the information is available, although with suitable caveats.

The BPCh project is being developed as a joint effort between CESE, the Defense Acquisition University (DAU), and the Office of the Secretary of Defense (OSD). The project has been underway for several years; efforts in 2008 focused on the acquisition of information about software best practices and the population of BPCh databases with it. Efforts were also undertaken, using an internal project, to develop a generic BPCh that can be targeted at organizations other than DAU. This genericization, called EMPEROR, is intended to be the source of future project work for CESE.



Applying Formal Methods for Medical Device Safety at FDA

As part of the National Science Foundation researchers in residence program, CESE is working with the Office of Science and Engineering Laboratories at the Center for Devices and Radiological Health, Food and Drug Administration (FDA) to improve the state of software engineering practice in the medical device industry, particularly with regard to safety.

The amount of software present in medical devices, both diagnostic as well as therapeutic, has exhibited a dramatic increase over the last decade. For example, infusion pumps, a class of medical device that automatically pumps fluids (insulin, morphine, blood) into a patient, may contain tens of thousands of lines of code. For proton therapy machines, this number can run into millions.

With amazing advances in hardware technology in the form of lower power consumption, miniaturization, and increased computational prowess, more and more medical devices are being placed under microprocessor control. This has been accompanied by a concomitant increase in the number of device functions that are being delegated to software. By virtue of being easier to configure, update and reuse, software has reduced device cost as well as enabled the delivery of a richer set of features to end-users than was previously possible. With remote surgery, intelligent operating rooms, and autonomous assisted living environments set to become the norm in the not-so-distant future, the need for high-integrity software in the health care industry has become more important than ever.

The increasing complexity of device software creates considerable engineering challenges. In 1998, close to 8% of device failures could be traced to software errors. Currently, the number of device recalls due to software is believed to

be about 18%. With a growing number of patient-critical functions expected to be allocated to software in the future, software defects will most likely have an even more significant effect on device failure than ever before.

CESE has been working with the Office of Science and Engineering Laboratories at the Center for Devices and Radiological Health, Food and Drug Administration (FDA) on a one-year project that seeks to improve the state of software engineering practice in the medical device industry. As part of this National Science Foundation project, researchers at CESE have been involved in

- i) creating software specifications for a generic infusion pump with reference to a device hazard analysis
- ii) constructing models of the system, software, and the user interface with reference to these specifications
- iii) formally verifying the models so constructed with respect to safety requirements

The ultimate goal of the project is to

- create a model of a generic infusion pump with special reference to safety features so that it may serve as a reference architecture for device manufacturers. It is worth mentioning that infusion pumps have proven to be a particularly problematic family of medical devices with the number of adverse reports (death and injury) per year running into thousands.
- demonstrate best practices of model-based verification and validation to the medical device industry.

This project was the subject of a news article in the Prince Georges County [Maryland, USA] Sentinel on November 6, 2008. Preliminary results have been presented at an internal symposium on bioinformatics inside the FDA and at the 11th Conference on Software Design for Medical Devices at San Diego in October, 2008.



Implementing Process Improvement at Social & Scientific Systems, Inc.

In 2008, CESE assisted a medium-sized public-health-oriented business in establishing a new process improvement initiative within the company to assure compliance with an industry process model framework, the Software Engineering Institute’s Capability Maturity Model Integration (CMMI). Leveraging work with previous small to medium-sized organizations, CESE designed a tailored process improvement approach and has begun guiding the establishment of process infrastructure, policies, procedures, and tools.

Social & Scientific Systems, Inc. (SSS) is an employee-owned company that has supported public and private sector programs since 1978. SSS contributes significantly to improving public health in the United States and in more than 90 other countries in areas such as: supporting HIV/AIDS clinical trials around the world, providing program monitoring and evaluation services in Africa, collecting epidemiologic data in Europe, coordinating AIDS conferences in the Caribbean and Africa, and analyzing Medicare data in the United States. SSS has offices in Silver Spring, MD; Durham, NC; Abidjan, Côte d’Ivoire; and Kampala, Uganda.

SSS has developed long-term relationships with a variety of clients, largely in the public health sector, including the National Institutes of Health, the U.S. Agency for International Development, the Food and Drug Administration, the Agency for Healthcare Research and Quality, and the Centers for Disease Control and Prevention. Some of SSS’s projects have been continuously running for many years.

The purpose of this project is to assist SSS in aligning existing software development processes with those defined in the Capability Maturity Model Integration (CMMI) Level 2 and pre-

pare the organization for a formal Standard CMMI Appraisal Method for Process Improvement (SCAMPI) appraisal.

The CMMI provides a reference of best practices that can be used to define organizational and project processes. The SCAMPI provides a consistent way to measure compliance with the reference model and progress towards implementation of the practices defined in the model. This appraisal will also provide SSS the ability to provide their customers with an objective assessment compliance with the CMMI.

Underlying this business objective of complying with CMMI, the organization would like to align and institutionalize successful processes among different work groups in response to the organization’s growth.

CESE’s approach for assisting SSS in improving their engineering practices and achieving compliance with CMMI Level 2 includes the following steps: (1) defining the recommended approach for the effort, (2) performing a preliminary gap analysis and assisting with the planning resulting from findings and recommendations, (3) implementing actions defined by the plan, and (4) assisting the organization in preparing for a formal appraisal.

Task 1 involves (1) establishing a detailed understanding of the organizational context for the process improvement effort, (2) defining high-level process improvement project performance goals, (3) selecting the scope of the process improvement initiative, and (4) performing an initial gap analysis.

The focus of Task 2 is the development of a plan that describes the steps, activities, resources, timelines, and milestones needed to execute the process improvement initiative. This plan will be updated as the initiative progresses and changes and provides the foundations for managing the process improvement initiative as a project.



Task 3 provides support for the core activities of the process improvement initiative: defining and implementing CMMI-based Level 2 practices. This may include enhancing existing processes for compliance with Level 2 or defining new processes to close up gaps.

CESE initially performed a gap analysis, spending several weeks to assess the current organizational processes. A central factor in establishing an approach is gaining a complete understanding of the organization's goals and objectives. Other key decisions include organizational scope of the initiative, types of projects to include, and identifying projects for prototypes. Also, training and education of specific resources is necessary to align all the organization's initiatives.

This experience has provided CESE further knowledge in our ongoing research into the success factors of implementing model-based processes. SSS's unique business provides additional data for this work.

GQM+Strategies™

GQM+Strategies™ is a new measurement approach jointly developed by software measurement experts at CESE and IESE. Measurement practitioners will recognize that this approach is based on a familiar name, GQM. The Goal Question Metric (GQM) approach (Basili et. al., 1981, 1984, 1984, ...) is widely used today for creating measurement programs throughout the software industry. This new extension to GQM adds the capability to create measurement programs that ensure alignment between business goals, software-specific business goals, and measurement goals.

In extending GQM, the GQM+Strategies™ approach first makes the business goals, strategies, and corresponding software goals explicit in the form of a model. Multifaceted links are made between each software goal and the organizational,

business-level strategy it supports. Such strategies deal with organizational issues, such as improving customer satisfaction, garnering market share, or reducing production costs. Finally, GQM+Strategies™ links the identified strategies with the larger business goals they are meant to fulfill.

The entire integrated model that is built by the GQM+Strategies™ approach provides an organization with a mechanism not only to define software measurement processes consistent with larger organizational concerns, but also to interpret and roll up the resulting measurement data at each level. GQM+Strategies™ linkages and measures ensure the business goals are fulfilled.

CESE and IESE are developing support tools that take advantage of actual experiences and specific expertise in GQM+Strategies™ by storing common business goals, strategies, scenarios, etc., and their linkages. Using these tools, organizations will be better able to choose and navigate through the space of options and will be able to identify their own measurement program and track the organization's performance over time.

IESE and CESE are also developing the following services to support organizations in the application of GQM+Strategies™:

- Set-up and installation of a measurement program:
- Definition and alignment of a measurement program with CMM(I)
- Management using performance-based measurement

CESE and IESE also provide training and workshops in the following areas:

- Managing projects with metrics
- Improving products/processes with metrics
- Eliciting business goals, software goals, and measurement goals
- Measurement-based decision-making



Executable Requirements for Embedded Systems

Requirements documents typically consist of natural-language descriptions of the intended form and behavior of embedded-control applications. As such, they are often imprecise and sometimes contradictory. Recent academic and commercial research suggests that requirements can, in principle, be formalized mathematically, and system models checked against these requirements. Several companies in the automotive sector are exploring the use of these technologies in their design flows. Modeling and simulation have become standard components of control-algorithm design, and engineers continue to find new ways to extract value from these models, which are typically given in notations such as ASCET-SD, MATLAB® / Simulink® / Stateflow®, or STATEMATE™. A common strategy is to treat these models as software and system specifications. In this case, it is important to know that model behavior provides the functionality expected of it. These expectations are typically found in requirements documents.

In collaboration with Bosch, CESE is conducting a series of pilot studies on automated techniques for checking functional requirements on models of embedded control applications, and exploring how these techniques might be combined with Bosch tools and methods for checking non-functional requirements. The project is intended to assess the utility of Bosch's controller-design and instrumentation-based validation processes for formally checking functional requirements against

models of embedded controllers. The key features of the technique include:

- Formalization of requirements as executable "monitors"
- Instrumentation of controllers with these monitors
- Automated test generation based on predefined model-coverage criteria in order to search for possible requirements violations.

The technical work in the project has involved taking a Bosch controller model and associated requirements specification, converting the model to Simulink / Stateflow, formalizing functional requirements as monitor models, also in Simulink / Stateflow, and using a Commercial Off-the-Shelf (COTS) tool, Reactis®, to perform the instrumentation and conduct the automated test generation.

An initial investigation has indicated that the tools and techniques being used at CESE can be combined with approaches in checking non-functional quality requirements being explored by Bosch, the Bosch Rapid Architecture Prototyping Tool (RAPT) for software architecture design.

The instrumentation-based approach to functional verification has also been applied in a project with a second automotive company based in Canada. This work was subcontracted to CESE by Reactive Systems, Inc., and involved the validation of models for an advanced hybrid powertrain controller.

CESE IN FIGURES

CESE in Figures

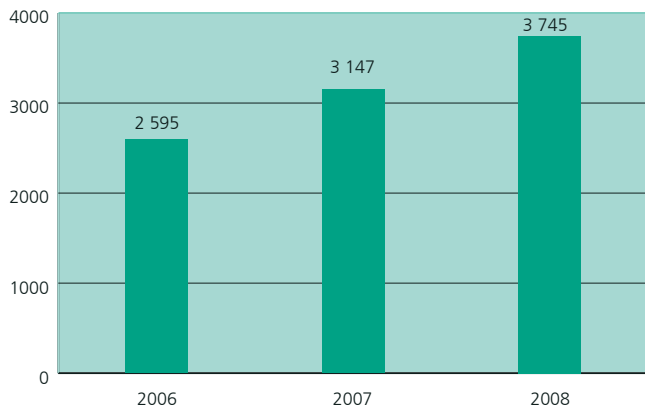
CESE experienced significant growth in its revenues in 2008 vis à vis 2007. This was due to important new project wins in NASA's Software Assurance Research Program, to new industrial projects in the automotive industry, and to renewals and increases in ongoing projects, specifically the Best Practices Clearinghouse. At the time of this report, final year-end figures for CESE were not available, but projections based on data through October 2008 suggest that 3rd-party revenues will be approximately 15% larger than those of 2007, becoming the best to date since CESE was founded. Retained earnings are also expected to show a significant increase.

University Partners

- University of Maryland at College Park
- University of Maryland at Baltimore County
- University of California, Santa Barbara
- Johns Hopkins University School of Medicine
- Mississippi State University
- University of Kaiserslautern

Other Partners

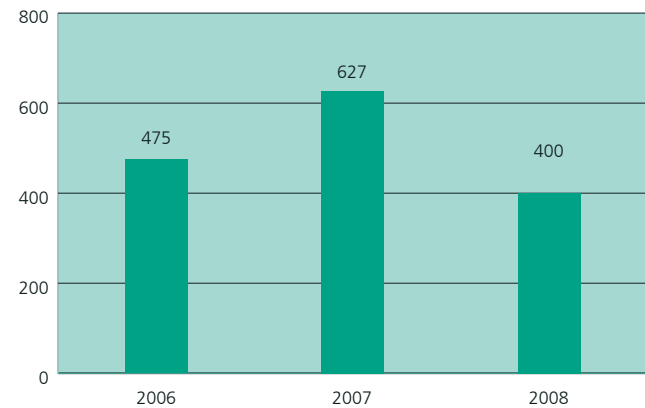
- Axiom Resource Management, Inc.
- BAE SYSTEMS
- CSC, Inc.
- DAU – Defense Acquisition University
- Johns Hopkins University Applied Physics Laboratory
- NASA IV&V Center



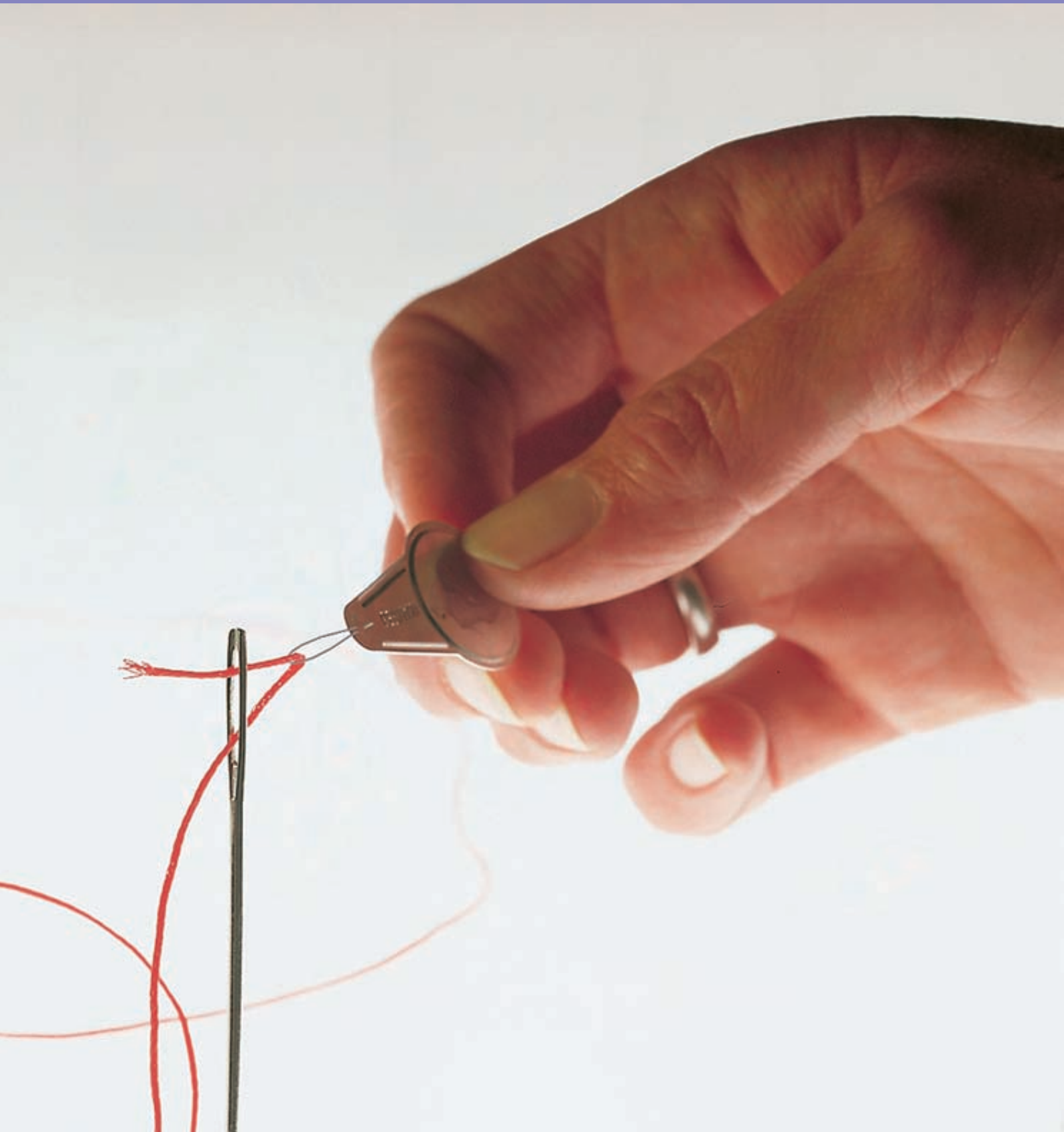
Total revenue (in T US dollars)



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.

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 our range of services offered.

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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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

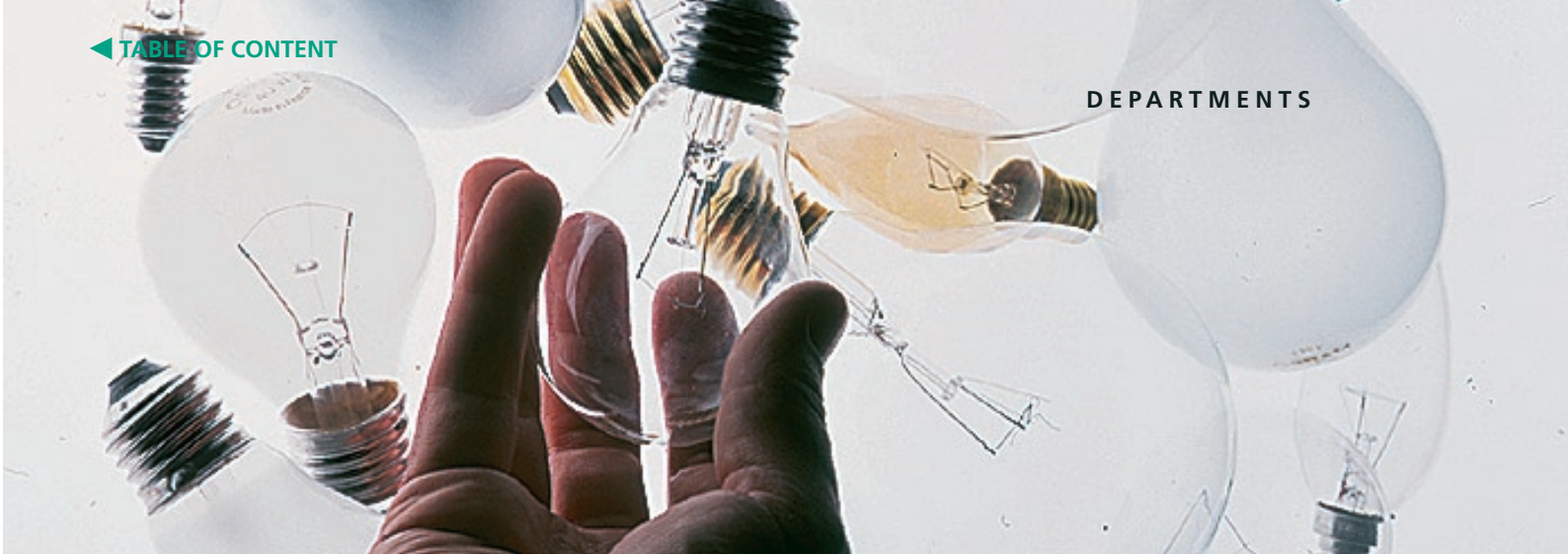
Architectures are the engineering-style blueprints of modern software-based systems. Especially in the case of complex software systems, the underlying architecture is of particular significance; software families can be developed with high efficiency via a product line approach anchored in the architecture 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:

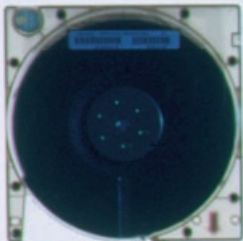
- **Domain-specific component systems:** By adapting component systems and modeling languages to the respective application domain, individual building block systems are created that can be integrated seamlessly with existing methods and tools. In practice, the overall result is higher system quality, 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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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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PROCESSES AND MEASUREMENT (PAM)

Measured and Approved

Every day, software-intensive systems and services take over more tasks and ensure the comfortable and safe functioning of equipment and machines. In order to develop these systems and services in accordance with their requirements, on time and at an acceptable cost, engineering-style processes are indispensable. This includes establishing efficient development processes and checking their effectiveness, as well as continuous process optimization.

In this context, the empirical approach employed by Fraunhofer IESE is particularly important. It provides measurable evidence of the added value of innovative development processes and enables their adaptation to various 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 recognized early and risks can be minimized.
- **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 with regard to their strengths and improvement potential, or with regard to their conformity to standards. Thus, they provide the basis for solid decisions in software and system development.

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:

- **Goal-oriented measurement:** Custom-tailored measurement systems make it possible to focus on relevant measurement data, on the selection of suitable measurement processes, on minimizing the cost of data elicitation, and on the analysis of data with regard to business, project, and improvement goals.
- **Project control centers:** They provide the stakeholders of a system development project online with measurement data packaged and visualized in a meaningful way. Through exact adaptation to the development environment, these data provide significantly higher performance than conventional project management tools.
- **Domain-specific quality models:** Each software or system development project has specific quality requirements depending on the application domain – custom-tailored quality models take this into account.
- **Process improvement:** Industrial software and system development usually follows defined processes, which can be continually optimized through proven processes in combination with innovative approaches.
- **Descriptive process modeling:** The successful development of software-based systems depends on a development process that is modeled systematically and accurately, and on corresponding flexible process management.
- **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.



Products and Services

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 system development processes that fulfill the highest requirements regarding efficiency, documentability, and conformity to standards, and that can be flexibly adapted to new requirements:

- **Measurement in system development:** Regardless of whether the issue is a measurement system based on the established GQM approaches, benchmarking, or data analysis with the OSR® method: Fraunhofer IESE is your competent partner in all matters regarding empirical process monitoring.
- **Quantitative control:** Fraunhofer IESE supports 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 or prediction models for process and product characteristics.
- **Effort and cost estimation:** For reliable effort and cost estimation, we offer methods such as the experience- and data-supported CoBRA® method or the Function Point method (e.g., IFPUG or COSMIC-FFP method).
- **Process management and improvement:** Proven development processes constitute important capital for any organization. The Fraunhofer IESE process experts provide support in modeling, defining, analyzing, optimizing, and documenting processes, ensure that process standards are adhered to, and implement continuous improvement programs into a company's practical operations.
- **Process and product assessments:** Before a process or product can be optimized, its current state must be determined as exactly as possible. Fraunhofer IESE performs assessments and supports the achievement of conformance to standards, for instance in accordance with ISO/IEC 15504 (SPICE) or V-Modell® XT. Customer-specific software product assessments and support in implementing CMMI® and Six Sigma are also possible. Systematic product analyses can be performed with the flexible M-System, for instance.
- **Training sessions, workshops and seminars:** The courses offered by Fraunhofer IESE enable decision makers and practitioners from the area of software and system development to apply measurement processes and process technology on their own. The institute offers one-day or multiple-day events, which can be held either at Fraunhofer IESE or directly at the company site. Topics include introductory courses for the V-Modell® XT as well as courses on issues such as product metrics, empirical studies, or cost estimation.

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TESTING AND INSPECTIONS (TAI)

Software Quality – a Challenge

Suppliers of high-quality software must permanently prove themselves on the market and continuously face new customer wishes and increasing market pressure: Growing system complexity and shorter innovation cycles along with highest demands on quality and reliability are characteristic of current developments. This requires quality assurance methods with increasing levels of performance and cost efficiency, methods that are optimally tailored to proven and innovative development processes.

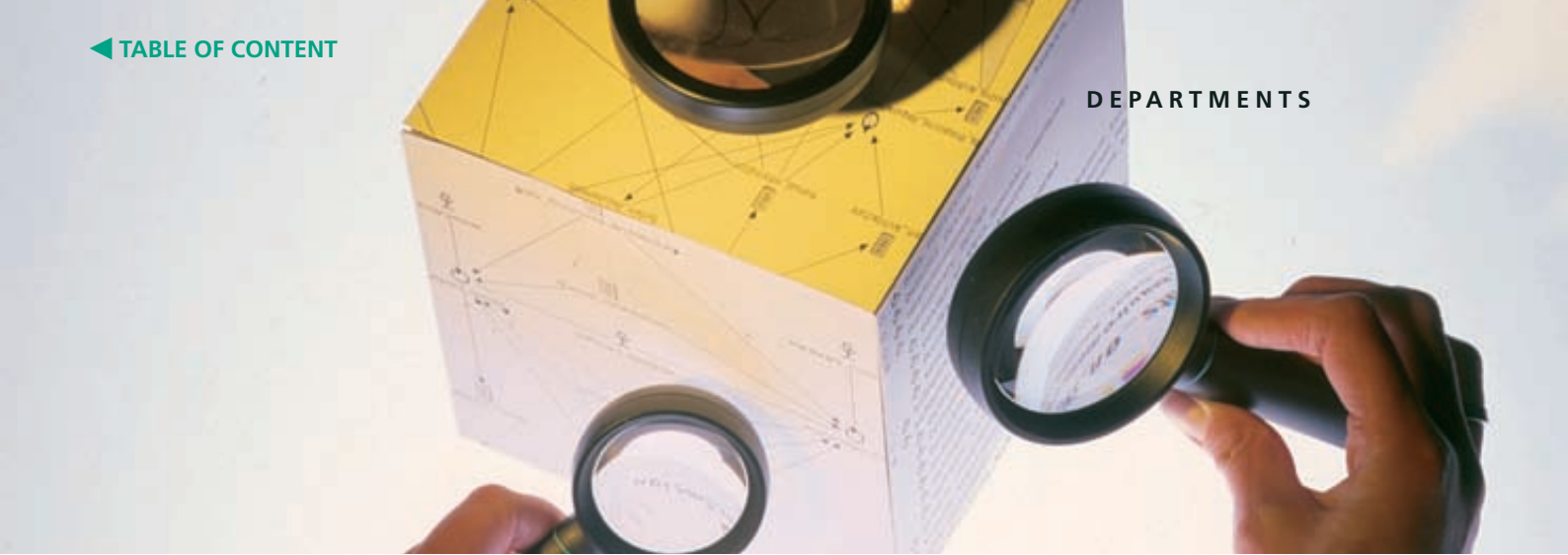
Fraunhofer IESE develops such high-performance and cost-efficient solutions for analytical quality assurance for a multitude of application domains, from technical, software-intensive systems to data processing and information systems that fulfill the highest demands. For this purpose, Fraunhofer IESE works on current software technology issues and continually analyzes the state of the art in quality assurance and quality management in the software development domain.

- **Model-based product development** integrates proven, high-performance methods of engineering-style hard- and software development into a cost-efficient overall concept spanning different systems.
- **Product-in-the-loop** can be combined in an ideal manner with model-based product development to create an efficient and flexible software development process.
- **Distributed technical software systems** play an increasingly important role in the development of technical products and call for innovative concepts and strategies for integration.
- **Information systems** are becoming more and more important in everyday life, both in the acquisition of needed information and in business processes and events.
- **Automatic code generation** will find its way into the most critical development areas of software with the increasing use of modern model-based development tools and the availability of cost-efficient, high-performance hardware.
- **Manual analysis and development methods** will continue to remain an economical and powerful means of quality assurance, despite the increasing degree of automation in product development.

Competence in Software and Systems Engineering

Our research and development approaches from the areas of quality management and software technology serve to combine modern methods and specific user knowledge in an engineering-style manner, resulting in processes that are suitable for practical usage. This enables cost savings through the use of synergies resulting from the combination of experience and state-of-the-art research knowledge. Our core competencies allow us to react to customer requirements on short notice and on time:

- **Model-based quality assurance:** Model-based development saves time and money, while software product quality continues to remain high. A powerful, model-based software development process demands an equally powerful, customized quality assurance process.
- **Test automation:** Reusability of test cases and automatic documentation of test runs are prerequisites for a high-performance quality assurance process. The introduction of customized methods and tool chains enables the use and optimization of high-performance testing methods.



- **Planning, adaptation, and improvement of testing and inspection processes:** The introduction of innovative development methods and paradigms is supported by structural adaptations of existing development processes.
- **Reliability modeling:** Based on a powerful software development and quality assurance process, statements on the reliability of a software product and on the defects remaining in it can be derived. This information allows systematic optimization of products and processes.

Products and Services

Fraunhofer IESE offers a comprehensive range of training and support programs for optimizing and introducing testing and inspection processes in an organization:

- **Analysis and strategy development:** In order to work out an efficient testing and inspection strategy for current development projects, Fraunhofer IESE provides support through in-depth analysis of existing practices and processes in concept development as well as through the selection, adaptation, and integration of innovative methods.
- **Method introduction and process optimization:** Fraunhofer IESE provides solutions and strategies that are optimally tailored to existing development processes. We assess the actual effects of new methods and technologies on the quality of the end products by means of quantitative and qualitative analyses, and we carefully modify and optimize the existing software development processes.
- **Training sessions and coaching:** Successful development of high-quality software does not only require highly developed quality assurance methods and processes, but also great expertise on the part of the system developers. Fraunhofer IESE offers training sessions, seminars, and workshops on demand and in accordance with current requirements in order to ensure that our customers' level of knowledge is always up to date.
- **Consortium research:** Together with various companies as customers, Fraunhofer IESE develops new software quality assurance concepts, strategies, or methods in pre-competition joint projects. Partners from industry and science contribute their ideas and experiences and jointly benefit from the progressive and powerful solutions.

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SECURITY AND SAFETY (SAS)

Motivation

Software-based systems make many areas of our lives easier, but also entail risks due to unexpected failures in critical situations or due to malicious manipulation by third parties – all the way to terrorist threats to our infrastructures.

The increasing complexity and networking of modern software makes it harder to get a complete overview of its safety and security problems and to build systems that are reliable and safe on the one hand, while being secure against manipulation and spy attempts on the other hand. Trying to make systems that are unsecure by construction secure later on usually requires an unreasonably large amount of effort. The goal is thus to consider security requirements as early as possible during system development in order to construct systems that are secure by design. Since a system's security quality is hard to measure using methods available today, security during development is still neglected quite often.

Vision

We develop systematic analysis and constructions methods that enable security engineering by design on the basis of measurable security indicators. We identify key attributes of a system architecture, a design, and its implementation, which enable reliable conclusions regarding the resulting security.

We design tools to elicit such attributes and develop constructive methods and guidelines for realizing predictable secure systems. Modular, composable security mechanisms help to master the increasing complexity of modern systems and development processes.

The combination of analytical and constructive security technologies during early phases of software and system development results in a drastic reduction in potential security weaknesses. The provable gain in security requires only moderate additional effort.

Competencies

Fraunhofer IESE provides various kinds of support for improving the reliability and security of software-based systems:

- **Tool-supported security audits for networks and network components:** Our security specialists support customers in designing secure network configurations. Self-developed analysis tools detect even hidden security leaks in web servers, routers, and firewalls, which are easily overlooked in manual procedures, despite high effort.
- **Software security engineering:** Our design and implementation guidelines help our partners to avoid typical errors in the security design and improve the development processes for critical systems with the proven methods of security assurance. 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.
- **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 source code, we design novel tools for the effective detection of security vulnerabilities.

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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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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 inobtrusive, 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.

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.

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EDUCATION AND TRAINING (EAT)

Competitive through Competence Development

Particularly in highly innovative branches of industry, up-to-date knowledge and competencies are the main factors that have a major influence on competitiveness. Fraunhofer IESE develops, tests, and evaluates needs-oriented and systematic qualification solutions for SE professionals, focusing on approaches that enable timely, flexible, workflow-integrated, and technology-supported learning.

- **Planning, design, and implementation of qualification processes:** Systematic needs analyses, skill profiling, and the analysis of an organization's existing continuing education culture form the basis for the customer-specific design and development of training courses, learning materials, and eContent for network-based learning and education.
- **Evaluation and optimization of qualification processes, programs, and media:** Efficient qualification must be integrated into the respective application context with regard to organizational, individual, and technological issues. Parallel evaluation, technology acceptance studies, and cost-benefit analyses contribute to establishing these firmly in an organization and lead to continuous improvement of the selected programs.
- **Design and development of user documentation:** Software documentation is developed and designed in such a way that, with the help of Single Source Publishing, various types of help systems and learning media for introducing the user to the software described can be efficiently developed.

Competence in Software and Systems Engineering

The strength of Fraunhofer IESE'S applied research lies in the new development, resp. further development, of SE methods and their adaptation and testing in a practical environment. This always centers around the customer's requirements and the problem being faced:

- **Development of courseware and process engineering:** Starting with the requirements analysis and the scoping of the educational needs, qualification programs, (mainly electronic) learning materials, and documentations are designed, implemented, and evaluated in an engineering-style manner. This procedure also makes it possible to analyze and optimize the existing development processes of educational programs, learning software, and documentations.
- **Rapid development:** Systematic reuse of existing materials and media enable the short-term production of high-quality learning systems and user guides without any loss of quality.
- **User support and help systems:** On the basis of structured technologies, multimedial and classical materials for user support and guidance are developed. Help systems and software instructions can be developed via DocBook, DITA, or other comparable procedures and settings.
- **Goal-oriented evaluation:** Proven empirical software engineering processes (such as the Goal Question Metric, GQM) are adapted to concrete measurement tasks and provide a quantitative view on the performance of learning systems or help systems, resp. enable systematic improvements regarding the design and execution of qualification processes.

Products and Services

Software and Systems Engineering is the key to gaining a competitive edge in a hard-fought market. Fraunhofer IESE develops and evaluates custom-tailored solutions for continuing education and training in the area of software as well as for product support.

- **Development and evaluation of courseware on behalf of customers:** Fraunhofer IESE's range of services includes everything from the elicitation of requirements and needs via the design of educational programs to content generation and evaluation.
- **Process development and improvement:** Some companies develop their own learning software and documentations. For them, Fraunhofer IESE offers to analyze and improve their development processes via IntView, the integrated development methodology for simultaneous consideration of all dimensions of courseware and documentation development.
- **Support in product selection:** In many cases, sophisticated solutions are already available for specific training or education problems, making expensive new development unnecessary. Fraunhofer IESE systematically compares products available on the market and finds the best learning system for specific task definitions.
- **Software documentation and software training:** Fraunhofer IESE designs, evaluates, and develops all types of software documentation as well as user guidance and training materials, including the configuration of documentation development environments, content development, product testing, and shipping.

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BUSINESS AREAS

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AUTOMOTIVE AND TRANSPORTATION SYSTEMS

Software Technology for a World in Motion

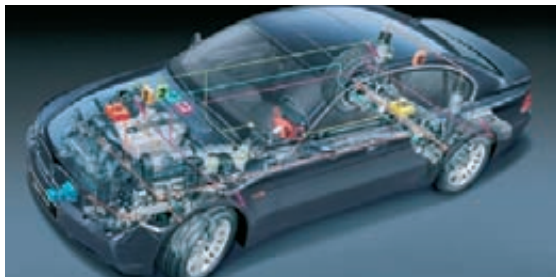
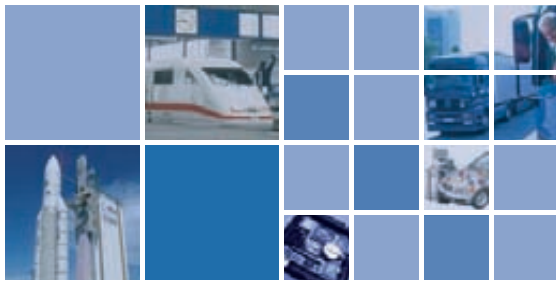
The business area “Automotive and Transportation Systems” especially aims at manufacturers and users of embedded systems, primarily in automotive and rail technology as well as aerospace. Automotive Software Engineering comprises processes, techniques, methods, and tools adapted specifically to the requirements 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, IEC 61508) 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



Example Competencies 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

Process Assessments and Assessment Preparation

We assist you in planning and implementing improvement measures based upon CMMi and Automotive SPICE.

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.

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.

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-WD 26262, or we provide support.



Ralf Kalmar

HEALTH CARE AND MEDICAL SYSTEMS

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Daniel Kerkow

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 life cycle.

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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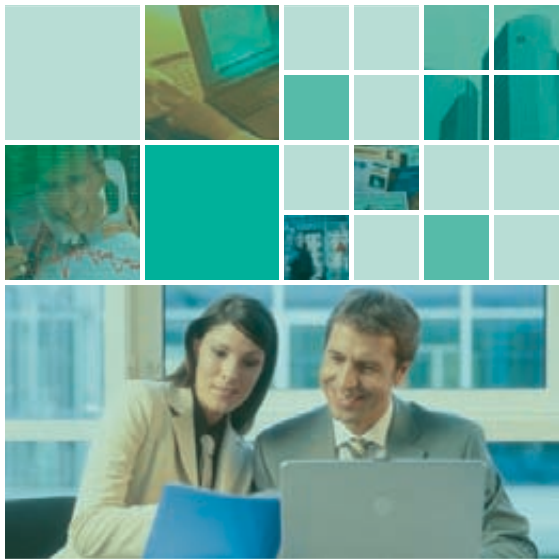
Software in the Age of Information

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.

Requirements and Usability Engineering

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

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.

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

Process assessments and 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.

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.

Systematic checks during the course of assessments

have a solid engineering-style basis with FAME®, the Fraunhofer Assessment Method. These checks exactly show an organization's improvement potential based on empirical data obtained from its running operation.

eGOVERNMENT

eGovernment Solutions for Public Sector and Business

The public sector with its more than 4 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.

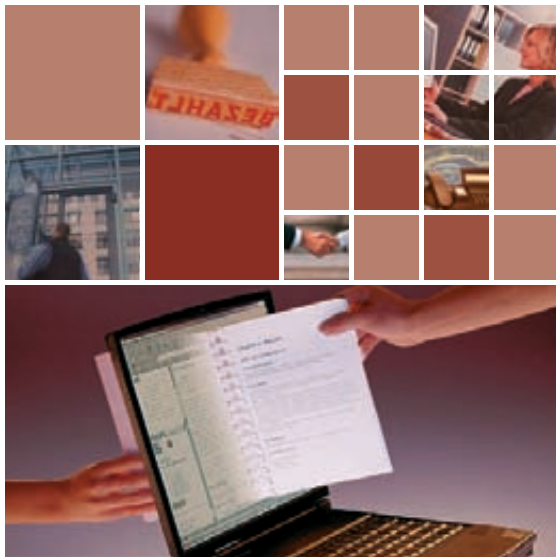
ROI analyses performed prior to implementation projects ensure a project’s return on investment. Using systematic and integrated requirements management and involving all stakeholders early on creates the prerequisites for high acceptance of a system. The adaption of the process model V-Modell® XT to 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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TELECOMMUNICATION, TELEMATICS AND SERVICE PROVIDERS

Note:

This business area will no longer be continued as a separate entity in the current fiscal year. Research work and projects from this area will be taken over by the institute's other business areas.

Confidence in Critical Systems

For the fast and especially smooth flow of modern production and business processes, error-free information processing is of particular importance. Software and the IT infrastructure systems must function correctly under all circumstances, especially since all domains increasingly depend on information and communications technology. The application domains telecommunication, telematics and service providers thus require system environments that are not only highly scalable, available, maintainable, and flexible, but also particularly secure and reliable.

If minor malfunctions can already have major effects, and if the systems to be designed are very complex, then only an engineering-style, systematic development method will do. The risk of major financial losses is too great if, for example, telephone or energy networks suddenly break down, or if service providers cannot offer their services temporarily due to a data network failure.

Competence in Software and Systems Engineering

Fraunhofer IESE supports the suppliers and sellers of components and equipment in the area of telecommunication and telematics for various application areas in all phases of software and system development. We also support service providers in the design, safeguarding, and implementation of their infrastructure services in the area of information and communications technology.

Our special focus is on security to prevent the potential manipulation of data networks and services, since maximum protection against attacks plays a central role for our customers from those application domains.

Consistent and efficient processes characterize our institute's work, which transfers the scientific results of modern research into a company's practical operations:

- **Security audits and tools for vulnerability analyses** uncover potential security problems in software and software-based systems during the development process already. The concept of "Security by Construction" offers more protection with lower costs than the later safeguarding of existing systems.
- **Process assessments and measurement-based improvement programs** enable optimization steps in development processes on the basis of empirical findings. Thus, even such aspects as the efficiency and acceptance of methods - which is normally hard to quantify - can be captured and evaluated objectively.



- **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.
- **Requirements and Usability Engineering** ensures that a system demonstrably fulfills a predetermined performance claim of all non-functional properties and is easy to use.
- **Systematic experience management** makes proven and tested knowledge - an indispensable tool – available for the daily work of software and system developers.
- **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.

Products and Services

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

- In modern production environments, security audits for active network components such as web servers, routers, firewalls, and operating system configurations must fulfill high requirements especially with regard to security against manipulations. Fraunhofer IESE's tool-supported processes, 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.
- Systematic checks during the course of assessments have a solid engineering-style basis with **FAME®**, the **Fraunhofer Assessment Method**. These checks exactly show an organization's improvement potential based on empirical data obtained from its running operation.
- With **PuLSE® – Product Line Software Engineering**, our customers get brand quality when it comes to designing product lines. Lower costs per unit through greatly reduced development effort quickly pay off when compared to single system development, and time-to-market is shorter for new product variants.
- Requirements Engineering made simple with **Usable Software Products Based on Innovative Requirements Engineering**. This process integrates the demands and organizational goals of industrial customers with the lowest possible effort. The user-focused procedure results in high usability and wide acceptance of the developed systems and thus guarantees highest customer satisfaction.

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PROJECTS

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SOFTWARE ENGINEERING FOR EMBEDDED SYSTEMS

PROCESSOR-CONTROLLED HYDRAULIC SYSTEMS – VARIETY AND QUALITY AS STANDARD FEATURES

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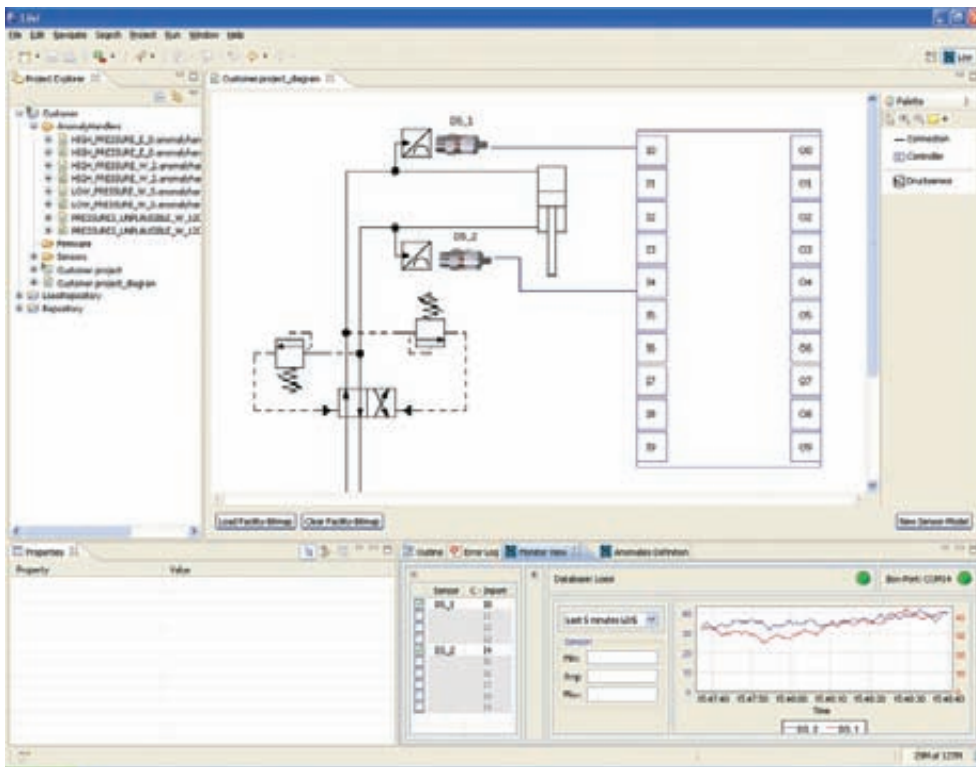
Further Information

Fraunhofer Innovation Cluster
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Modern technical products often contain software controls, and numerous variants are on the market. Medium-sized companies manufacturing such systems are faced with the challenge of developing high-quality controls for a wide variety of usage scenarios with an acceptable amount of effort. LöSi GmbH in Kaiserslautern is specialized in the production of hydraulic components and systems in small production runs. Together with Fraunhofer IESE, the company was able within a short period of time to initiate innovative production that avoids cost-intensive make-to-order production.

More complex types of hydraulic systems contain a special kind of control called a Condition Monitoring System (CMS). This system detects the state of the system by capturing pressures and temperatures at various measurement points and adjusts the system's power in accordance with the requirements. However, since hydraulic systems may differ widely, the necessary hardware and software had to be specially created by system developers with domain-specific skills. High development costs, relatively long times to market, as well as process-induced quality problems were thus bound to occur. Until now, the high effort required did not permit economically feasible make-to-order production of such systems at LöSi GmbH.

A configuration software developed jointly by engineers from LöSi GmbH and by Fraunhofer IESE now allows adjusting a CMS to new hydraulic systems in a very simple manner, without manual programming effort. The core part is a symbol language specifically adapted to the respective application domain. It is intuitively understood by experts in the domain and represents measured values, analyses, and recognition strategies for anomalies as well as their treatment. By using graphical language elements, the development engineers model the envisioned algorithms. From these, a code generator automatically generates an individual implementation for the generic hardware platform developed concurrently on the basis of a common standard microcontroller. As a result, in practical application, the time needed for developing variants is reduced, while both hardware and software system quality are increased through the consistent reuse of building blocks proven to be free of defects.



Construction kit system:
 Complex control systems for hydraulic systems can be easily created and tested on 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 system is then generated automatically. This happens surprisingly fast - and the quality of the resulting overall systems surpasses that of single systems in every regard.

Compared to the manual development approaches offered by competitors, LöSi GmbH was able to achieve clear benefits in terms of development time and cost/benefit ratio, and managed to start a new business area in make-to-order production: hydraulic systems equipped with CM systems, which were newly incorporated into the LöSi product portfolio due to the greatly reduced development effort.

More system quality under pressure

SAFE SOFTWARE ENGINEERING

GUARANTEED TO WORK – RELIABLE SOFTWARE IN COMMERCIAL VEHICLES

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Further Information

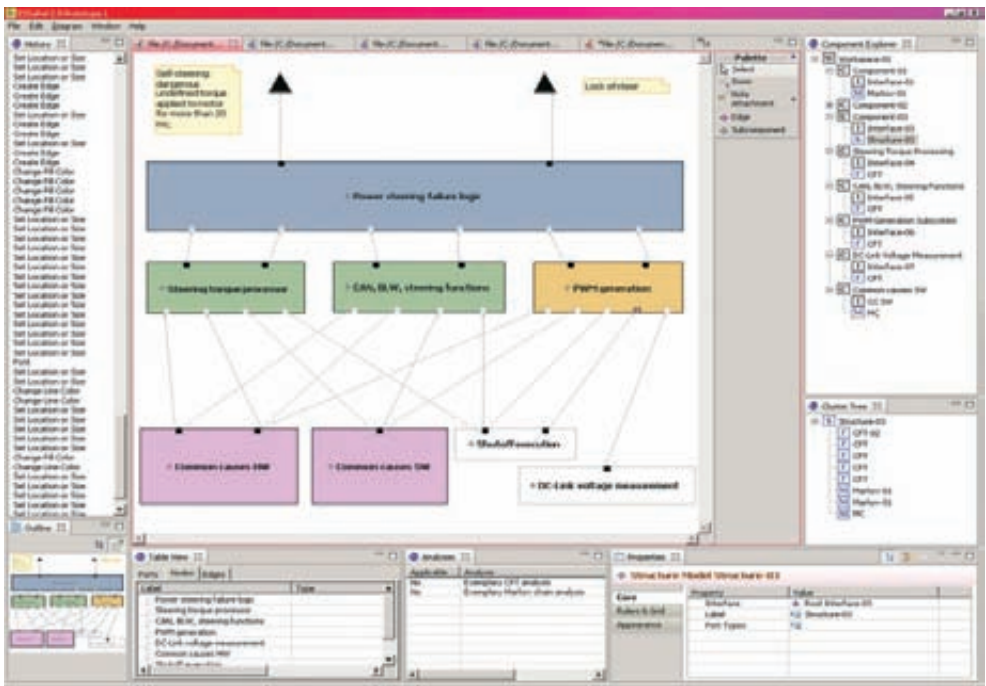
Fraunhofer Innovation Cluster
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A technical system's functional safety is undoubtedly a central characteristic of a product. Here, the standards known from mechanical engineering and electrical engineering are becoming increasingly important. This includes, in particular, the comprehensive IEC 61508 for safety-critical systems or its specific adaptation ISO 26262 for functional safety in the development of software, respectively software-based, networked systems. Current development requirements more and more often include conformance to standards in order to qualify the finished product for certain application areas or obtain domain-specific certificates. In industrial practice, however, project teams often have to overcome many obstacles in the form of tight time and budget constraints and operative challenges. It is at this point, at the latest, where the text of the standard by itself only provides limited help, since concrete instructions for resource-optimized implementation of the requirements in the respective project context are missing.

The SICMA method (Safe design of Complex eMbedded Applications) of Fraunhofer IESE fills this gap and provides adequate technical support to system developers. Instead of just reformulating well-known knowledge, the goal is rather to create a safety-conscious culture in a company.

An example from the domain of commercial vehicles illustrates the procedure used by Fraunhofer IESE, which is fundamentally different and often more helpful than the procedures offered by traditional consulting companies. In the case in point, development in accordance with IEC 61508 was to be proven for a software project, although absolutely no empirical values existed on the manufacturer's side regarding projects using this standard. Considering the far-reaching importance of the standard, this constituted a major challenge: This requirement, which is also called a basic safety standard for good reasons, encompasses everything from the design, planning, development, realization, launch, and modification to the shut-down and de-installation of both the risk-causing system and the safety-relevant (risk-minimizing) systems.

A check with a large German certification agency did not provide any solution to this problem, however: The final report of a commissioned analysis of the missing process know-how mainly consisted of the exact wording of the underlying standard. It remained unclear how this should actually be integrated into the development project of the commercial vehicle manufacturer.



The Embedded Systems Safety and Reliability Analyser (ESSaRel) is a modern tool for evaluating the reliability of embedded systems. Due to its high-performance analysis procedures and user-friendly interface, it is especially suited for the assessment of complex, safety-critical software systems, such as those implemented in modern commercial vehicles.

This is where the engineers of Fraunhofer IESE came in with the SICMA method. They incrementally “translated” the text of the standard into project-specific process steps. Subsequently, the now concrete, necessary steps were integrated into the pending development work with the active support of Fraunhofer IESE. To this end, a prototype implementation of the standards based on existing tools and methods was used in a running project. This made it possible to concurrently train project members on the job, without affecting the operation, let alone interrupting it.

In addition to concluding the project on schedule, this resulted in a fundamental understanding by the company’s employees regarding the safety-critical development of software systems – an experience that can now be used by our collaboration partner to continue a wide range of development projects independently, efficiently, and conformant to standards.

Safety first for trucks, excavators, and buses!

IT SECURITY FOR COMPLEX NETWORKS

“CROCODILE RELOADED”

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For several years, a German network provider has been successfully using the checking software CROCODILE® developed by Fraunhofer IESE for monitoring the security of its IP networks. So far, however, the tool and the checking criteria were tailored to routers using the operating system IOS.

Recently, routers using the operating system SmartEdge OS are also being used increasingly in the provider's network. Due to a lack of suitable analysis tools, SmartEdge systems have required high-effort manual security checks until now.

In order to be able to assess SmartEdge configurations faster and more reliably, Fraunhofer IESE was commissioned by the customer to extend the CROCODILE tool with SmartEdge checking rule sets. For this purpose, Fraunhofer IESE first reviewed the SmartEdge documentation as well as pertinent security guidelines of the customer. The configuration recommendations derived from this were coordinated with the customer and were documented in a catalog containing 110 fundamental security criteria. For each criterion, Fraunhofer IESE formulated one or several checkpoints and implemented corresponding automatic checks with the help of CROCODILE plugins.

The support of different configuration languages — IOS and SmartEdge OS — required several adjustments and extensions to be made to the CROCODILE analysis framework. The fact that it was still possible to provide the new checking rule sets with moderate effort was due, on the one hand, to the modular setup of the tool. On the other hand, the implementation of the checkpoints was able to use the framework's proven, universal checking rule language. Therefore, most of the checking criteria could be realized with the help of simple, flexibly adaptable rule specifications. Only a few cases required new checking modules to be programmed in order to achieve implementation.

As suggested by the customer, the new version of CROCODILE now offers an online catalog of checking criteria. To this end, CROCODILE attaches a link to the underlying catalog entry to each report message. Via mouse click, the user gets a more detailed description of the current security problem, hints on how to improve the configuration, as well as references to additional sources of information. Security auditors are now no longer restricted to the brief messages in checking reports when they assess security reports, which makes it easier to assess the situa-



Router Configuration

```

1 / Redback device (Redback 500)
2 /
3 /
4 app test-disconnect
5 /
6 app test-headers status local
7 policy policy name KTRIDR01-FILTER
8 attribute 27 drop
9 attribute 28 drop
10 attribute 292 drop
11 attribute vendor-specific 2002 1 drop
12 attribute vendor-specific 2002 3 drop
13 attribute vendor-specific 2002 4 drop
14 attribute vendor-specific 2002 21 drop
15 attribute vendor-specific 2002 22 drop
16 attribute vendor-specific 2002 28 drop
17 attribute vendor-specific 2002 38 drop
18 attribute vendor-specific 2002 97 drop
19 attribute vendor-specific 2002 98 drop
20 attribute vendor-specific 2002 99 drop
21 attribute vendor-specific 2002 101 drop
22 attribute vendor-specific 2002 102 drop
23 attribute vendor-specific 2002 103 drop
    
```

Evaluation Target

Evaluated: 2008/11/25 11:03:02
 Ruleset: Redback_Configuration
 Source: redbackdemo.cfg
 Last Modified: 2008/11/25 11:02:39

Evaluation Profile

Module	# Findings	CRITICAL	INFO	WARN	ALERT
CompoundPatterns	36	1	13	11	2
RedbackIngress	2				2
RedbackPasswords	2		1	1	
RedbackACL	8	1			
Total	48	4	9	14	9

Neatly arranged and now even more versatile:
 With the new CROCODILE, even routers based on SmartEdge OS can now be analyzed. The proven user interface has been kept and enables intuitive and secure operation of the checking system, which is an indispensable requirement for security tools.

tion. The criteria catalog has been so well received by the users that it is now being considered to also provide an extensive online catalog for the IOS checking rules.

Since security requirements must be continually adapted to new risks, the checking criteria catalog has an XML format that is easy to maintain. The user himself can update the catalog entries with little effort and without a thorough knowledge of CROCODILE.

**Reliable protection
 for secure
 production systems!**

USABILITY ENGINEERING FOR SURGICAL NAVIGATION DEVICES

DEPENDABLE ORIENTATION IN SURGICAL ENVIRONMENTS

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In operating rooms, the usability of the systems and devices used has a major influence on how safely a surgical procedure proceeds and thus does not only have an impact on the hospital's budget, but especially on the patient's health. Stryker Leibinger GmbH & Co. KG as one of the worldwide leading manufacturers of surgical instruments and surgical navigation devices has already been using proven methods for ensuring usability for several years. Nevertheless, harmonized standards regarding the issue of usability called for a review of the traditional process in order to avoid both difficulties during audits due to a lack of compliance and cost-intensive over-interpretation of the requirements demanded by the standards.

In order to assess the compliance of their usability methods with the updated standard, Stryker Leibinger GmbH & Co. KG relied on the know-how of Fraunhofer IESE. The subject of the assessment was the performance of an actual-state documentation. The resultant introduction of a standard-compliant documentation of the current process and possibly an extension of the portfolio of methods used were additional goals of this collaboration.

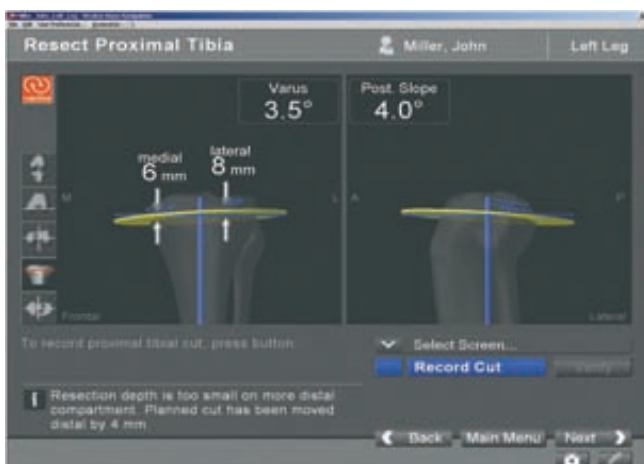
Based on the checklists of Fraunhofer IESE, which are similar to DIN EN 60601-1-6, 62366 and FDA Guidance Documents, the first step was for Fraunhofer IESE experts to analyze existing activities, methods, and results that are used to ensure usability.

To this end, all artifacts (risk assessments, test plans, and review reports) from the definition of the product via the requirements, development, and test phases all the way to clinical approval were reviewed together with the process and quality managers and were systematically compared to the requirements demanded by the standards. This enabled an assessment of compliance with the standards (IAW DIN EN 60601-1-6, 62366, FDA Guidance Documents) and revealed potential areas of improvement in the current development process. A standard-compliant template provided by Fraunhofer IESE for the usability file bundled all information in one central document, which made it easy to check whether the numerous artifacts were complete. In addition, several new techniques for ensuring the usability of the assessed systems to an even greater degree could be recommended. These did not require any major restructuring of existing processes, just the extension of processes already in use.

During the in-house training held concurrently, a larger group of the company's developers and quality managers were taught basic methods, principles, and reference processes of usability engineering. Thus, Stryker Leibinger GmbH & Co. KG was able to ensure a homogeneous level of knowledge and raise its employees' awareness regarding the higher quality requirements demanded by the standard.



Precise localization:
 Data obtained prior to an operation by means of imaging techniques (e.g., computer-assisted tomography) allow planning surgical procedures accurately to the millimeter – even if the view is restricted in a real operating environment. In order to make sure that the surgeon makes no grave mistake, the usability of complex surgical navigation systems must satisfy the highest demands.



Usability minimizes risks!

ACCESSIBLE SOFTWARE DESIGN

COMPUTER USAGE WITHOUT OBSTACLES

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Due to the demographic changes, the number of elderly people is rising continually. It is thus up to society to enable elderly people to live largely independent lives for as long as possible. Technical systems can play an important role in this regard by facilitating or partly carrying out everyday activities. However, various factors need to be taken into consideration. Not least of all due to physical disabilities, senior citizens have a harder time using modern information and communication technology than younger people. In light of this background, Fraunhofer IESE and Microsoft Deutschland GmbH performed a study that investigated the potential of the Microsoft technologies "User Interface Automation" and "Silverlight" both for elderly people and for people with physical disabilities.

With the help of a new methodological approach, Fraunhofer IESE studied how the user interface of an application fulfills the requirements of both elderly people and people with physical disabilities. The approach was based on scenarios that illustrate the user requirements of a fictitious person with various disabilities in using computer systems. The scenarios therefore included both visual disabilities and disabilities regarding a person's mobility.

The study showed that the physically completely fit average user should no longer be considered the benchmark for application development. In order to enable elderly people and people with physical disabilities such as visual disabilities or restricted mobility to access information technologies such as the Internet, their requirements must be incorporated into the design of the human-machine interfaces already at the time of product development.

Adaptive systems and intelligent assistive technologies provide optimal support for elderly people and people with disabilities, without causing a major increase in the manufacturer's development effort, and also automatically adjust to the current requirements of the users.

The software engineers of Fraunhofer IESE are working especially to achieve accessibility as a fundamental part of software design. A so-called "Universal Design" is intended to make products and services so accessible right from the start that users do not need to employ any additional, cost-intensive tools. The subsequent dynamic adaptation of Internet applications to possible physical disabilities will then no longer be required either.



IT helps to overcome obstacles!

SOFTWARE ENGINEERING IN E-GOVERNMENT

AN OVERALL E-GOVERNMENT STRATEGY FOR GERMANY

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Further Information

Study:
 Scenarios for the Future – Ideas for a “German Comprehensive E-Government Strategy”
www.iese.fraunhofer.de

On 20 November 2008, the German federal government’s Third National IT Summit took place in Darmstadt, with the attendance of the German Chancellor. In nine working groups and four forums, experts from government, business, and academia held intensive discussions about ICT issues of national relevance, such as the expansion of broadband networks, IT security, and electronic identities. The topic of e-Government, in particular, was the subject of a publication of its own, which was presented at the summit by the working group “IT-based Public Services in Germany – E-Government” (AG 3).

The publication of AG 3 intended to obtain a visionary view from the experts from public administration, business, and academia represented in AG 3 on the development during the next five to ten years of an e-Government that transcends federal and state levels. For this collection, the various fields of activity of e-Government were to be considered in an interdisciplinary overall view spanning all levels. Under the leadership of the scientists represented in AG 3 and coordinated by Fraunhofer IESE, a collection of future scenarios was put together that is intended to provide clear impulses to the federal government’s future strategy development in the area of government modernization.

Represented by Prof. Dieter Rombach and Dr. Michael Tschichholz, the Fraunhofer eGovernment Center has formulated its vision of a future e-Government and corresponding key issues for a national e-Government strategy in this publication. These include:

- The establishment of a multi-level e-Government infrastructure based on
 - a service-oriented e-Government reference architecture as well as
 - mandatory interoperability standards and
 - guidelines for an SOA governance.
- The integrated usage of fundamental infrastructure components such as the Deutschland-Online-Infrastruktur (DOI), the electronic personal ID card (ePA), De-Mail, and De-Safe by public administrations, businesses, academia, and citizens.
- The design and implementation of process chains spanning different organizations and levels without changes in medium.
- The inclusion of academia with its legal, organizational, and technical competencies.



Konvergenz der Medien

IT-basierte öffentliche Dienste

Sicherheit und Vertrauen

Hightech-Strategie

IuK im Mittelstand

The authors are convinced that academia has the role of a catalyst that promotes, moderates, and designs the collaboration between representatives from all levels of public administration and businesses in a very interdisciplinary process. However, the contribution by the Fraunhofer experts also noted that the project-oriented funding used so far is strongly oriented towards immediate problems and thus can often not contribute much to solving fundamental issues. Therefore, a national e-Government research program is called for, which should be oriented in such a way that collaboration across boundaries between disciplines as well as between academia and the real world is promoted systematically, and which supports not only short-term, practice-oriented results, but also mid- and long-term research into fundamental issues. This is a prerequisite for turning e-Government into an export hit "made in Germany".

Dritter Nationaler IT Gipfel

*Integrated concepts
for efficient public
administration!*

VERSATILE SOFTWARE ARCHITECTURES

“QUALITY BY DESIGN” FOR EMBEDDED SYSTEMS

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Jens Knodel

In the project ArQuE - Architecture-centric Quality Engineering, which is funded by the German Federal Ministry of Education and Research (BMBF), the focus is on the system architecture of embedded systems. It captures the fundamental properties of the software system both during development and during runtime. Thus, the architecture is also an indispensable level of abstraction needed to evolve a system.

The ArQuE method visualizes quality aspects of embedded systems that have been predefined for specific target groups. These views supply the information needed to weigh decisions regarding further development and then to be able to consistently implement the selected solution. The ArQuE approach combines the software engineering processes of reverse engineering, code analysis, and quality engineering, as well as those of architecture analysis and validation into an integrated procedure based on an organization’s quality profile. Additional innovative development tools such as SAVE - Software Architecture Evaluation and Visualization developed by Fraunhofer IESE accompany the review of how the respective decision is implemented. Such continuous monitoring of success allows optimizations to be done during system development already.

The ArQuE method has demonstrated its potential with industry partners in very different applications in the embedded systems domain:

- Against the backdrop of increasing health awareness, weather-independent fitness training on ergometer machines is becoming increasingly popular. These fitness devices, which nowadays are equipped with state-of-the-art analysis and visualization technology, contain complex embedded systems and also allow several training partners to network via the Internet. A well-known virtual “race” that is held with bicycle ergometers is ergo_bike trophy. Defect-free implementation of hardware and software and a perfect match of the ergometer-client-server architecture are the prerequisites for stable operation during these virtual competitions. In racing situations, the availability of the networked overall system that is required for performing ergo_bike trophy, which was developed by Büren & Partner Software-Design GBR in collaboration with the ergometer manufacturer Daum electronic, could be increased significantly with the help of ArQuE.



GEFÖRDERT VOM



Bundesministerium
 für Bildung
 und Forschung

BMBF grant number:
 01 IS F14



- Under the brand name Gossen Metrawatt, GMC-I Messtechnik GmbH located in Nuremberg sells high-quality systems for electrical measurement and test engineering, which are used, among other things, for the prescribed monitoring of the electrical safety of electrical devices and facilities. The modular measurement and test system SECUSTAR FM could be significantly optimized in collaboration between Büren & Partner Software-Design GBR and Fraunhofer IESE with the help of the ArQuE method: Test procedures now run faster and taking over data from external systems is made easier.
- Testo AG located in Lenzkirch was able to save effort in the development of their multi-variant special measurement devices for refrigeration, air conditioning, and flue gas analysis applications. This was made possible through better reusability of already existing system components during the design of the software product lines underlying the devices in the context of the ArQuE project.
- In the case of the telecommunication system LambdaUnite Multi-Service Switch(TM) developed by Alcatel-Lucent in Nuremberg, the success of the measures taken to increase maintainability and ensure the evolvability of individual sub-systems was proven with the help of systematic analyses, e.g., regarding the reduction of software clones in recent system releases. In addition, test cases in subsequent releases could be prioritized systematically through the use of a novel defect prediction process.
- Tynos IT Services developed an all-in-one solution for scanning RFID tags with mobile end devices. In the context of the ArQuE project, the adaptability of the Mobile Transaction Services (MTS) running on "BlackBerry"-type MDAs could be improved significantly.
- WIKON Kommunikationstechnik GmbH from Kaiserslautern was able to reduce the development and testing effort for its wireless telecontrol system XENON8 by 35% through the use of innovative architecture-centric methodology from the ArQuE project.

During the further course of the ArQuE project, lessons learned from all industry partners – improved reaction to customer wishes, faster time to market, and increased maintainability – were consolidated until April 2009. Applicability, transferability, and scalability of the ArQuE methodology could be proven successfully. Software architectures that were designed in an engineering-style manner ensure success in software and systems development systematically, efficiently, and sustainably – as empirically demonstrated in ArQuE.

Collaboration Partners

Büren & Partner Software-Design GBR
www.spin.noris.de

Daum electronic
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GMC-I Messtechnik
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Testo AG
www.testo.de

Alcatel-Lucent
www.alcatel-lucent.de

tynos GBR
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WIKON Kommunikationstechnik GmbH
www.wikon.de

Further Information

ArQuE - Architecture-centric Quality Engineering
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It is the architecture that determines a product's success!

SERVICE-ORIENTED ARCHITECTURES

TEAMWORK FOR MORE PUBLIC SAFETY

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Catastrophes or major disasters frequently lead to extreme strains on the rescue units and security forces in charge. In order to be able to collaborate quickly, in a coordinated and anticipatory manner, the decision makers and institutions would require an infrastructure corresponding to the current state of the practice, which is often non-existent. The research project “Service-oriented architectures for the support of networks in the context of public safety” SoKNOS shall create a service platform for the support of public safety on the basis of distributed infrastructures, data, and processes already existing today. The focus is on the specific requirements on the interoperability, security, and robustness of the infrastructure.

As a partner in the interdisciplinary project consortium, Fraunhofer IESE was tasked with performing requirements engineering (RE). For eliciting the requirements on the platform to be designed, numerous public safety institutions (such as police, fire departments, Federal Agency for Technical Relief, etc.) had to be analyzed regarding their internal organization, taking into account the respective security and non-disclosure aspects.

Eliciting and mapping the workflows required the whole range of available RE techniques. In particular, sub-scenarios of field work in disaster situations, user roles, generalized use cases, user requirements, wishes and problems, as well as existing IT systems were analyzed.



GEFÖRDERT VOM



Bundesministerium
 für Bildung
 und Forschung

In a creativity workshop with numerous participants, users from different organizations and scientists met and generated an ambitious, but realizable required state from the actual state. Using current RE methods, this state was packaged in such a way that it could be transferred into a Service-Oriented Architecture (SOA) as efficiently as possible. In particular, the challenge was to match the required platform services from the user perspective with existing services from the system architecture perspective. During this process, requirements engineering and architecture design were fused into an integrated process without any clear separation between the disciplines.

This project is being funded by the Federal Ministry of Education and Research (BMBF) under grant no. 01ISO7009 in the context of the research initiative ICT 2020 / Research for Innovation.



Life-saving collaboration:

When a major disaster happens, seconds often make all the difference. To prevent valuable time being wasted during the collaboration of the different rescue units, SoKNOS provides an integrated service platform.

The result of the analysis were innovative service concepts that allow numerous aspects and data related to major disasters or catastrophe scenarios to be handled with the support of technology. These range from reports about the current situation (including weather, geographical conditions, traffic, environmental data, media information) via the calculation of resources to risk assessment and scenario simulation. A first demonstrator of the integrated platform was presented to experts on the occasion of the third IT summit held in Darmstadt in November 2008.

During the remainder of the project, Fraunhofer IESE will be involved intensively in the validation of the implemented performance features. In the field of service-oriented requirements engineering, the institute will especially investigate issues relating to the active reuse of existing services in the context of application development.

Collaboration Partners

- | | |
|---|--|
| B2M Software AG
www.b2m-software.de | itelligence AG
www.itelligence.de |
| Berlin Fire Department
www.berliner-feuerwehr.de | Rutgers University (CIMIC), Newark/USA
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Further Information

SoKNOS – Service-oriented architectures for the support of networks in the context of public safety
www.soknos.de

Requirements Engineering meets the highest requirements!

IT-SUPPORTED WORKFLOW ANALYSIS

THE TAKE-A-CLOSE-LOOK METHOD

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1. FC Kaiserslautern
www.fck.de

In which formation will the opponent play? What are the strengths and weaknesses of a potential new player? Why was the last goal scored against us? Coaches and club managers want to have quick and reliable answers to these and many other questions related to "scouting". Fraunhofer IESE and the soccer club 1. FC Kaiserslautern have now worked out in close collaboration how these complicated processes can be simplified and accelerated.

In the context of the research focus "Virtual Office of the Future (VOF)", Fraunhofer IESE is developing workflow-oriented methods for the design of distributed electronic systems for data processing. As part of the collaboration, some of the concepts developed in the VOF could be transferred to scouting. During scouting, information about teams or individual players is collected and analyzed systematically. The game observations themselves are done by the scouts and then analyzed by a chief scout, who relays his assessment to the coaches and the team. Successful scouting is based on information supplied by the scouts with the highest possible degree of quality and on careful analysis by the chief scout.

The engineers of Fraunhofer IESE have developed an information system in support of the scouting process in collaboration with Fuat Kilic, the assistant coach and chief scout of 1. FC Kaiserslautern, and students from the local university. As a starting point, a methodology for the elicitation and assessment of workflows was used that originates from requirements engineering and was originally developed at Fraunhofer IESE. Specialists from the area of Usability Engineering provide support to the students during all phases of development to maintain the highest possible level of usability. The individual scouts can now electronically transmit the information collected during observation of a game to the chief scout, who himself receives support in bringing together and evaluating this information. The significant reduction in the burden to the chief scout benefits the quality of the analysis on the one hand, and accelerates the feedback of urgently needed data into the team's operative training activities on the other hand. The architecture design of the information system was done using the well-proven methodology PuLSE® DSSA (Product Line Software Engineering - Domain Specific Software Architecture) of Fraunhofer IESE.

The system will be tested by 1. FC Kaiserslautern during the 2009 season, while development will continue on the part of Fraunhofer IESE. Strategic planning and expansion of the collaboration in the context of other core processes of the club are also envisioned.

*Optimal process –
optimal result!*



EXPERIENCE KNOWLEDGE IN SOFTWARE DEVELOPMENT

TESTING EMPIRICAL METHODS

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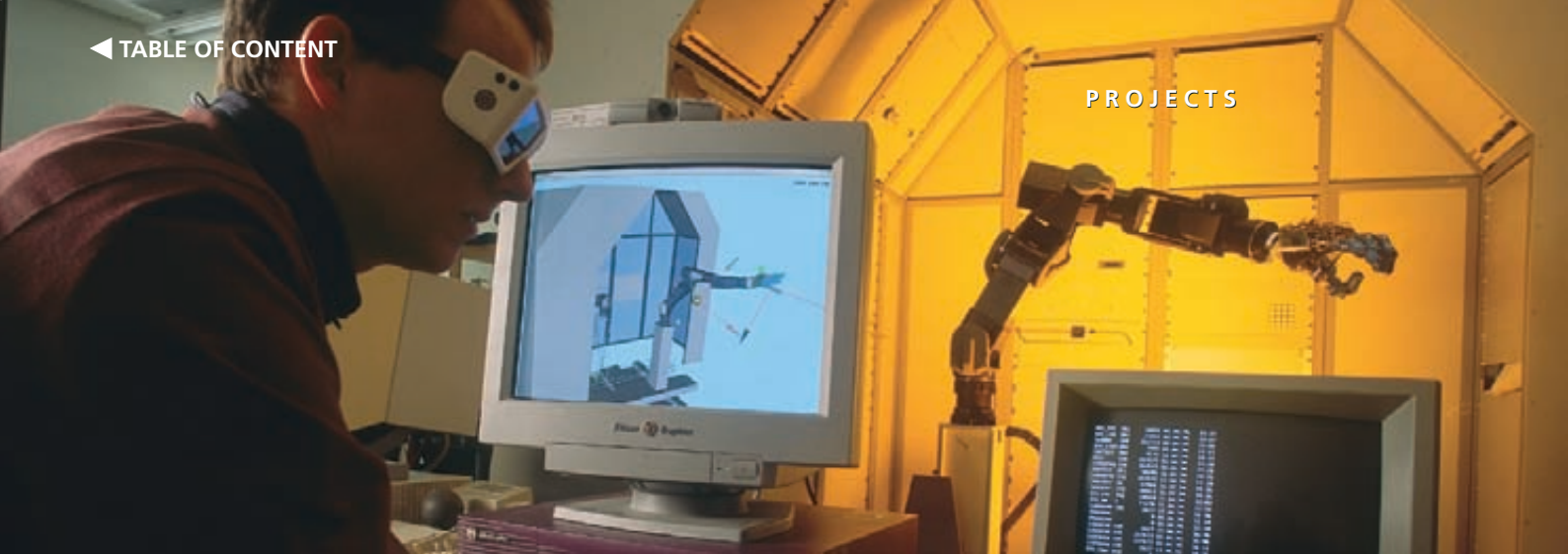
Collaboration Partner

Robert Bosch GmbH
www.bosch.de

Engineering-style software development is sustainable and successful. This requires development methods and tools whose suitability for the given project goals and characteristics has been proven and whose costs, risks, and benefits are known. Bosch Corporate Research is developing and adapting software development methods for the company-internal business areas of Robert Bosch GmbH. The Bosch Empirical Methods Lab (EML) thoroughly tests these methods in empirical studies and thereby supports the internal technology transfer from company research to operative development.

Empirical studies, for example in the form of controlled experiments or case studies, are an approved means for proving the benefits and drawbacks of the software development methods and tools to be investigated in a practice-oriented manner. However, performing such studies in a professional manner requires competence in terms of planning, performing, and evaluating such studies if relevant and robust results are to be obtained. In addition, the underlying business processes must be taken into account appropriately, and the responsible managers must be involved. Fraunhofer IESE with its internationally recognized expertise in the area of empirical software development processes provided intensive support to Robert Bosch GmbH during the establishment of its own empirical method lab.

The goal of the lab is to recognize and assess the benefit of new technologies for the process of industrial software development as early as possible. Similar to mechanical engineering, where new materials must pass thorough material and process tests before the start of production, new software development methods must also be tested before being introduced into industrial practice. Insufficiently optimized, inefficient, or defective process may severely disrupt active development processes and demotivate employees. Empirical studies performed in advance can also check the usability and practical suitability of the respective processes beyond merely technical aspects and indicate potential areas of optimization.



During the initial phase of the Empirical Method Lab (EML), the needed infrastructure was established first at Robert Bosch GmbH, consisting mainly of a “method suitcase” for documenting the empirical processes, and access to company-internal test persons. Software engineers from Fraunhofer IESE transferred the necessary competence regarding empirical processes in method development. Practically applicable processes were documented in the form of a “method suitcase” and relevant metrics were developed for the future analysis of the studies.

After the launch of the Empirical Method Lab, the focus of the work was on the performance of studies. In the future, additional studies will be performed. Another methodological focus will be the summarizing analysis of results across several studies and their comparison with data outside Robert Bosch GmbH.

*Observe, analyze,
optimize!*

SOFTWARE ENGINEERING IN HEAVY INDUSTRY

SOFTWARE LIKE STEEL – SOLID AND FLEXIBLE AT THE SAME TIME

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Collaboration Partner

Pohang Iron and Steel
Company
www.posco.com

The South Korean Pohang Iron and Steel Company POSCO is the world's fourth-largest producer of steel. Currently, POSCO is operating two steel plants, one in Pohang and one in Gwangyang. The production of steel encompasses several process steps, from the mining of pig iron via the actual production of steel in the converter to the removal of impurities in special furnaces. After a brief cooling period, the liquid steel is shaped into slabs, billets, or blooms in continuous casting systems (CCS) and then processed further in hot or cold rolling mills.

The entire process runs fully automatically and is controlled by programmable logic controllers. Software-based systems are also used to set up, track, and archive the production processes in real time. Due to the high degree of abrasion caused by the harsh operating conditions, production facilities and their corresponding electronic components must be replaced often in a steel plant. Furthermore, there are numerous variants due to different production lines and hardware manufacturers.

Against this background, Fraunhofer IESE successfully employed the institute's own product line engineering framework PuLSE® DSSA. By using PuLSE®, a product line-based system architecture could be developed that is optimally prepared for potential change scenarios.

In the context of practical project work, the engineers from Fraunhofer IESE first analyzed the control software of an automatic continuous casting system at POSCO together with its corresponding documentation. In this endeavor, the tool SAVE (Software Architecture Visualization and Evaluation), also developed by Fraunhofer IESE, proved to be valuable especially for reconstructing, respectively complementing, the undocumented views of the existing software architecture.



Afterwards, the specialists from Kaiserslautern used PuLSE® DSSA to study the influence of configuration changes made to the CCS on its system software in order to evaluate the flexibility of the underlying software architecture. Scenario-based analyses in combination with the measurement data obtained through PuLSE® DSSA allowed both qualitative and quantitative inferences regarding the concrete impact of potential changes as well as identification of possible flaws in the design of the reviewed architecture.

Based on the lessons learned from analyzing the legacy system, a new product line architecture for the software systems of future continuous casting systems at POSCO was developed in the next step. The feasibility of this software design was subsequently validated in a pilot implementation, which focused especially on key concepts intended to ensure, in particular, the envisioned flexibility and maintainability of future control software for new CCS or CCS to be modified.

In order to enable POSCO in the future to develop its own components that are in tune with the newly designed product line architecture, Fraunhofer IESE developed methodological guidelines that were taught in training sessions at the production site. During the seven-month duration of the project, an engineer from the Korean steel company was based at the institute in Kaiserslautern to support smooth cooperation with the distant collaboration partner and ensure an efficient transfer of technology.

*Software
Engineering strikes
the iron while it's
hot!*

IT SUPPORT IN EVERYDAY LIFE

EMERGE: SMART AND PROACTIVE LIVING

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Further Information

The EMERGE Project
www.emerge-project.eu

EMERGE is funded by the European Commission in the context of the 6th Framework Programme under project number IST-2005-045056.



Due to the demographic and social changes expected for the next few decades, age-related medical emergencies and thus rescue service missions will experience a dramatic increase. This will happen all over the world, especially, however, in most European countries. Already today, 44 % of the resources of medical emergency and rescue services are used for people over 70 years of age. In the future, significantly higher costs are therefore to be expected for rescue services and the health care system in general. However, affordable and yet high-quality emergency care is the prerequisite for people to live independent lives in their familiar environments until old age.

The aim of the EU project EMERGE – Emergency Monitoring and Prevention is to develop a modern and automated environment for elderly people using Ambient Intelligence technologies. The sensors that are needed for unobtrusively monitoring elderly people in their daily lives are primarily integrated into the home environment. Sensors mounted on people's bodies are only used for monitoring vital parameters such as pulse. The data captured on the environment and the residents are fed into a so-called "Human Capability Model" (HCM), which combines the functional assessment of movements, activities, and vital data and derives Activities of Daily Life (ADL). The HCM is divided into a series of sub-models for sensors, environment, the functional health condition of an individual, and descriptions of normal, resp. irregular, activities from an emergency medicine perspective. These sub-models adapt to the respective "abilities" of the individual in question and to his or her very specific environment in order to detect potential, respectively acute, emergencies as accurately as possible. The system-generated assistance in case of an emergency is performed incrementally and involves other stakeholders such as family members, neighbors, caregivers, and emergency rescue dispatch centers. Emergency-specific information is transmitted using modern communication technologies in order to enable optimal reaction to the respective situation while improving resource disposition at the same time.



The benefits and disadvantages of the models, technologies, and solutions developed in EMERGE are studied under realistic conditions in two field trials as well as under laboratory conditions (including studies performed at the Assisted Living Laboratory of Fraunhofer IESE). These studies employ engineering-style quality models. They are performed from the perspective of the people affected and from that of professional caregivers, as well as under technological aspects. In the medium term, positive results may lead to new medical and technical guidelines and standard operating procedures for emergency medicine and dispatch offices.

Collaboration Partners

Siemens Corporate Technology

www.ct.siemens.com

Westpfalz-Klinikum Kaiserslautern

www.westpfalz-klinikum.de

e-ISOTIS

www.e-isotis.org/

Bay Zoltan Foundation for Applied Research

www.bzlogi.hu

Art of Technology

www.art-of-technology.ch

European Microsoft Innovation Center (EMIC)

www.microsoft.com/emic/

National Center of Scientific Research

"Demokritos"

www.demokritos.gr

Medical University of Graz

www.meduni-graz.at/

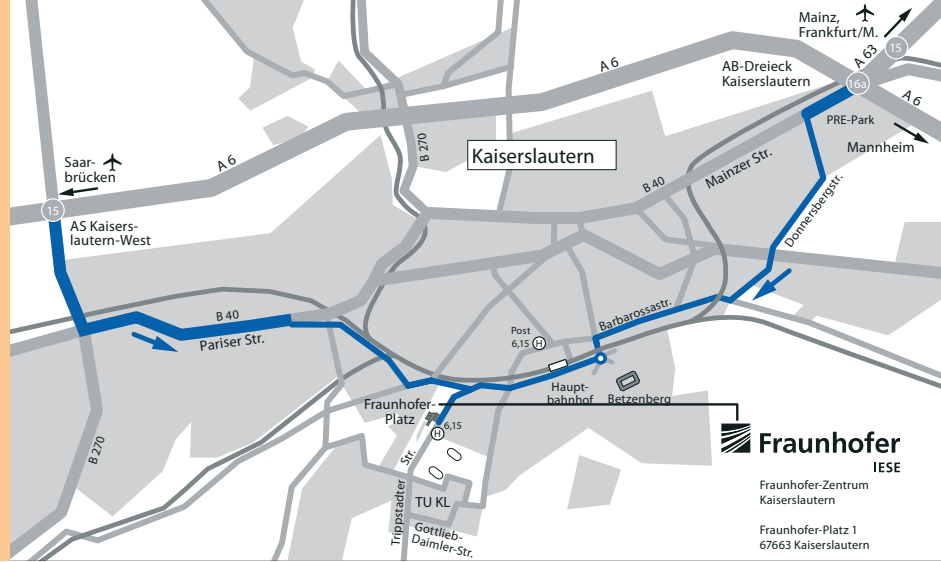
*Technology that
thinks ahead!*



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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:

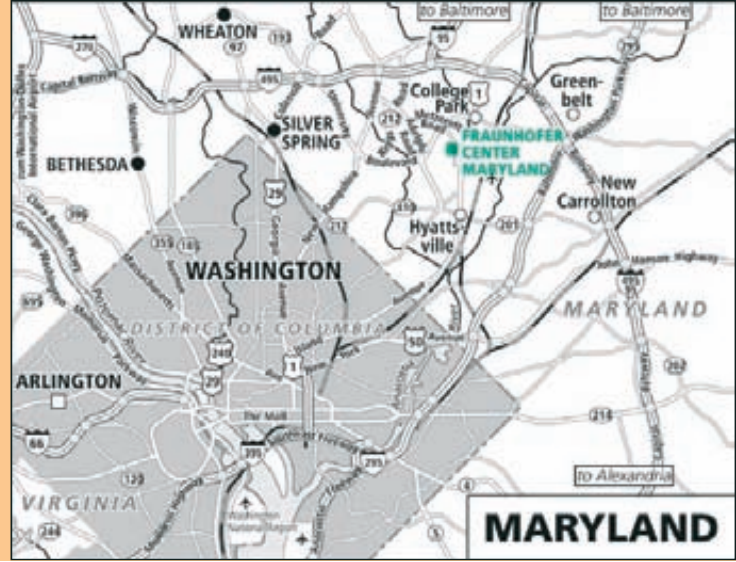
Since most likely, the Fraunhofer-Platz is not yet listed in most electronic navigation systems, we recommend using “Trippstadter Strasse 125” as the destination instead. The Fraunhofer Center is located directly across the street..

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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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.
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included Appendix and other publications (press releases,
previous Annual Reports) are available at

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- Siemens Medical Solutions Health Service AG, Erlangen
- SOFTEAM, Paris, France
- SOFTWIN S.R.L., Bukarest, Romania
- Sportbund Rheinhessen, Mainz
- SQS Software Quality Systems AG, Cologne
- Steinbichler Optotechnik GmbH, Neubeuern
- Stryker Leibinger GmbH, Freiburg
- Süddeutsche Klassenlotterie, Munich
- Technische Werke Kaiserslautern Versorgungs-AG, Kaiserslautern
- Telekomunikacja Polska S.A., Warsaw, Poland
- Telenor ASA, Fornebu, Norway
- Testing Technologies IST GmbH, Berlin
- Testo AG, Lenzkirch
- T-Mobile International AG & Co KG, Bonn
- Valeo Schalter und Sensoren GmbH, Bietigheim-Bissingen
- Vision Tools GmbH, Waghäusel
- WIKON Kommunikationstechnik GmbH, Kaiserslautern

NATIONAL RESEARCH PARTNERS

- Arbeitsgruppe Softwaretechnik, Universität Bremen (Software Engineering Research Group, University of Bremen), Bremen
- Berufsakademie Karlsruhe (University of Cooperative Education Karlsruhe), Karlsruhe
- Deutsches Forschungszentrum für Künstliche Intelligenz GmbH (DFKI) (German Research Center for Artificial Intelligence GmbH), Kaiserslautern
- European Space Agency (ESA), Darmstadt
- Fachbereich Elektrotechnik und Informatik, Fachhochschule Münster (Department of Electronical Engineering and Informatics, Muenster University of Applied Sciences), Münster
- 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
- Institut für Informatik IV, Technische Universität München (Institute for Computer Science, Technical University of Munich), München
- Institut für Technologie und Arbeit, Technische Universität Kaiserslautern (Institute for Technology and Work, University of Kaiserslautern), Kaiserslautern
- 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 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
- Westpfalz-Klinikum GmbH, Kaiserslautern

INTERNATIONAL RESEARCH PARTNERS

- Akademia Ekonomiczna W Poznaniu, Poznan, Poland
- Bay Zoltan Foundation for Applied Research, Budapest, Hungary
- Bournemouth University, Poole, United Kingdom
- Center for Empirically Based Software Engineering CeBase, Maryland, USA
- Concordia University, Quebec, Canada
- Experimental Software Engineering Group of the University of Maryland (UMD/ESEG), College Park, USA (formal affiliation agreement)
- Facultés Universitaires Notre-Dame de la Paix, Namur, Belgium
- Faculty of Informatics, University Dzemal Bijedic, Mostar, Bosnia-Herzegovina
- Faculty of Information Technology, University of Akureyri, Akureyri, Iceland
- Helsinki University of Technology, Espoo, Finland
- Heriot-Watt University, Edinburgh, United Kingdom
- Information Society Open To Impairments, Athens, Greece
- Information-technology Promotion Agency, Tokyo, Japan
- Infovide Spolka Akcyjna, Warsaw, Poland
- Institut National Polytechnique de Toulouse, Toulouse, France
- Japan Electronics and Information Technology, Tokyo, Japan
- Japan Aerospace Exploration Agency JAXA, Tokyo, Japan
- Japan Manned Space Systems Corporation, Ibaraki, Japan
- Jozef Stefan Institute, Ljubljana, Slovenia
- Kyungpook National University, Daegu, Korea
- Laboratory for Software Engineering Decision Support, University of Calgary, Calgary, Canada
- Latvijas Universitates Matematikas un Informatikas Instituts, Riga, Latvia
- Medical University of Graz, Graz, Austria
- National Centre for Scientific Research DEMOKRITOS, Athens, Greece
- National College of Ireland, Dublin, Ireland
- National ICT Australia (NICTA), Australian Technology Park, Eveleigh, Australia
- National University of Ireland, Galway, Ireland
- New Bulgarian University, Sofia, Bulgaria
- Open University, Milton Keynes, United Kingdom
- Polish Japanese Institute of Information Technology, Warsaw, Poland
- Politecnico di Milano, Milan, Italy
- Politechnika Warszawska, Warsaw, Poland
- SQI Software Quality Institute, Brisbane, Australia
- Swinburne University of Technology, Hawthorn, Australia
- Swiss Federal Institute of Technology, Zurich, Switzerland
- Tampere University of Technology (Pori), Pori, Finland
- Technical University of Vienna, Vienna, Austria
- Technische Universiteit Eindhoven, Eindhoven, The Netherlands
- Universidad de Lleida, Lleida, Spain
- Universidad Nacional Autónoma de México, Mexico City, Mexico
- Universidad Rey Juan Carlos, Mostoles, Spain
- Universität für Bodenkultur Wien, Vienna, Austria
- Universiteit Maastricht, Maastricht, The Netherlands
- University of Innsbruck, Innsbruck, Austria
- University of Queensland, Brisbane, Australia
- VTT Electronics, Oulu, Finland (formal affiliation agreement)

INTERNATIONAL SOFTWARE ENGINEERING RESEARCH NETWORK (ISERN)

- Avaya Labs, USA
- Blekinge Institute of Technology BTH, Sweden
- Computer Science and Systems Engineering Program COPPE, Federal University of Rio de Janeiro, 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 (IPA), Software Engineering Center (SEC), Japan
- Japan Manned Space Systems Corporation JAMSS, Japan
- Japan Aerospace Exploration Agency JAXA, Japan
- Leiden University, The Netherlands
- LERO, Ireland
- Lund University, Sweden
- Massachusetts Institute of Technology Lean Aerospace Initiative, USA
- Microsoft Research, USA
- Nara Institute of Science and Technology, Japan
- Naval Postgraduate School, USA

- North Carolina State University, USA
- Northrop Grumman, USA
- Norwegian University of Technology and Science, Norway
- NRC Institute for Information Technology, Canada
- NTT Data Corporation, Japan
- Osaka University, Japan
- Robert Bosch GmbH, Germany
- SIMULA Research Laboratory, Norway
- SINTEF, Norway
- Softability, Finland
- SUN Microsystems, USA
- Technische Universität München, Germany
- University of Kaiserslautern, Germany
- Universidad ORT Uruguay, Uruguay
- Universidad Politécnica de Madrid, Spain
- Universidad Politécnica de Valencia, Spain
- Università degli Studi dell'Insubria, 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 Maryland, Baltimore County, USA
- University of Maryland at College Park, USA
- University of New South Wales, Australia
- University of Oulu, Finland
- University Politecnico di Torino, Italy
- University of Rome Tor Vergata, Italy
- University of São Paulo, Campus of São Carlos USP, Brazil
- University of Sheffield, United Kingdom
- University of Southern California, USA
- University of Strathclyde, United Kingdom
- University of Technology Sydney, Australia
- Vienna University of Technology, Austria
- VTT Electronics, Finland

VISITORS HOSTED

Gustav Herzog, Member of the German Federal Parliament, Berlin, Germany, May 21

Jörg Tauss, Member of the German Federal Parliament, Berlin, Germany, May 21

Dietmar Winkler, Vienna University of Technology, Austria, May 8-9

Shuji Morisaki, Nara Institute of Technology (NAIST), Japan, October 8-14

Haruka Nakao, Japan Manned Space Systems Corporation, Tokyo, Japan, June 01, 2007 - March 31, 2008

Oscar Dieste, Facultad de Informática - UPM, Campus de Montegancedo, Boadilla del Monte, Spain, May 2 - October 31

Dr. Rainer Jansen, Federal Ministry of Education and Research, Berlin, Germany, October 29

Michael Ebling, State Secretary, Ministry of Education, Science, Youth and Culture of the State of Rheinland-Pfalz, Mainz, Germany, October 29

Dr. Klaus Weichel, Lord Mayor of the City of Kaiserslautern, Germany, October 29

Rolf Künne, District Administrator of the district of Kaiserslautern, Germany, April 12

Dr. Karina Villela, Department of Computer Science, University of Salvador (UNIFACS), Brazil, January - September 2008

Ricardo Neisse, University of Twente, Enschede, The Netherlands, December 9

Prof. Stefan Biffel, Institute of Software Technology and Interactive Systems, Vienna University of Technology, Austria, October 9

Prof. Daniel Port, Shidler College of Business, University of Hawaii, Honolulu, Hawaii, USA, October 8

Prof. Micheal Ernst, Massachusetts Institute of Technology (MIT), Cambridge, USA, November 24

Prof. Lionel Briand, Simula Research Laboratory, Lysaker, Norway, October 8

Prof. Dietmar Pfahl, Simula Research Laboratory, Lysaker, Norway, October 8

Andrey Rybalchenko, Max-Planck-Institute for Software Systems, Saarbrücken, Germany, October 21

Taflin Murnane, KJ Ross & associates, Melbourne, Australia, May 27

Prof. Rance Cleaveland, Department of Computer Science, University of Maryland, USA, December 4

PROFESSIONAL CONTRIBUTIONS

LECTURING ASSIGNMENTS

Eschbach, R.:

Lecture
Formal Specification and Verification Techniques, Computer Science Department, University of Kaiserslautern, Winter 2008/2009

Dörr, J.:

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

Göpfert, B.:

Guest Lecture
Management von internen Informationseinrichtungen, Department of Information and Communication, University of Applied Sciences and Arts Hannover, Summer 2008

Pai, G.:

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

Kloos, J.:

Lecture
Formal Specification and Verification Techniques
Computer Science Department, University of Kaiserslautern, Winter 2008/2009

Pretschner, A.:

Lecture
Advanced Topics of Software Testing, Computer Science Department, University of Kaiserslautern, Winter 2008/2009

Münch, J.:

Lecture
Process Modeling, Computer Science Department, University of Kaiserslautern, Summer 2008

Rombach, D.:

Lecture
Software Engineering I, Computer Science Department, University of Kaiserslautern, Winter 2007/2008

Lecture
Empirical Model Building and Methods, Computer Science Department, University of Kaiserslautern, Winter 2007/ 2008

Lecture
Project Management and Quality Assurance, Computer Science Department, University of Kaiserslautern, Winter 2007/ 2008

Lecture Series
Software Engineering: Innovation and Value Creation by Software, Swiss Federal Institute of Technology Zurich and University of Zurich, May 2008

EDITORIAL BOARDS

Bomarius, F.:

Member, Editorial Board, Ph.D. Theses in Experimental Software Engineering, Fraunhofer IRB Publishing Company, since 2001

Liggismeyer, P.:

Editor, it – information technology, Oldenbourg-Verlag, München, since 2003

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

Editor, Informatik – Forschung und Entwicklung, Springer, since 2000

Member, Editorial Board, Ph.D. Theses in Experimental Software Engineering, Fraunhofer IRB Publishing Company, since 2004

Münch, 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, ACM-TOSEM, 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****Alves, V.:**

Member, Program Committee, Workshop on Modularization, Composition and Generative Techniques for Product Line Engineering, GPCE '08, Nashville, USA, October 23

Member, Program Committee, Second Latin-American Workshop on Aspect-Oriented Software Development, 22nd Brazilian Symposium on Software Engineering (SBES'08), Campinas, Brazil, October 13-17

Member, Program Committee, Tutorial Track, 22nd Brazilian Symposium on Software Engineering (SBES'08), Campinas, Brazil, October 13-17

Member, Program Committee, 11th Early Aspects Workshop, AOSD 2008, Brussels, Belgium, March 31

Member, Program Committee, 12th Early Aspects Workshop, ICSE 2008, Leipzig, Germany, May 12

Workshop Organizer, 13th Early Aspects Workshop, SPLC 2008, Limerick, Ireland, September 8

Bauer, T.:

Workshop Organizer, MoTiP 2008 co-located with ECMDA 2008, Berlin, Germany, June 12

Dörr, J.:

Member, Program Committee, SCC 2008, Honolulu, USA, July 8-11

Member, Program Committee, ICSR 2008, Beijing, China, May 25-29

Member, Program Committee, TAV/RE Workshop, Bad Honnef, Germany, June 5-6

Workshop Organizer, SE 08, Munich, Germany, February 18-22

Member, Program Committee, Integration von Usability-Engineering und Software-Engineering, Esslingen, Germany, March 6-7

Member, Program Committee, Workshop NFP in DSML 2008 in conjunction with MoDELS 2008, Toulouse, France, September 28 - October 3

Member, Program Committee, Workshop MaRK '08 in conjunction with RE 2008, Barcelona, Spain, September 8-12

Member, Program Committee, icchp 2008, Linz, Austria, July 9-12

Member, Program Committee, IUI '08, Maspalomas, Spain, January 13-16

Elberzhager, F.:

Member, Program Committee, Euromicro DSD, Parma, Italy, September 3-5

Eschbach, R.:

Industry Track Chair, ICST 2008, Lillehammer, Norway, April 8-12

Member, Program Committee, MoTiP 2008, Berlin, Germany, June 12

Member, Program Committee, SEETEST 2008, Sofia, Bulgaria, July 2-3

Kerkow, D.:

Member, Program Committee, Integration von Usability-Engineering und Software-Engineering, Esslingen, Germany, March 6-7

Kläs, M.:

Member, Program Committee, 1st Workshop on Dependable Software Engineering 2008 in conjunction with ISSRE 2008, Seattle, USA, November 11-14

Knodel, J.:

Member, Program Committee, 15th Working Conference on Reverse Engineering, Antwerp, Belgium, October 15-18

Member, Program Committee, WSR 2008, Bad Honnef, Germany, May 5-7

Member, Steering Committee, CSMR 2008, Athens, Greece, April 1-4

Kohler, K.:

Member, Program Committee, Integration von Usability-Engineering und Software-Engineering, Esslingen, Germany, March 6-7

Liggesmeyer, P.:

Member, Program Committee, Workshop "Model-based Testing in Practice" in conjunction with ECMDA 2008, Berlin, Germany, June 12

Member, Program Committee, SEETEST 2008, Sofia, Bulgaria, July 2-3

Member, Program Committee, STeP 2008, Furtwangen, Germany, June 12

Member, Program Committee, Modellierung 2008, Berlin, Germany, March 12-14

Member, Program Committee, SE '08, Munich, Germany, February 18-22

Member, Program Committee, ICSE 2008, Leipzig, Germany, May 10-18

Member, Program Committee, Informatik 2008, Munich, Germany, September 8-13

Member, Program Committee, CONQUEST 2008, Nuremberg, Germany, September 16-18

Münch, J.:

Member, Program Committee, ESEM Short Paper Track within ESEM 2008, Kaiserslautern, Germany, October 9-10

Member, Steering Committee, ESEM 2008, Kaiserslautern, Germany, October 9-10

Program Co-Chair, ESEM 2008, Kaiserslautern, Germany, October 9-10

Publicity Co-Chair, ICSP 2008, Leipzig, Germany, May 10-11

Co-Organizer, SQMB 2008, Leipzig, Germany, February 18

Member, Program Committee, SMEF 2008, Milano, Italy, May 18-20

Member, Program Committee, Workshop SPACE 2008 in conjunction with APSEC 2008, Beijing, China, December 2

Member, Program Committee, MetriKon 2008, Munich, Germany, November 18-19

Member, Program Committee, IWSM 2008, Munich, Germany, November 18-19

Member, Program Committee, Mensura 2008, Munich, Germany, November 18-19

Member, Program Committee, CEE-SET 2008, Brno, Czech Republic, October 13-15

Member, Program Committee, Workshop "Vorgehensmodelle in der Praxis" in conjunction with Informatik 2008, Munich, Germany, September 8-13

Member, Program Committee, Track on Software Management within Euromicro, Parma, Italy, September 3-5

Member, Program Committee, Track on Software Process and Product Improvement within Euromicro, Parma, Italy, September 3-5

Member, Program Committee, ICGSE 2008, Bangalore, India, August 17-20

Member, Program Committee, PROFES 2008, Frascati, Italy, June 23-25

Member, Program Committee, Short Paper Track within PROFES 2008, Frascati, Italy, June 23-25

Member, Program Committee, ICSP 2008, Leipzig, Germany, May 10-11

Member, Program Committee, SEE 2007, Bern, Switzerland

Member, Program Committee, 15th Workshop of WIVM 2008, Berlin, Germany, April 10-11

Mukasa, K.:
Workshop Organizer, IUI '08, Maspalomas, Spain, January 13-16

Workshop Organizer, MoRSE08 in conjunction with ICSR 2008, Beijing, China, May 25-29

Member, Program Committee, CADIUI 2008, Albacete, Spain, June 11-13

Muthig, D.
Member, Program Committee, SPLC 2008, Limerick, Ireland, September 8-12

Member, Program Committee, Workshop MOMPES within ICSE 2009, Vancouver, Canada, May 16-24

Peine, H.:
Member, Program Committee, ARES 2008, Barcelona, Spain, March 4-7

Pretschner, A.:
Organizer, Doctoral Symposium within MoDELS 2008, Toulouse, France, September 28 - October 3

Member, Program Committee, MoDELS 2008, Toulouse, France, September 28 - October 3

Member, Program Committee, ICST 2008, Lillehammer, Norway, April 9-11

Member, Program Committee, FORMS/FORMAT 2008, Budapest, Hungary, October 9-10

Member, Organizing Committee, Swiss Testing Day, Zurich, Switzerland, March 19

Ras, E.:
Workshop Organizer, LEB 08 in conjunction with ECTEL 2008, Maastricht, The Netherlands, September 17

Workshop Organizer, WL-LOKOMOL 2008 in conjunction with I-KNOW 2008, Graz, Austria, September 3

Rombach, D.:
Member of the Steering Committee and Chair, ISERN Workshop in conjunction with ESEM 2008, Kaiserslautern, Germany, October 9-10

Schwarz, R.:
Member, Program Committee, ISA 2008, Busan, Korea, April 24-26

Member, Program Committee, ESEM 2008, Kaiserslautern, Germany, October 9-10

SCIENTIFIC AND TECHNOLOGICAL ADVISORY BOARDS

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

Rech, J.:
Speaker, GI Working Group on Architecture and Design Patterns, Germany, since 2006

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

Member, Scientific Advisory Board, Simula Research Lab, Oslo, Norway, since 2001

Chairman, Fraunhofer ICT Group, Germany, since 2006

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

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, Scientific Research Board, Kaiserslautern University of Applied Sciences, Germany, since 2003

Coordinator, German-Hungarian Cooperation of the University of Kaiserslautern, Germany, since 2004

Member, European Council on Information Technology Governance and Strategy, Brussels, Belgium, since December 2006

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

Member, Scientific Advisory Board, Public Systems GmbH, Germany, since 2006

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

Member, Advisory Board, Projekt "Internet 2010" der Deutschen Messe AG, Hanover, Germany, since October 2006

Member, Advisory Board, Business and Innovation Center (BIC), Kaiserslautern, Germany, since February 2008

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

Göpfert, B.:
Member, STAR-Anwenderbeirat, Munich, Germany, since October 2007

Kerkow, D.:
Member, VDI-Fachausschuss "Qualitätssicherung für Software in der Medizintechnik", Düsseldorf, 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

Chairman, Advisory Board, 1. FC Kaiserslautern (Professional Soccer Club), Kaiserslautern, Germany, since 2008

PARTICIPATION IN DELEGATIONS

Rombach, D.:
Delegation of the City of Kaiserslautern to South Carolina, USA, September 11-17

MEMBERSHIPS IN INDUSTRIAL 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

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

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

KEYNOTES

Anastasopoulos, M.:

“Product Line Evolution: Keeping Systematic Reuse under Control”, 2nd RiSE Summer School on Software Product Lines, Recife, Brazil, November 30

Liggesmeyer, P.:

“Paradigmenwechsel in der Fahrzeugtechnik: Vom Maschinenbau zum softwareintensiven System”, Tag der Technik, Mannheim, Germany, June 16-17

“Sichere Systeme: Theorie und Erfahrung, Standards und Common Sense”, sgs-kongress Sicherheitsgerichtete Systeme 2008, Stuttgart, Germany, October 20-22

“Softwareprüfung gestern und heute: Theorie und Erfahrung, Standards und Common Sense”, Annual Meeting of STI e.V., Kaiserslautern, Germany, November 8

“Software-Qualitätssicherung gestern und heute: Theorie und Erfahrung, Standards und Common Sense”, Software-Management 2008, Stuttgart, Germany, November 12-14

Münc, J.:

“Software Process Improvements: Opportunities and Risks”, Euromicro, Parma, Italy, September 4

Muthig, D.:

“Product Lines in Practice - Bridging the Gap between Economics and Engineering”, Brazilian Symposium on Components, Architectures, and

Reuse, Porto Alegre, Brazil, August 21

Rombach, D.:

“Informationstechnologie – Innovationsmotor für die Medizin”, Fachtagung Smart Biomedical IT / Informationstechnologie für die Medizin, Nuremberg, Germany, January 30

“Status of Software Engineering Education in Europe”, International Education Symposium of the Universities of Osaka, Kyoto and Kobe, Osaka, Japan, February 27

“Trends and R&D for an Ambient Intelligent World”, Ubiquitous IT Europe Forum, Bonn, Germany, March 10

“Schule als Vorbereitung für IT-Berufe”, 99th MNU Congress, Kaiserslautern, Germany, March 10

“Empirical Studies - A Means of Classroom Instruction”, IEEE ASEET, Charleston, SC, USA, April 14

“From Software to Systems Engineering”, Birthday Colloquium for Dr. Les Belady, John-von-Neumann Foundation, Budapest, Hungary, May 23

“Empirical Software Engineering Evidence: A Key Step towards Engineering”, Experimental Software Engineering Latin American Workshop, ESELAW 2008, Salvador, Brazil, November 5

“Future Challenges in Software Engineering for EADS”, Annual EADS Leadership Conference, Paris, France, November 13

PRESENTATIONS

Adam, S.:

“High Quality in Elicitation and Specification of Non-functional Requirements - Lessons Learned from Applying this Method to the Automotive Domain”, Conference Presentation, CONQUEST 2008, Potsdam, Germany, September 25

“How to better align BPM & SOA - Ideas on Improving the Transition between Process Design and Deployment”, Workshop, BPMDS 2008, Montpellier, France, June 16

“The Role of Service Abstraction and Service Variability and its Impact on Requirements Engineering for Service-oriented Systems”, Workshop, COMPSAC 2008, IEEE, Turku, Finland, July 27

Alves, V.:

“An Exploratory Study of Information Retrieval Techniques in Domain Analysis”, Conference Presentation, 12th Software Product Line Conference (SPLC 2008), Limerick, Ireland, September 9

“Experiences with Mobile Games Product Line Development at Meantime”, Conference Presentation, 12th Software Product Line Conference (SPLC 2008), Limerick, Ireland, September 11

“FLiP: Managing Software Product Line Extraction and Reaction with Aspects”, Conference Presentation, 12th Software Product Line Conference (SPLC 2008), Limerick, Ireland, September 10

Armbrust, O.:

“Scoping Software Process Models - Initial Concepts and Experience from Defining Space Standards”, Presentation, ICSP 2008, Leipzig, Germany, May 10

“Organisationsweite Prozesseinführung und -reifung bei Witt Weiden”, Conference Presentation, Software and Systems Quality Conference International (SQI), Dusseldorf, Germany, April 16-18

Bauer, Th.:

“Model-based Statistical Testing”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, November 3

“Structure-oriented Testing”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 31

“Fundamental Concepts of Software Dependability”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 30

“Model-Based Testing and its Use in the ITEA2 Project D-MINT”, Tutorial, International Conference on Software & Systems Engineering and their Applications (ICSSEA 2008), Paris, France, December 9-11

“MOTIP 08 - Workshop on Model-based Testing in Practice”, Workshop, 4th European Conference on Model Driven Architecture Foundations and Applications (ECMDA 2008), Berlin, Germany, June 12

“Risikobasierte Ableitung und Priorisierung von Testfällen für den modellbasierten Systemtest”, Presentation, Software Engineering Konferenz 2008 (SE 2008), Munich, Germany, February 22

Böhr, F.

“On MiL, HiL, Statistical Testing, Reuse, and Efforts”, Presentation, MOTIP 08 - Workshop on Model-based Testing in Practice, Berlin Germany, June 12

“Testen von Umgebungsmodellen”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, July 9

“Modellierungstechniken für Testmodelle von hybriden Systemen”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, July 9

“Testkonzepte für neue Entwicklungen in der Fahrzeugindustrie”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, July 9

Dörr, J.:

“Erfolgreiche Produkte durch nutzerorientierte Featurepriorisierung”, Conference

Presentation, Reconf 2008, HOOD Group, Munich, Germany, March 10

“Supporting Requirements Engineering for Medical Products - Early Consideration of User-Perceived Quality”, Conference Presentation, ICSE 2008, IEEE / ACM, Leipzig, Germany, May 16

“Deriving Software Services from Exemplary Business Processes”, Presentation, SOCCER 08 Workshop, RE 2008, Barcelona, Spain, September 5

Domis, D.:

“Integrating Safety Analysis and Component-based Design”, Conference Presentation, 27th Int. Conference on Computer Safety, Reliability and Security, Newcastle upon Tyne, United Kingdom, September 22-25

Eisenbarth, M.:

“Facilitating Project Management by Capturing Requirements Quality and Volatility Information”, Conference Presentation, SQS 2008, Dusseldorf, Germany, March 16

“Verwendung von RE-Metriken im Projektmanagement”, Conference Presentation Reconf 2008, HOOD Group, Munich, Germany, March 10

“Automatisierte Konsistenzüberprüfung von Anforderungsdokumenten mit Hilfe formaler Verfolgbarkeitsmodelle”, Conference Presentation, SEISCONF 2008, Ottobrunn, Germany, November 18

“TraceChange in Doors”, Presentation, GI-Fachgruppentreffen RE, Karlsruhe, Germany, November 28

Elberzhager, F.:

“Software effizient verifizieren”, Industry Seminar, module 6 of the seminar series Software for Medical Products, Fraunhofer IESE and EUROCAT GmbH, Stuttgart, Germany, April 16-17

“Testbalance”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, October 23

“Software Reliability - Theory”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 31

“Inspection based on Safety-requirements”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 31

“Software effizient verifizieren”, Industry Seminar, module 6 of the seminar series Software for Medical Products, Fraunhofer IESE and EUROCAT GmbH, Darmstadt, Germany, October 1

Enriquez, E.:

“Software Reliability - Practical”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate,

Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 31

Eschbach, R.:

“Software effizient verifizieren”, Seminar, module 6 of the seminar series Software for Medical Products, Fraunhofer IESE and EUROCAT GmbH, Germany, October 2008

“Typische Validierungs- und Verifizierungstechniken im Lebenszyklus; Einführung Qualitätsmanagement (speziell Tests und Inspektionen)”, seminar series Software for Medical Products, Fraunhofer IESE and EUROCAT GmbH, Germany, April 2008

“Compositional Approaches for Model-based Safety Analysis: Current Research Activities”, SQRL-Day, University of Tennessee, Knoxville, USA, April

“Systematisches Testen”, Seminar, STI e.V., Kaiserslautern, Germany, June 10

“Model-based Software Engineering”, Presentation, ESA Workshop on Avionics Data, Control and Software Systems (ADCSS), ESA / ESTEC, Noordwijk, The Netherlands, October 30

“Model-based Statistical Testing”, ESTEC Workshop, ESA / ESTEC, Noordwijk, The Netherlands, March 27

“Wiederverwendungskonzepte bei MiL / HiL-Tests”, Presentation, Systemengineering Mechatronics, marcus.evans-Konferenz, Cologne, Germany, October 13-14

“Statistical Testing”, Seminar, D-MINT Webinar Series, STI e.V. Kaiserslautern, Germany, May 30

“Systematisches Testen und Verifizieren von Software”, Seminar, Deutsche Informatik-Akademie GmbH, Stuttgart, Germany, November 20-21

“Systematisches Testen und Verifizieren von Software”, Seminar, Deutsche Informatik-Akademie GmbH, Stuttgart, Germany, February 29

“Model-based Statistical Testing”, Presentation, InnoComp 2008, Rhode & Schwarz GmbH & Co. KG, Munich, Germany, May 6

“Model-Based Testing: Statistical and Risk-Based Approaches”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, July 9

“Model-based Statistical Testing”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, October 23

“Modellbasiertes Testen in der Praxis”, Seminar, Fraunhofer IESE Akademie, Kaiserslautern, Germany, February 28

Göpfert, B.:

“1 Jahr STAR-Anwenderbeirat – Stand und Perspektiven”, Presentation, Fraunhofer-Jahrestagung der Fachinformatik-Manager 2008, Muenster, Germany, October 8

Groß, A.:

“Emerge Study - Information and Usability Needs of Emergency Documents”, Workshop Presentation, Human-Computer Interaction for Medicine and Health Care (HCI4MED), British HCI 2008, Liverpool, United Kingdom, September 1-5

“EPC vs. UML”, Presentation, GI-Fachgruppentreffen RE, Karlsruhe, Germany, November 27

Hussain, T.:

“Statistical Testing for Industrial Automation”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, October 23

Jawurek, M.:

“Security Goal Indicator Trees: A Model of Software Features that Supports Efficient Security Inspection”, Presentation, 11th IEEE High Assurance Systems Engineering Symposium, University of Nanjing, China, December 3

John, I.; Vilela, K.:

“Evolutionary Product Line Requirements Engineering”, Tutorial, SPLC 2008, Limerick, Ireland, September 8-12

Kerkow, D.:

“Emerge Study - Information and Usability Needs of Emergency Documents”, Workshop Presentation, Human-Computer Interaction for Medicine and Health Care (HCI4MED), British HCI 2008, Liverpool, United Kingdom, September 1-5

“Frühzeitige Beachtung von Nutzerakzeptanz bei der Anforderungspriorisierung – Erfahrung mit AMUSE im Medizinkontext”, Conference Presentation, Medconf 2008, Munich, Germany, September 25

“Erhöhung von Patienten-Compliance durch systematische Identifikation von Interaktionspatterns”, Conference Presentation, Medconf 2008, Munich, Germany, September 24

Keuler, Th.:

“Softwarearchitekturen für Medizinprodukte”, Industry Seminar, seminar series Software for Medical Products, Fraunhofer IESE and EUROCAT GmbH, Frankfurt, Germany, June 3

“Architecture Compliance Checking at Run-time: An Experience Report”, Conference Presentation, International Conference on Quality Software (QSIC), Oxford University, United Kingdom, August 12-13

“Efficient Quality Impact Analyses for Iterative Architecture Construction”, Conference Presentation, Working IEEE/IFIP Conference on Software Architecture (WICSA) 2008, University of British Columbia, Vancouver, Canada, February 18-22

“A Light-weight Load-time Weaving Approach for OSGi”, Workshop Presentation, International Conference on Aspect-Oriented Software Development, Vrije Universiteit Brussel, Brussels, Belgium, March 31 - April 4

“Mobility in the Virtual Office of the Future: A Document-centric Approach”, Workshop, International Conference on Software Engineering (ICSE), Leipzig, Germany, May 10-18

“An Aspect-oriented Approach for Improving Architecture Design Efficiency”, Doctoral Symposium, International Conference on Software Engineering (ICSE), Leipzig, Germany, May 9-16

Kläs, M.:

“Balancing Upfront Definition and Customization of Quality Models”, Workshop, SQMB 2008, GI-Fachbereich Softwaretechnik, Munich, Germany, February 18

“Predicting Defect Content and Quality Assurance Effectiveness by Combining Expert Judgment and Defect Data - A Case Study”, Invited Talk, Microsoft Developer Division, Seattle, USA, November 13

“Predicting Defect Content and Quality Assurance Effectiveness by Combining Expert Judgment and Defect Data - A Case Study”, Presentation, ISSRE 2008, Seattle, USA, November 11-14

Klaus, A.:

“Testmanagement für modellbasiertes Testen”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, July 9

“Werkzeugintegration”, Presentation, Workshop “Digital Engineering for Commercial

Vehicles", Fraunhofer IESE, Kaiserslautern, Germany, July 9

"Functional Testing", Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 30

"Test Specification Based on International Standards", Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 30

Kleinberger, Th.:

"Nutzung von Auto-ID/RFID-Technologien im Umfeld von Ambient Intelligence - Assisted Living", Presentation, 1. RFID-Tag AIDA 2008, Rheinland-Pfalz, Land Rheinland-Pfalz, Mainz, Germany, February 14

Klößner, K.:

"Softwareentwickler als Interaktionsgestalter: Erfahrungen zu Einsatz und Verwendung von Interaktionspattern", Conference Presentation, Usability Professionals 2008, Mensch & Computer 2008, Lubeck, Germany, September 8

Kloos, J.:

"Safety and Reliability", Presentation, Workshop "Digital Engineering for Commercial Vehicles", Fraunhofer IESE, Kaiserslautern, Germany, July 9

"Formale Safety-Analysen", Presentation, Workshop "Digital Engineering for Commercial Vehicles", Fraunhofer IESE, Kaiserslautern, Germany, July 9

"Automatisierter Test variantenreicher Systeme", Presentation, Workshop "Digital Engineering for Commercial Vehicles", Fraunhofer IESE, Kaiserslautern, Germany, July 9

"Testautomatisierung, modellbasiertes und risikoorientiertes Testen", Presentation, Workshop "Digital Engineering for Commercial Vehicles", Fraunhofer IESE, Kaiserslautern, Germany, October 23

"Formal Methods", Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 31

"Sequence-based Specification", Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, November 3

Knodel, J.:

"Analyzing Software Architectures in Real-Time: The SAVE Evolution Monitor", Conference Presentation, The 1st Annual SAVE Conference 2008, Fraunhofer IESE and Fraunhofer Center Maryland, College Park, USA, February 5

"Architecture Compliance Checking – Experiences from Successful Technology Trans-

fer to Industry", Conference Presentation, 12th European Conference on Software Maintenance and Reengineering (CSMR 2008), Kostas Kontogiannis, National Technical University of Athens, Greece, April 2

"A Decade of Reverse Engineering at Fraunhofer IESE – The Changing Role of Reverse Engineering in Applied Research", Workshop Presentation, 10. Workshop Software Reengineering (WSR), GI-Fachgruppe Software-Reengineering (SRE), Bad Honnef, Germany, May 5-7

"Analyzing Software Architectures with SAVE", Lecture "Software Architectures", University of Applied Sciences Mannheim, Germany, June 5

"Constructive Architecture Compliance Checking – An Experiment on Support by Live Feedback", Conference Presentation, 24th IEEE International Conference on Software Maintenance ICSM 2008, Beijing, China, October 2

Landmann, D.:

"Supporting Requirements Engineering for Medical Products - Early Consideration of User-Perceived Quality", Conference Presentation, ICSE 2008, IEEE / ACM, Leipzig, Germany, May 16

Münch, J.:

"Predictable Software Development: Challenges, Approaches, and Experience", Invited Talk, Philipps-Universität, Marburg, Germany, September 25

"Predictable Software Development: Challenges, Approaches, and Experience", Invited Talk, University of Passau, Germany, July 23

"Predictable Software Development: Challenges, Approaches, and Experience", Invited Talk, Business and Innovation Center Kaiserslautern, Germany, April 23

"Using Measurement to Translate Business Vision into Operational Software Strategies", Invited Talk, Banking SPICE Conference, CRP Henri Tutor, Luxembourg, April 9

"Using Measurement to Translate Business Vision into Operational Software Strategies", Invited Talk, Computer Science Faculty Seminar, Free University of Bolzano, Italy, March 27

"Aligning Business Strategies with Software Development", Invited Talk, BITKOM e.V., Arbeitskreis "Software Quality Management", Berlin, Germany, March 26

"Software Engineering and Visual Analytics", Fraunhofer Futures Workshop, Fraunhofer-Gesellschaft, Munich, Germany, March 5

"Predictable Software Development: Challenges, Approaches, and Experience", Invited Talk, Mitsubishi Research Institute (MRI), Tokyo, Japan, February 27

"Software Engineering for the Aerospace Domain", Invited Talk, Japanese Space Agency (JAXA), Tsukuba, Japan, February 26

"Predictable Software Development: Challenges, Approaches, and Experience", Invited Talk, University of Kaiserslautern, Germany, February 21

Mukasa, K.:
"Towards a Natural Interaction Concept for SUI in AAL", Workshop, IUI4AAL 2008, Maspalomas, Spain, January 13

Muthig, D.:
"Softwarearchitekturen und Design zielgerecht erstellen", Industry Presentation, Eurocat Institute for Certification and Testing GmbH and Fraunhofer IESE, Stuttgart, Germany, January 29

"Implementing Product Lines in Practice – A Path towards Optimal Software Engineering Practices", Presentation, Brazilian Symposium on Components, Architectures, and Reuse, TechnoPuc, Porto Alegre, Brazil, August 22

"Building Complex Systems – The Role of Product Lines and Architectures", Presentation, 5th Alpine Workshop on Software Engineering, Free University of Bozen - Bolzano, Breuil-Cervinia, Italy, December 6

"Product Lines in Practice - Bridging the Gap between Economics and Engineering", Presentation, Brazilian Symposium on Components, Architectures, and Reuse, PUC Rio - Pontificia Universidade Católica do Rio de Janeiro, Brazil, August 1

"Visualizing and Evaluating Software Architectures: Status and Outlook", Confer-

ence Presentation, The 1st Annual SAVE Conference 2008, Fraunhofer IESE and Fraunhofer Center Maryland, College Park, USA, February 5

"Role and Effects of Architectures on Software Organizations", Presentation, Studencki Festiwal Informatyczny Kraków, Akademia Górniczo-Hutnicza w Krakowie, Politechnika Krakowska, Uniwersytet Ekonomiczny w Krakowie, Uniwersytet Jagiellonski, Krakow, Poland, March 7

"Bedeutung und Wege zur zielgerichteten Bewertung von Software-Architekturen", Workshop, 4. SafeTRANS Industrial Day, Berlin, Germany, April 30

"From Architecture To Design", Industry Seminar, Ricoh Research Center Beijing, China, May 22

"Introducing Architecture-Centric Reuse into a Small Development Organization", Conference Presentation, International Conference on Software Reuse (ICSR), Beijing, China, May 26

"Product Line Software and System Engineering", Presentation, Fraunhofer Automotive Symposium, Fraunhofer Korea, Seoul, Korea, September 2

Naab, M:
"A Method for Collaborative Development of Systems of Systems in the Office Domain", Conference Presentation, The 12th IEEE International EDOC Conference (EDOC 2008), Munich, Germany, September 15-19

Nass, C.:
"Exploration - ein Pattern zur Steigerung des Engagements", Conference Presentation, Usability Professionals 2008, Mensch & Computer 2008, Lubeck, Germany, September 8

Pech, D.:
"Understanding Decision Models – Visualization and Complexity Reduction of Software Variability", Research Paper, VaMoS 2008, Essen, Germany, January 16-18

"Model-based Design of Product Line Components in the Automotive Domain", Experience Report, SPLC 2008, Limerick, Ireland, September 8-12

Peine, H.:
"Rules of Thumb for Developing Secure Software: Analyzing and consolidating two proposed sets of rules", Workshop Presentation, 2nd International Workshop on Secure Software Engineering, Universitat Politècnica de Catalunya, Barcelona, Spain, March 4-7

Peper, Ch.:
"Component Engineering for Adaptive Ad-hoc Systems", Presentation, ICSE2008 - SEAMS Workshop, Leipzig, Germany, May 12

Pretschner, A.:
"Distributed Usage Control: From Policies to Mechanisms", Presentation, ZISC Workshop on Advanced Topics of Access and Usage Control, Federal Institute of Technology Zurich / ZISC, Zurich, Switzerland, September 4

"Verteilte Nutzungskontrolle", Presentation, DFG-SPP-Vorbereitung, Karlsruhe, Germany, October 10

"Distributed Usage Control: From Policies to Mechanisms", Invited Talk, Microsoft Research, Redmond, USA, November 11

"Finding Faults: Manual Testing vs. Random Testing+ vs. User Reports", Presentation, 19th Intl. Symp. on Software Reliability Engineering, Redmond, USA, November 13

Ras, E.:
"Improving Reuse of Experience Packages Through Learning Spaces: A Controlled Experiment", Conference Presentation, ESEM 2008, Fraunhofer IESE, Kaiserslautern, Germany, October 9-10

"Collaborative Authoring of Learning Elements for Adaptive Learning Spaces", Presentation, Workshop Authoring of Adaptive and Adaptable Hypermedia 2008 (AAAH 2008), Hanover, Germany, July 29 - August 1

"Using Decision Models for the Adaptive Generation of Learning Spaces", Conference Presentation, 5th Int. Conference on Adaptive Hypermedia and Adaptive Web-based Systems 2008 (AH 2008), Hanover, Germany, July 29 - August 1

"Improving Knowledge Acquisition in Capstone Projects Using Learning Spaces for Experiential Learning", Conference Presentation, 21st Int. Conference on Software Engineering Education and Training

(CSEE&T 2008), Charleston, SC, USA, April 14-17

Rombach, D.:

“Status of Software Engineering Education in Europe”, Presentation, Software Engineering Education Symposium, Osaka, Japan, February 27

“Softwareentwicklung für die Medizintechnik”, Presentation, 2. Wirtschaftswoche Tagung Medizintechnik: Zukunftsaussichten der Schlüsselbranche im Gesundheitswesen, Berlin, Germany, July 3

“Konversion als Motor der Wirtschaftsentwicklung: Beispiel Westpfalz”, Westpfalzkonferenz, Ministry of Education, Science, Youth and Culture of the State of Rhineland-Palatinate, Zweibrücken, Germany, May 16

“Software Engineering: Innovation & Wertschöpfung durch Software”, Presentation, Federal Institute of Technology Zurich and University of Zurich, Lecture Series “IT and Service Innovation”, Zurich, Switzerland, May 5

“Ambiente Technologie: Herausforderungen & Anwendungen”, Workshop Presentation, Universitätsklinikum Mannheim, Germany, May 7

“From Software to Systems Engineering”, Workshop Presentation, University of Technology, Budapest, Hungary, May 23

“Software & System Engineering Research at Kaiserslautern”, Presentation in conjunction with the visit of Prof. Wakasugi in Kaiserslautern,

Fraunhofer IESE, Kaiserslautern, Germany, May 02

“Erfolg durch starke Netzwerke - Internationale Anerkennung für IT-Cluster Kaiserslautern”, Off-the-Cuff Presentation, 7. Multimedia-kongress, Fraunhofer IESE, Kaiserslautern, Germany, May 30

“Softwareentwicklung für die Medizintechnik”, Presentation, 2. Wirtschaftswoche Tagung “Medizintechnik”, Berlin, Germany, July 3

“Ambient Assisted Living: Towards Solving the Aging Society Challenge?”, Presentation, Lisbon Research and Policy Workshop Series on Science, Technology and Social Change, Portugal EU Presidency, Lisbon, Portugal, October 30, 2007

“Software and System Engineering at Kaiserslautern”, Presentation, Colloquium at Clemson University, ICAR, Greenville, SC, USA, April 16

“Software and System Engineering at Kaiserslautern”, Presentation, Faculty Symposium at University of South Carolina, School for Computer Science and Engineering, Columbia, SC, USA, April 16

“Obtaining Funding in Europe”, Presentation, New Software Engineering Faculty Symposium, ICSE 2008, Leipzig, Germany, May 13

“Innovation und Kompetenz am Technologiestandort Kaiserslautern”, Presentation, Westpfalzkonferenz des Landes Rheinland-Pfalz, Zweibrücken, Germany, May 16

“Innovation fördern: Beispiel IT-Cluster Kaiserslautern”, Presentation, Ressortkonferenz des Landes Rheinland-Pfalz, Koblenz, Germany, June 12

Schmitt, M.:

“Embedding Defect and Traceability Information in CIM- and PIM-level Software Models”, Presentation, Tools Europe 2008, MDABIZ Workshop, Federal Institute of Technology Zurich, Switzerland, July 3

Schwarz, R.:

“Methoden, Techniken und Werkzeuge zur Entwicklung hochsicherer Software”, Final Presentation, Study for the Bundesamt für Sicherheit in der Informationstechnik (BSI), Bonn, Germany, February 21

“CROCODILE für Redback SmartEdge OS”, Presentation, Workshop der Group Business Security, Deutsche Telekom AG (T-Com), Darmstadt, Germany, October 29

Simon, K.:

“IT-Sicherheitsüberprüfungen 2007”, Presentation, ATIS (Arbeitstagung der IT-Sicherheitsbeauftragten), Fraunhofer-Gesellschaft, Eisenach, Germany, March 11-12

“Penetrationstests”, Workshop, ATIS (Arbeitstagung der IT-Sicherheitsbeauftragten), Fraunhofer-Gesellschaft, Eisenach, Germany, March 11-12

“Vulnerability Scans”, Workshop, Herbsttagung der IT-Sicherheitsbeauftragten,

Fraunhofer-Gesellschaft, Kassel, Germany, September 30

Trapp, S.:

“Technologiegestütztes Lernen für Ältere”, Presentation, Workshop “Lernend altern – Altern lernen”, Fraunhofer IESE, Kaiserslautern, Germany, August 12

Ünalán, Ö.:

“Using Enhanced Wiki-based Solutions for Managing Requirements”, Presentation, MARK 08 Workshop, RE 2008, Barcelona, Spain, September 8

Zimmermann, F.:

“Risiko-basiertes Testen”, Presentation, Workshop “Digital Engineering for Commercial Vehicles”, Fraunhofer IESE, Kaiserslautern, Germany, October 23

“Classification Trees”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 30

“Integrity Level Determination and Risk-based Testing”, Tutorial, Standardization Testing and Quality Certification (STQC) Directorate, Tutorial: Software Quality Assurance and Reliability, Fraunhofer IESE, Kaiserslautern, Germany, October 31

SCIENTIFIC CONTRIBUTIONS²

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Rabe, Alexander:

Strategische Grenzen des Wachstums: Entwicklung einer Methode zur Früherkennung von Wahrnehmungsverschiebungen bei Konsumenten. Saarbrücken: VDM Verlag Dr. Müller, 2008
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Bayer, Joachim; **Eisenbarth, Michael**; Lehner, Theresa; Petersen, Kai:
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In: Kuropka, Dominik (Ed.); Tröger, Peter (Ed.); Staab, Steffen (Ed.); Weske, Mathias (Ed.):
Semantic Service Provisioning
Berlin: Springer-Verlag, 2008, 185-201: Ill.

Jedlitschka, Andreas; **Ciolkowski, Marcus**; Pfahl, Dietmar:
Reporting Experiments in Software Engineering.
In: **Shull, Forrest** (Ed.); Singer, Janice (Ed.); Sjöberg, Dag I.K. (Ed.):
Guide to Advanced Empirical Software Engineering
London: Springer-Verlag, 2008, 201-228: Lit.

Kläs, Michael; Trendowicz, Adam; **Wickenkamp, Axel**; **Münch, Jürgen**; Kikuchi, Nahomi; Ishigai, Yasushi:
The Use of Simulation Techniques for Hybrid Software Cost Estimation and Risk Analysis.
In: Zelkowitz, Marvin V. (Ed.):
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London: Academic Press, 2008, 115-174: Ill., Lit.
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Rombach, H. Dieter:
Stand komponentenbasierter Softwareentwicklung. Verbundprojekt KOBRA (1999-2001).
In: Reuse, Bernd (Ed.); Vollmar, Roland (Ed.):
Informatikforschung in Deutschland
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Steffens, Petra; Geißner, Gerhard:
FLOrIp - Land Parcel Information Online for Farmers and Administration.
In: Welfens, Paul J. J. (Ed.); Walther-Klaus, Ellen (Ed.):
Digital Excellence. University Meets Economy
Berlin: Springer-Verlag, 2008, 117-135: Lit.

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Abrahamsson, Pekka; **Münch, Jürgen**; Kuvaja, Pasi:
Perspectives on Global Software Development: Special Issue on PROFES 2007: Guest Editorial.
In: Software Process - Improvement and Practice 13 (2008), 3, 213-215 : Lit.

Armbrust, Ove; Ebell, Jan; Hammerschall, Ulrike; **Münch, Jürgen**; Thoma, Daniela:
Experiences and Results from Tailoring and Deploying a Large Process Standard in a Company.
In: Software Process - Improvement and Practice 13 (2008), 4, 301-309: Ill., Lit.

Doerr, Joerg:
Arbeitskreis Nichtfunktionale Anforderungen.
In: Softwaretechnik-Trends 28 (2008), 1, 26: Ill., Lit.

Doerr, Joerg; **Adam, Sebastian**; **Eisenbarth, Michael**; Ehresmann, Michael:
Implementing Requirements Engineering Processes: Using Cooperative Self-Assessment and Improvement.
In: IEEE Software 25 (2008), 3, 71-77: Ill., Lit.

Kerkow, Daniel; **Doerr, Joerg**; **Landmann, Dennis**:
AMUSE: Priorisieren von Anforderungen auf der Basis geschätzter Nutzerakzeptanz.
In: Softwaretechnik-Trends 28 (2008), 1, 7-8: Ill., Lit.

Kerkow, Daniel; **Grützner, Ines**:
Mitarbeiter ins Boot holen.
In: Der Gemeinderat (2008), August, 18-19: Ill.

Kleinberger, Thomas; Holzinger, Andreas; Müller, Paul:
Adaptive multimedia presentations enabling universal access in technology enhanced situational learning.
In: Universal Access in the Information Society 7 (2008), 4, 223-245: Ill., Lit.

Knodel, Jens; **Muthig, Dirk**; **Naab, Matthias**:
An Experiment on the Role of Graphical Elements in Architecture Visualization.
In: Empirical Software Engineering 13 (2008), 6, 693-726: Ill., Lit.

Lindvall, Mikael; **Muthig, Dirk**:
Bridging the Software Architecture Gap.
In: IEEE Computer - Innovative technology for computer professionals 41 (2008), 6, 98-101: Ill.

Lotz, Volkmar; Pigout, Emmanuel; Fischer, Peter M.; Kossmann, Donald; Massacci, Fabio; **Pretschner, Alexander**:
Towards Systematic Achievement of Compliance in Service-Oriented Architectures: The MASTER Approach.
In: Wirtschaftsinformatik 50 (2008), 5, 383-391: Ill., Lit.

2) Names of FC-MD and Fraunhofer IESE members appear in bold.

Ocampo, Alexis; Münch, Jürgen:

Rationale Modeling for Software Process Evolution. In: Software Process - Improvement and Practice (2008), Published Online: Jun 12 2008, 21 S.: Ill., Lit.

Prückner, Stephan; Luiz, Thomas; Steinbach-Nordmann, Silke; Nehmer, Jürgen; Danner, K.; Madler, Christian:

Notfallmedizin - Medizin für eine alternde Gesellschaft : Emergency medicine - Medicine for an ageing society. Beitrag zum Kontext von Notarzteinsätzen bei alten Menschen. In: Der Anaesthesist 57 (2008), 4, 391-396

Rombach, H. Dieter; Münch, Jürgen; Ocampo, Alexis; Humphrey, Watts S.; Burton, Dan:

Teaching disciplined software development. In: The Journal of Systems and Software 81 (2008), 5, 747-763: Ill., Lit.

Steffens, Petra; Branding, Holger; Korhummel, Sven: Regionaler Zugang. In: Kommune21 (2008), 4, 52-53: Ill.

CONTRIBUTIONS TO CONFERENCE PROCEEDINGS

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Klößner, Kerstin:
The Fraunhofer IESE 2008 Award for Project Excellence

Keuler, Thomas:
The Fraunhofer IESE 2008 Award for Research Excellence

Kläs, Michael:
The Fraunhofer IESE 2008 Award for Research Excellence

Elberzhager, Frank:
The Fraunhofer IESE 2008 Award for Research Excellence

Trapp, Marcus:
The Fraunhofer IESE 2008 Award for Empirical Excellence

Adam, Sebastian:
The Fraunhofer IESE 2008 Award for Empirical Excellence

Heidrich, Jens:
The Fraunhofer IESE 2008 Award for Doctoral Theses Excellence

Zimmer, Bastian:
The Fraunhofer IESE 2008 Award for Diploma Thesis Excellence

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EXTERNAL AWARDS

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