IESE

Fraunhofer Institut
Experimentelles
Software Engineering

Annual Report 2006

The Fraunhofer Institute for Experimental Software Engineering

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Fraunhofer IESE in Kaiserslautern currently has about 200 employees who perform research in the areas of software development, software quality management, and software competence management. Together with its sister institute in the USA, Fraunhofer IESE offers processes, methods, and techniques for developing software-based systems according to engineering-style principles. In doing so, it follows an empirical approach: Through proven, innovative solutions, products based on software can be brought to the market with a measurably higher degree of efficiency.

The customers of Fraunhofer IESE come from domains where products are dominated by software: automotive and transportation systems, telecommunications, telematics and service providers, medical systems, as well as information systems and applications in the public sector. The institute provides support to companies of any size – from international corporations to small and medium-sized enterprises. The public sector also plays an important role as a project partner.

Fraunhofer IESE, which was founded in 1996, is directed by Prof. Dieter Rombach and Prof. Peter Liggesmeyer. It is one of 56 institutes of the Fraunhofer-Gesellschaft, which, as the largest applied research organization in Europe, contributes to national and international competitiveness.

Annual Report 2006

Fraunhofer Institute for
Experimental Software
Engineering IESE

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Fraunhofer

Editorial

Prof. Dr. Dieter Rombach

Prof. Dr. Peter Liggesmeyer

In addition to our institute's exciting scientific and project-related work, the year 2006 offered various occasions and welcome opportunities to reflect on what has been achieved, and to look forward to the many promises held by the future.

One important event that took place in the Fraunhofer-Gesellschaft was the opening of the new institute center at Fraunhofer-Platz in Kaiserslautern. The impressive event united a large number of representatives from politics, academia, and business. We would like to invite you to once again recall this important moment for our institute in our photo report starting on page 14.

With the construction of the new institute center, another milestone in the history of Fraunhofer IESE has been achieved. In 1996, a mere 20 employees started to realize a vision that has changed only little until now: empirical research in software engineering with the objective of establishing, managing, and continuously evolving our customers' and partners' software competence. Yet, the dimensions have definitely changed: With almost 200 employees today, and with an annual budget volume of approx. 10 million euros, Fraunhofer IESE celebrated its 10-year anniversary last year. Fellow Weggefährten from politics, research, and industry have all contributed to this success story – in our report starting on p. 19, they get their say.

Due to the soccer world cup, the year 2006 was a festival and a source of inspiration for all of Germany. Kaiserslautern as one of the world cup venues played an important part in this, and our institute had also thought of something special. Read on p. 10 how our engineers provided support to those reporting about this prominent event with top-modern information technology.

There are other areas where software and systems engineering has shown its great practical relevance. The Assisted Living Laboratory in our building was opened on schedule and with great interest from the public and the media. Starting on p. 12, you can read about how this Ambient Intelligence research institution, which is unique in Germany and by now also known internationally, came into being.

The research areas of Fraunhofer IESE have always been characterized by a special dynamic. In accordance with the great and still increasing importance of information technology for modern medical technology, our new business area presented this new focus for the first time at MEDICA, the world's largest medical fair, in Düsseldorf. In the public sector, too, we are experiencing an increasing demand for engineering-style systems engineering. An up-to-date project report of our business area "eGovernment", which will be a business area of its own in the future, can be found starting on page 68.

Fraunhofer IESE is integrated into a global network of scientific and industrial collaborations. In this context, we would like to point out our new commitment in the context of the German-Korean research partnership. In the international section of our annual report, you can read more about the extremely successful 1st workshop on software product lines, which took place in this context at Sogang University in Seoul (starting on p. 105).

Overall, we are looking back at eventful times and thank our partners and customers for their trust in collaborating with us. We are looking forward to face the challenges that our partners will have for us in the year 2007.

Dieter Rombach,
Executive Director
Fraunhofer IESE

Peter Liggesmeyer,
Director Fraunhofer IESE

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Profile of Fraunhofer IESE

Highlights in 2006

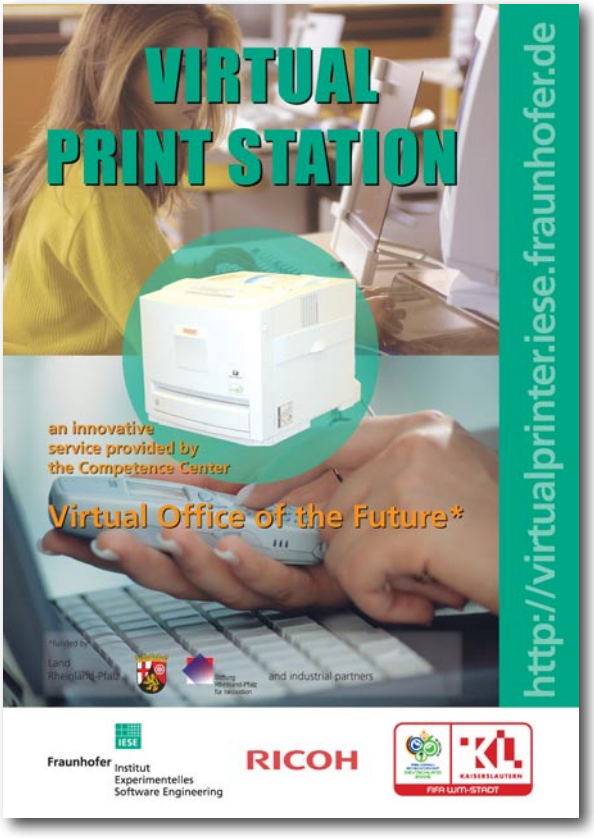
Fraunhofer IESE and Ricoh Co. Ltd. offered a "Virtual Printer" for journalists

The Fraunhofer Institute for Experimental Software Engineering (IESE) and the Japanese company Ricoh Co. Ltd. in cooperation with the World Cup office of the city of Kaiserslautern offered a special service to journalists during the 2006 FIFA World Cup: All registered press people were able to send documents to a printer online, from their laptops – the system is called "Virtual Printer".

The system directed the printing requests to a conveniently located printing station. Printing stations were available free of charge across the entire city as well as in hotels. Ricoh Co. Ltd. provided 15 color laser printers for this purpose.

Printing service was easy to use

The only requirement on the user's computer was an Internet browser. A wireless network connection, a so-called "WLAN", was made available free of charge in downtown Kaiserslautern. The printing service was available to the journalists via an Internet address, which made it possible to easily and comfortably upload the document to be printed with the selected printing options (for example, "A4, double-sided").



Visible from far away: During the World Cup, posters like this indicated central locations where journalists could pick up their printouts from the "Virtual Printer".

"The system selected the printer that was located closest to the user. Afterwards, the sender could pick up his printed document from the printing station – completely free of charge", said the project's research manager, Dr. Dirk Muthig. Printing stations were established at several locations in Kaiserslautern: at the World Cup office, at the Tourist Information office, at the World Cup stadium, and in several hotels in the city.

The competence center "Virtual Office of the Future"

The state of Rhineland-Palatinate provides funding for the competence center "Virtual Office of the Future" (VOF), in which the Fraunhofer Institute for Experimental Software Engineering (IESE) together with the German Research Center for Artificial Intelligence (DFKI) performs research into the requirements on a new form of the office: Not paperless, but intelligent, based on the idea that office environments will interact more and more independently. Realizing this idea with technical efficiency primarily requires highly differentiated, flexible software architectures. The printing service presented on the occasion of the World Cup is one of the research results of VOF.

Business area Medical Systems of Fraunhofer IESE presents itself for the first time at Medica trade fair

At this year's medical trade fair Medica in Düsseldorf – held 15 to 18 November 2006 –, the Fraunhofer Institute for Experimental Software Engineering (IESE) presented itself for the first time with its business area "Medical Systems". "There is hardly another area of our daily lives where computer technology comes so close to humans – and consequently, defects can have severe effects", said Business Area Manager Christian Denger about the central importance of software when developing medical devices. One current example of the work done at Fraunhofer IESE is therefore "SICMA" (Software Integrated Component Fault Tree and Failure Modes Analysis): an innovative method for systematically identifying and analyzing software risks and ensuring software safety in medical devices.

SICMA combines techniques such as "Failure Mode and Effects Analysis" (FMEA) and "Fault Tree Analyses" (FTA) into a holistic approach specifically tailored to the characteristics of software safety, and is conformant to the requirements of the medical devices standards IEC 62304 and ISO 1497. It enables traceability of risk analyses and makes these more reliable, resulting in increased product safety. At the same time, software development costs can be significantly reduced through early detection and elimination of potential weak points.

Software engineering in medicine:
At MEDICA, Marc Förster presents innovative ways of making medical systems safe.

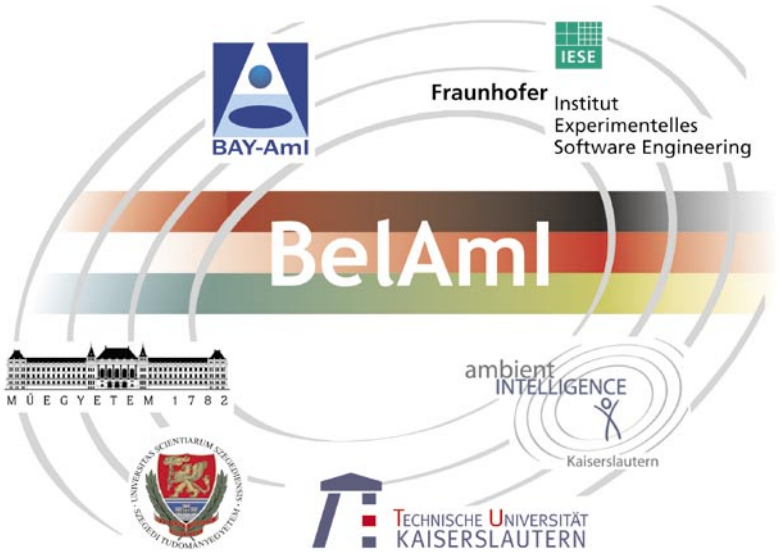
Opening of "Assisted Living Lab" celebrated at Fraunhofer IESE

Following the ten-year anniversary celebration of the Fraunhofer Institute for Experimental Software Engineering (IESE), Fraunhofer IESE's "Assisted Living Lab" was officially opened: At first glance, it looks like a regular apartment, with living room, bedroom, kitchen, and bathroom. But smart sensor technology is hidden everywhere: "In combination with Assisted Living solutions, Ambient Intelligence technology can provide persons in need of care with some degree of autonomy in their own home", explained project manager Thomas Kleinberger: "In the Assisted Living Lab, we can now show what is already possible today."

Thus, a cup, for instance, "feels" whether it has been emptied, the intelligent refrigerator monitors the expiration dates of its contents, and the intelligent walking cane actively reports when it drops to the ground – because the person using it might have also fallen down. These are just a few examples of an intelligent environment. Institute director Dieter Rombach sees the need for Assisted Living research in the demographic development: "People are living longer, the age pyramid is changing". The goal of the project is to allow elderly people to live in their familiar environment for as long as possible. Information technology shall get to know the resident in his own home and support him in his daily life. "A project with soul and mind", said Lord Mayor Bernhard Deubig during the opening of the lab.

Research in Ambient Intelligence is also shared by the University of Kaiserslautern: "The project presents a grand scientific challenge", stated Jürgen Nehmer from the University of Kaiserslautern. Christian Madler, Chief Physician at the Westpfalz-Klinikum Kaiserslautern, called Assisted Living research "an important interface for medicine".

Important collaborations have already been established. Harald Orlamünder from Alcatel SEL AG confirmed the importance of Assisted Living for industry: "Assisted Living is absolutely in line with current trends, and I am looking forward to a fruitful future". Looking at the future, project manager Thomas Kleinberger stated that "After tests in the lab and trial phases in senior citizen homes, first prototypes might already be brought to market in collaboration with industry in three to five years".



Concentrated competence:
Fraunhofer IESE's Assisted Living Lab is one of the application foci of the international BelAmI project.

Turning an empty room ...

For starters, service pipes and cables are installed.

Important preparations: The "intelligent wall-to-wall carpet" will contain hundreds of individual RFID tags. Will they stick reliably, and can they be read without errors? Once they have been attached, the chips will no longer be accessible.

Row after row: The fleece webs with the RFID tags are glued to the floor.

Still open: As long as the carpet has not been laid yet, each RFID tag is located precisely, is registered and tested ...

... and then the carpet is glued over them.

Structural work: The cross beams for the drywalls of the laboratory "apartment" are mounted.

Dividing the rooms: One can already recognize where the individual "rooms" will be located.

Almost ready for move-in: Just some minor electrical installation work needs to be done.

Ambience for Ambient Intelligence: The first pieces of furniture provide a realistic feeling.

... into a special kind of laboratory environment!

On behalf of the Fraunhofer-Gesellschaft, president Prof. Dr. Hans-Jörg Bullinger addresses the audience.

First Fraunhofer Center in Rhineland-Palatinate officially inaugurated

The fact that the official inauguration ceremony for the new Fraunhofer Center could take place after only two years of construction time is mainly due to the excellent cooperation between investors, architects, owners, and construction companies. Just like envisioned at the beginning, the new Fraunhofer Center now forms the core of a new technology park along Trippstadter Straße, since additional institutes and companies will soon be settling there.

The event brought together a great number of politicians, business people, and scientists, whose commitment and determination during the past few years has led to realizing the idea of creating a competence center that would act as a scientific pacemaker, complementing the University of Kaiserslautern and promoting Kaiserslautern as a center of technology. The Center has now been built within a very short period of time in the immediate vicinity of the University of Kaiserslautern.

In his keynote speech, the President of the Fraunhofer-Gesellschaft, Prof. Hans-Jörg Bullinger, stressed the topic of "Signposts for Tomorrow's Markets" and, in particular, the importance of the Fraunhofer Information and Communication Technology Group, whose members also include the two institutes Fraunhofer IESE and Fraunhofer ITWM. With 15 member institutes and an annual budget of 170 million euros, the Fraunhofer I&C Group is not only the largest alliance of institutes within the Fraunhofer-Gesellschaft, but also the largest research alliance for information and communication technology in Europe. Thanks to their direct vicinity to each other, the two institutes IESE and ITWM are now able to make even better use of the existing synergies, which increases the added value for customers from the Information and Communications Technology domain. According to Prof. Bullinger, the new Fraunhofer Center can provide important impulses for this: "Buildings are places to meet. Openness and transparency in the architecture create the basis for communication. Values are generated where people combine interdisciplinary knowledge and creatively develop something new", said Prof. Bullinger in his speech.

Together with the research competence of the University of Kaiserslautern, the two Fraunhofer institutes, and the German Center for Artificial Intelligence, the western Palatinate region and the entire state are becoming a globally visible center for information technology, said Minister President Kurt Beck. "With systematic investments, the state government has created kernels of growth in areas that used to be structurally weak, and this will secure the long-term future of the state." During the past few years, the state made

Bread and salt – the traditional wish for a happy future in the new domicile.

The Minister President of the state of Rheinland-Pfalz, Kurt Beck, with the executive director of Fraunhofer IESE, Prof. Dieter Rombach.

major efforts to expand and evolve Rhineland-Palatinate as a center of research, science, and universities, thus creating the basis for good education and training as well as for new jobs. The Minister President cited the funds spent on the universities as an example: From 1991 to 2004, funding increased by 59.5 percent. This is impressive evidence of the fact that science and universities are top priorities on the state government's political agenda.

The director of the department for information and communication and new technologies at the Federal Ministry of Education and Research, Dr. Wolf-Dieter Lukas, stressed the emphasis placed by the federal government on research, development, and innovation. One of the first decisions of the new cabinet had been to provide an additional six billion euros for this sector. "We want a coherent, integrated innovation policy." He stressed the special role of information and communication technology as a motor of innovation and pointed out the excellent position of the Saarbrücken / Kaiserslautern region in the area of computer science.

The Lord Mayor of Kaiserslautern, Bernhard Deubig, characterized this large-scale project as a smart decision with regard to the development of the region, which will fulfill the high expectations in every respect. The President of the University of Kaiserslautern, Prof. Helmut J. Schmidt, cited especially the numerous synergy effects that have already occurred between the university and the new Fraunhofer Center, respectively that will be generated soon. The concentration of IT research and development, which is unique in Europe, will help strengthen the long-term importance of Kaiserslautern as a center of science, stated Prof. Schmidt.

The directors of the two institutes thanked friends and supporters in their speeches, which centered on the pride about what has been achieved and on the perspective of the new potentials offered by the Fraunhofer Center. Prof. Dieter Rombach from Fraunhofer IESE especially mentioned that the process of innovation from the first idea to industrial implementation is ideally supported by the clearly structured, multi-

Prof. Horst Ermel, director of the architecture company AS Plan Architekten BDA in Kaiserslautern, is happy about the successful realization of the building complex constructed according to his designs.

functional building. The director of ITWM, Prof. Dieter Prätzel-Wolters, also drew parallels to mathematics: Just like the science of mathematics, the new Fraunhofer Center is also very convincing with its beautiful forms and its clear structures.

Prof. Horst Ermel, who was in charge of planning and developing the construction project together with his office of architects ASPLAN, was highly satisfied with the fact that the scheduled move-in date of the second half of 2005 was not delayed. For him, the qualified architecture promotes communication and generates innovation – prerequisites for successful research.

The project with a budget of 47 million euros went entirely according to plan – which is quite remarkable considering the complexity of the project. In August 2005, Fraunhofer IESE was able to move into its new facility, whereas Fraunhofer ITWM followed at the beginning of 2006. The overall project management was done by the construction division of the Fraunhofer-Gesellschaft.

The celebration with over 200 invited guests ended with a small snack accompanied by the sounds of the Helmut Engelhardt quartet.

Prof. Dieter Rombach appointed to the scientific advisory group of the Australian research consortium NICTA

Dieter Rombach, executive director of the Fraunhofer Institute for Experimental Software Engineering IESE and professor in the department of computer science at the University of Kaiserslautern, was appointed to the International Scientific Advisory Group (ISAG) of the Australian research consortium "National Information and Communications Technologies Australia" NICTA in April 2006.

The consortium was founded in 2002 by the Australian government to provide application-oriented research in the area of information and communications technology for the benefit of industry and society. Its objectives are thus similar to those of the German Fraunhofer model.

NICTA's scientific advisory group consists of six leading individuals from the international business (e. g., IBM) and research community (e. g., MIT, Stanford, Berkeley). The group's tasks include advising the board of directors on strategic planning issues, providing an overview of international research trends, and recruiting international top researchers.

EVI meeting 2006 in Kaiserslautern – Fraunhofer connects people!

This year's Fraunhofer EVI meeting took place in Kaiserslautern: From 6 to 8 July, the former members of the board of directors and the former institute directors of the Fraunhofer-Gesellschaft met for the fourth time in a row. Together, they wanted to look back upon their time in office at the Fraunhofer-Gesellschaft, exchange information and ideas, and inform themselves about the most recent developments in the world of Fraunhofer. The program was colorful: In addition to a guided tour of Kaiserslautern and a tour of the brand new Fraunhofer Center consisting of Fraunhofer IESE and Fraunhofer ITWM, the program included an internal meeting of the former board members, a presentation by the Fraunhofer board of directors about recent developments in the organization, and a video conference with Fraunhofer IAO in Stuttgart on the occasion of its 25-year anniversary. Even the "Betze", Kaiserslautern's famous soccer stadium, was part of the event program: With joyful interest, the group of approx. 30 former board members and institute directors, some with their partners, immersed themselves in the atmosphere of the home turf of the 1. FC Kaiserslautern. The dignified reunion ended with a culinary program item on the third day: By bus, the group made its way to the Anterior Palatinate for lunch and wine tasting, before everyone left, already looking forward to the next meeting in Golm near Potsdam. On the part of Fraunhofer ITWM, the group also included hosts Prof. Prätzel-Wolters and Dr. Schulz-Reese, on the part of IESE, Prof. Rombach and Prof. Liggesmeyer had joined the group. Everyone agreed: The cordial, relaxed, and interested atmosphere of the meeting is the best example that "Fraunhofer connects people". There was happiness and pride about the fact that the new Fraunhofer Center in Kaiserslautern had been chosen as the location for an EVI meeting.

The former members of the Board of Directors and former directors of the Fraunhofer-Gesellschaft got an on-site impression of Germany's newest institute center.

Fraunhofer Director of Finance, Dr. A. Gossner (left), with institute director Prof. D. Rombach during the celebration on the occasion of the 10-year anniversary of Fraunhofer IESE.

Fraunhofer IESE celebrated its ten-year anniversary

The Fraunhofer Institute for Experimental Software Engineering (IESE) celebrated its ten-year anniversary with a festive evening event last Tuesday at the new Fraunhofer Center on Trippstadter Straße. More than 250 international guests from politics, research, and industry took part in the celebration. "It was a special pleasure for us to share this festive atmosphere on our milestone birthday with so many guests", said Dieter Rombach, the institute's executive director.

The anniversary celebration began with a joint retrospect on the institute's successful history. "IESE has won an excellent reputation abroad, and has moved a lot together with BMBF", underlined Helge Kahler from the German Federal Ministry of Education and Research (BMBF).

Dorothee Dzwonnek, State Secretary for Science, Continuing Education, Research, and Culture, considered the institute's ten-year history as proof that investments into science and research are investments into the future: "They make a central contribution to scientific performance and to securing and creating high-qualification jobs, not only in public institutions, but even more so in collaborating companies", said Dzwonnek. When the state gave its go for IESE by systematically providing state funding, the future-oriented area of information and communications technology in Kaiserslautern started evolving in a unique manner.

Fraunhofer IESE is present internationally: in the USA, it has a sister institute with approx. 25 scientists; in Eastern Europe and Asia, it is involved in numerous projects. That Fraunhofer IESE has been able to evolve into one of the top addresses worldwide was confirmed by Alfred Gossner, member of

10 years of Fraunhofer IESE: An occasion for flags at the new institute center.

Guests included the former director of the Fraunhofer Center Maryland (FC-MD), Prof. V. Basili ...

... as well as its new director Prof. R. Cleaveland (pictured on the right side of Prof. F. Bomarius of Fraunhofer IESE).

the Board of Directors of Fraunhofer-Gesellschaft: "Through excellent scientific work and a remarkable growth rate, IESE has made a major contribution to Fraunhofer research".

At the same time, the institute emphasizes its local roots. "IESE has brought the future to Kaiserslautern and, within ten years, has practically created a legacy for the future". Words of congratulation from Lord Mayor Bernhard Deubig on the occasion of the institute's anniversary.

Lothar Litz, Vice-President of the University of Kaiserslautern, focused on the importance of the collaboration between the University of Kaiserslautern and IESE: "We do not only collaborate closely in projects, such as the BelAMI project on the topic of 'Ambient Intelligence', but the University has also submitted two applications to the Federal Excellence Program, and IESE is involved in both of them".

"We are collaborating with renowned companies in Rhineland-Palatinate, Germany, and beyond to improve their market potential", says institute director Dieter Rombach. For Thomas Wagner, Executive Vice President of Robert Bosch GmbH and Chairman of the Advisory Board of Fraunhofer IESE, this is one of the institute's most important recipes for success: "During the past ten years, IESE has managed in a unique way to create interest in and motivation for empirical software engineering in companies of various sizes."

"In the future, we want to continue to contribute to our customers' success with scientific work on an international level", stated institute director Peter Liggesmeyer. "We will expand the existing focus on the topic of 'Systems Engineering' and increasingly dedicate our work to the so-called 'Embedded Systems'". In order to achieve this, the institute, which has been so successful until now, plans to increase the number of its employees: "During the next five years, we want to increase the number of our employees from currently almost 200 to 270", said institute director Rombach.

In the future, successful marketing will also continue to play an important role for maintaining close contact with IESE customers – professional representation of the institute to the outside will be of major importance. Therefore, IESE treated itself to a special gift on its tenth anniversary: Professional short films were ordered for the six currently most important research and application areas. These were presented to guests and employees for the first time in the context of the anniversary celebration. ZDF and 3sat moderator Stefan Schulze-Hausmann, whose company coment produced the films and who also moderated the evening's program, was delighted about how well the project films on such topics as "Virtual Office of the Future", "Automotive Technology", and "Assisted Living – Living in a computer-supported environment", were received.

LEARNTEC 2006: Software documentation made easy

At this year's LEARNTEC in Karlsruhe, Fraunhofer IESE presented itself at the joint booth of the Fraunhofer-Gesellschaft in the Garden Hall. Its portfolio included new online courses, innovative single-source publishing approaches, and extensive methodological support for professional documentation and training programs.

An online course for learning the basics of technical documentations was presented by the Fraunhofer Institute for Experimental Software Engineering IESE at this year's LEARNTEC in Karlsruhe. The extensive, multimedia learning materials include important aspects of professional documentation – from the requirements document and the specification via the editorial handbook to target group testing of the finished documentation.

In addition to this training opportunity for future documentation specialists, companies who want to have their software documentation developed externally or who are looking for competent support for their own documentation were able to get in touch with the institute. The elegant and efficient solution provided by Fraunhofer IESE is based on the principle of single-source publishing.

In addition, Fraunhofer IESE presented its entire range of methodological support in the development of high-quality training media. In this area, the institute makes use of its many years of experience in the engineering-style design, realization, and evaluation of qualification solutions, and provides a competent answer to any question from the area of continuing education and training in the field of software.

Great interest: Institute director Prof. P. Liggesmeyer explains the Fraunhofer principle to numerous interested visitors.

Open Day at Fraunhofer IESE

On the afternoon of 17 November, the Fraunhofer Institute for Experimental Software Engineering opened its doors for a day of information on "software engineering" methods, techniques, and application examples. On behalf of his employees, the institute's director, Professor Dieter Rombach, extended a cordial invitation: "With our Open Day, we want to provide an opportunity to all students, the interested public, as well as business people involved in software engineering to take a look behind the scenes of the work at our institute."

Starting at 3 p.m., a diverse program took place at the Fraunhofer Center on Trippstadter Straße. With project films and demonstrations, the employees of Fraunhofer IESE presented examples of the application of their research: You could, for instance, learn something about state-of-the-art software requirements in automotive and medical technology, or you could delve into the possibilities of the "Virtual Office of the Future". In a small workshop, interested persons could trace the development of assisted living systems

in the newly opened "Assisted Living Lab". A short practical class on "Embedded Systems" was also offered – a topic that provided especially high school students with a glimpse of what it means to study software engineering. Simultaneously, public guided tours of the Fraunhofer building were offered. In addition, the Fraunhofer Institute for Applied Mathematics (ITWM), the Gesellschaft für Informatik (GI), and the Department of Computer Science of the University of Applied Sciences Kaiserslautern also offered lectures about information technology topics at the Fraunhofer Center. All programs offered on that day in Kaiserslautern were held under the motto "Kaiserslautern – City of Computer Science" as a joint event in the context of the "Informatics Year" 2006.

Hands-on science:
The task is to carefully guide self-programmed robots through the maze together with department head Dr. C. Bunse.

Always crowded: Information about the institute center and the work of the institutes was in great demand among young and old.

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.

ISERN
International Software Engineering Research Network
Quality Improvement

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.

International competence networks promote global scientific exchange – not only virtually.

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

- Brandenburgische Technische Universität ("Brandenburg University of Technology"), Cottbus
- Fraunhofer-Institut für Rechnerarchitektur und Softwaretechnik FIRST ("Fraunhofer Institute for Computer Architecture and Software Technology"), Berlin
- Fraunhofer-Institut für angewandte Informationstechnik FIT ("Fraunhofer Institute for Applied Information Technology"), St. Augustin
- Fraunhofer-Institut for Experimental Software Engineering IESE, Kaiserslautern
- Fraunhofer-Institut für Informations- und Datenverarbeitung IITB ("Fraunhofer Institute for Information and Data Processing"), Karlsruhe
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- Oldenburger Forschungs- und Entwicklungsinstitut für Informatik-Werkzeuge und -Systeme OFFIS ("Oldenburg Research and Development Institute for Computer Science Tools and Systems"), Oldenburg
- Institute for Computer Science IV, Technical University of Munich, Munich

The mission of ViSEK 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 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 ViSEK 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.

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.

On the European level, Fraunhofer IESE was the coordinator of the Experimental Software Engineering Research Network (ESERNET). The main objective of ESERNET was to establish and maintain Europe's leadership position in experimental software engineering as an essential catalyst for the rapid and sustained improvement of European software competencies. It was funded by the European Commission in the context of the 5th Framework's IST program.

ESERNET was funded by the Information Societies Technology Programme of the European Union under grant IST-2000-26754. The complete list of partners and members can be found at www.esernet.org.

Furthermore, there are collaborations with several other publicly-funded consortia. These either deal with further development of software engineering technology or with the dissemination of best practices and technology transfer. Often, these projects result in bilateral, industrially-funded collaborations. Public project sponsors include the state government of Rhineland-Palatinate, the German federal government, and the European Commission.

Further information:

www.software-kompetenz.de

In addition to the bilateral collaborations, Fraunhofer IESE and FC-MD 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 Competence Center for Software Technology and Training (KSTW) offers services that are custom-tailored to small and medium-sized enterprises. Services focus on fundamental software engineering practices such as requirements engineering, systematic testing, inspections, etc. KSTW's software competence kit ("Baukasten Software Kompetenz") allows for individual consultation, including self-assessment workshops, systematic business process modeling, problem analyses based on ISO 15504/SPICE, and customized continuing education measures for employees.

The Research Lab for SMEs (which was established with funds from the state of Rhineland-Palatinate and the European Commission/EFRE) offers clusters of SMEs an opportunity to jointly work on one software engineering research topic. The focus is on establishing an infrastructure for adapting software engineering topics to the special needs of SMEs, and also includes preparations for transferring such topics to SMEs.

The Fraunhofer-Gesellschaft

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Fraunhofer Locations in the USA
Brooklyn, Massachusetts
College Park, Maryland
Newark, Delaware
Plymouth, Michigan

Fraunhofer Locations in Asia
Beijing, China
Jakarta, Indonesia
Kuala Lumpur, Malaysia
Singapore
Tokyo, Japan

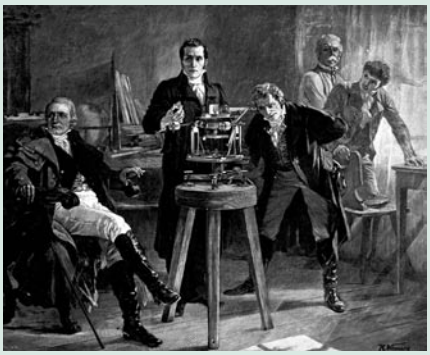
Fraunhofer Locations in Europe
Brussels, Belgium
Moscow, Russia

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. The organization also accepts commissions from German federal and Länder ministries and government departments to participate in futureoriented research projects with the aim of finding innovative solutions to issues concerning the industrial economy and society in general.

Applied research has a knockon 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, accelerating technological progress, improving the acceptance of new technologies, and not least by disseminating their knowledge 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, in other scientific domains, in industry and in society. Students working 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.

At present, the Fraunhofer-Gesellschaft maintains more than 80 research units, including 56 Fraunhofer Institutes, at 40 different locations in Germany. The majority of the 12,500 staff are qualified scientists and engineers, who work with an annual research budget of €1.2 billion. Of this sum, more than €1 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 institutional 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.



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".

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.

Executive Board (as of 31 December 2006)

Prof. Dr. HansJörg Bullinger
President, Corporate Policy

Dr. Ulrich Buller
Research Planning

Dr. Alfred Gossner
Finances and Controlling (incl. Business Management, Purchasing, Real Estate), IT

Dr. DirkMeints Polter
Human Resources and Legal Affairs

Fraunhofer IESE Alliances

Fraunhofer Group Information and Communication Technology

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 thirteen institutes as full members and two associated members, representing a workforce of roughly 2800 employees. It manages an annual budget of about €168 million. Its central office in Berlin serves as a one-stop shop, referring customers to the appropriate contacts.

Within the Fraunhofer Group Information & Communication Technology, Fraunhofer IESE is particularly active in the areas of eGovernment, IT security (e. g., in the context of the E-Security Network) and software engineering (systematization of requirements; modeling and design of distributed, parallel, and embedded systems; development of methods and tools; structural assessment of organizations regarding I&C). In addition, Fraunhofer IESE, together with the Virtual Software Engineering Competence Center (which can be accessed on the Internet via www.software-kompetenz.de), bundles the know-how of more than 500 experts who implement new technologies in practice in a sustainable manner. On 01 October 2006, Prof. Rombach from Fraunhofer IESE became chairman of the Fraunhofer ICT Group.

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

Contact at Fraunhofer IESE

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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 Rheinland-Pfalz, 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.

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Fraunhofer Traffic and Transportation Alliance

The Fraunhofer Transport Alliance currently represents the combined traffic engineering expertise of nineteen Fraunhofer institutes. It develops adequate technical and conceptual solutions for the public and for industry partners and puts these solutions into practice by means of transport-related research. It creates a new choice of R&D services in transport by bundling the existing potential and through broad system competence. Due to different core groups such as FVV-Automotive, there exists close bonding to industry. Because of their participation in international research programs, member institutes have worldwide contacts with companies and research organizations involved in the fields of transportation engineering and management.

Contact at Fraunhofer IESE
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Organizational Structure

Fraunhofer Virtual Institute for Experimental Software Engineering (FVIESE)

Prof. R. Cleaveland
Prof. D. Rombach

Fraunhofer Institute for Experimental Software Engineering (IESE), Kaiserslautern

Executive Office Manager / PR & Events
Dr. F. Seelisch

Executive Director
Prof. D. Rombach

Director
Prof. P. Liggesmeyer

Director of Operations
Prof. F. Bomarius

Managing Director
H. Westing

Marketing
R. Kalmar

Software Development
Dr. D. Muthig

- Requirements and Usability Engineering (RUE)
  J. Dörr
- Product Line Architectures (PLA)
  Dr. D. Muthig
- Component Engineering (CE)
  Dr. M. Trapp

Quality Management
Dr. J. Münch

- Processes and Messurement (PAM)
  Dr. J. Münch
- Testing and Inspections (TAI)
  Dr. C. Robinson-Mallett
- Security and Safety (SAS)
  Dr. R. Schwarz

Competence Management
Prof. F. Bomarius

- Experience Management (EM)
  Prof. F. Bomarius
- Education and Training (EAT)
  Prof. F. Bomarius

Central Services

- Administration Services (AS)
  I. Würtz
- Technical Services (TS)
  B. Recktenwald
- Library and Publication Services (LS)
  B. Göpfert

Business Areas

- Automotive and Transportation Systems
  R. Kalmar
- Medical Systems
  C. Denger
- Telecomm., Telematics and Service Providers
  Dr. V. Hübsch
- Information Systems and Public Sector
  M. Ochs / P. Steffens

Competence & Service Centers

- Experimentation
  Prof. D. Rombach
- STI / RLP
  Dr. V. Hübsch
- AmI / Assisted Living
  Dr. M. Becker
- Commercial Vehicles
  R. Kalmar
- Virtual Office of the Future
  Dr. D. Muthig

Fraunhofer Center for Experimental Software Engineering, Maryland (FC-MD), College Park, Maryland, USA

Executive Director
Prof. R. Cleaveland

Managing Director
F. Herman

- Administration
  Office Administration: M. Berry
  Contract Administration: K. Griffin
- Chief Scientists
  Prof. V. Basili
  Prof. M. Zelkowitz
- Universitz Faculty
  Dr. A. Memon
  Dr. C. Seaman

- Software Management and Operations
  Division Director K. Dangle
- Software Architecture and Embedded Systems
  Division Director Dr. M. Lindvall
- Measurement and Knowledge Management
  Division Director Dr. F. Shull

The Fraunhofer Virtual Institute for Experimental Software Engineering

The Fraunhofer Virtual Institute for Experimental Software Engineering, FVIESE, includes two partner institutions: the Fraunhofer Institute for Experimental Software Engineering (IESE) in Kaiserslautern and the Fraunhofer Center for Experimental Software Engineering, Maryland (FC-MD) 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 FC-MD jointly coordinate FVIESE.

Departments and Business Areas

To ensure efficient execution of daily operations, the FVIESE institutes – Fraunhofer IESE and FC-MD – 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
- Medical Systems
- Telecommunication, Telematics and Service Providers
- Information Systems and Public Sector

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 Fraunhofer IESE Advisory Board

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

Research

Prof. Dr. Victor Basili
Institute for Advanced Computer Science
Department of Computer Science
University of Maryland
College Park, MD
USA

Prof. Manfred Broy
Institute for Computer Science
Technical University of Munich
Munich

Dr. Paul C. Clements
Software Engineering Institute (SEI)
Pittsburgh, PA
USA

Prof. Dr. Werner Mellis
Department of Information Systems
System Development
University of Cologne
Cologne

Prof. Jürgen Nehmer
Department of Computer Science
University of Kaiserslautern
Kaiserslautern

Prof. Helmut Schmidt
President
University of Kaiserslautern
Kaiserslautern

Prof. Mary Shaw
Carnegie Mellon University
Pittsburgh, PA
USA

Industry

Reinhold E. Achatz
Vice President Corporate Technology
Siemens AG
Munich

Dr. Matthias Berg
Former CEO
Pfaff Industrie Maschinen AG
Kaiserslautern

Dr. Klaus Grimm
Director Software Technology
DaimlerChrysler AG
Berlin

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

Wolfgang Jung
Head of Development Center West
T-Systems NOVA
Saarbrücken

Dr. Michael Strugala
Robert-Bosch GmbH
Schwieberdingen

Dr. Martin Verlage
Vice Executive Director
vwd group Technology
Frankfurt

Dr. Thomas Wagner
Head of the Advisory Board
Executive Vice President, Corporate
Robert-Bosch GmbH
Stuttgart

Dr. Hans-Ulrich Wiese
Former member of the Executive Board
of Fraunhofer-Gesellschaft e. V.
Gräfelfing

Government

Dr. Rudolf Büllesbach
Directing Ministerial Councilor, Rhineland-Palatinate State Chancellery
Mainz

Brigitte Klempt
Ministerial Councilor, Ministry of Education, Science and Continuing Education
Mainz

Dr. Ulrich Müller
Directing Ministerial Councilor
Ministry of Economy, Transportation, Agriculture and Viniculture
Mainz

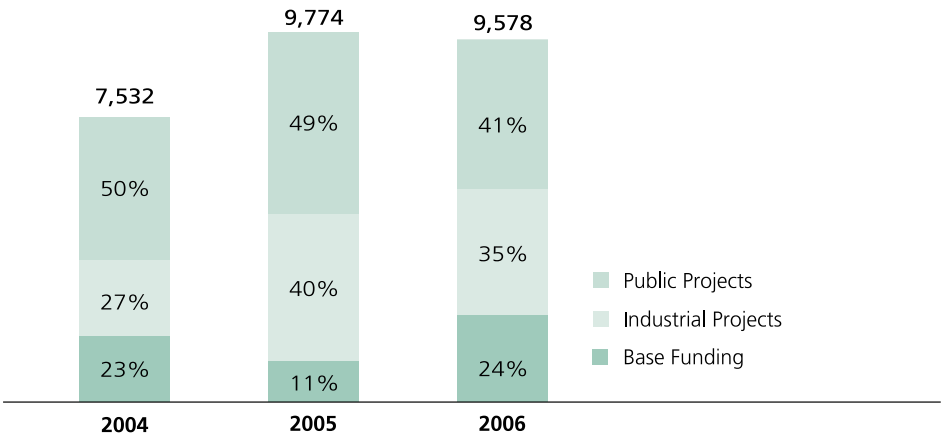
Dr. Bernd Reuse
Ministerial Councilor, Federal Ministry of Education and Research (BMBF)
Bonn

Fraunhofer-Gesellschaft

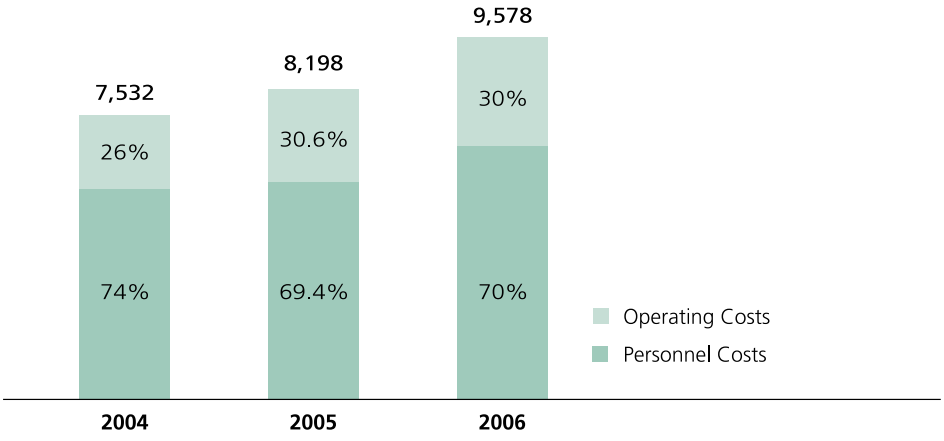
Dr. Alfred Gossner
Member of the Executive Board
Fraunhofer-Gesellschaft e. V.
Munich

Dr. Helmut Seliger
Research Planning
Fraunhofer-Gesellschaft e. V.
Munich

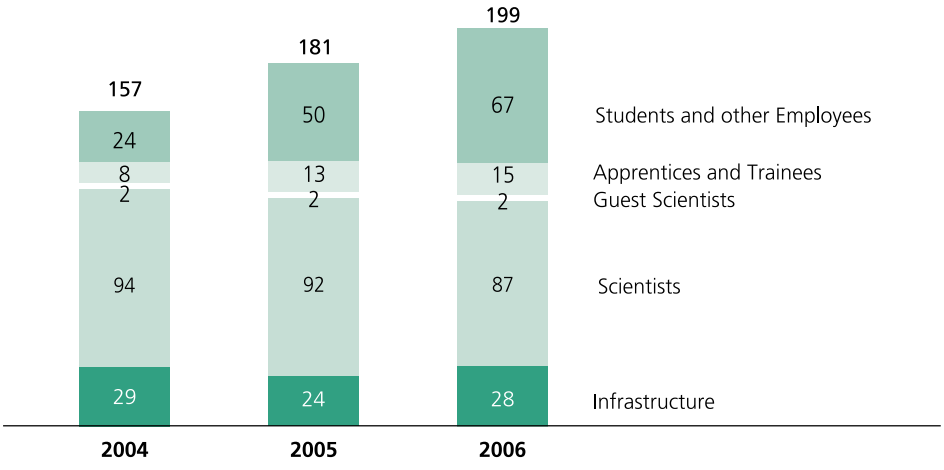
Development of Personnel and Budget



Development of Budget (in T euro).



Development of Costs (in T euro).

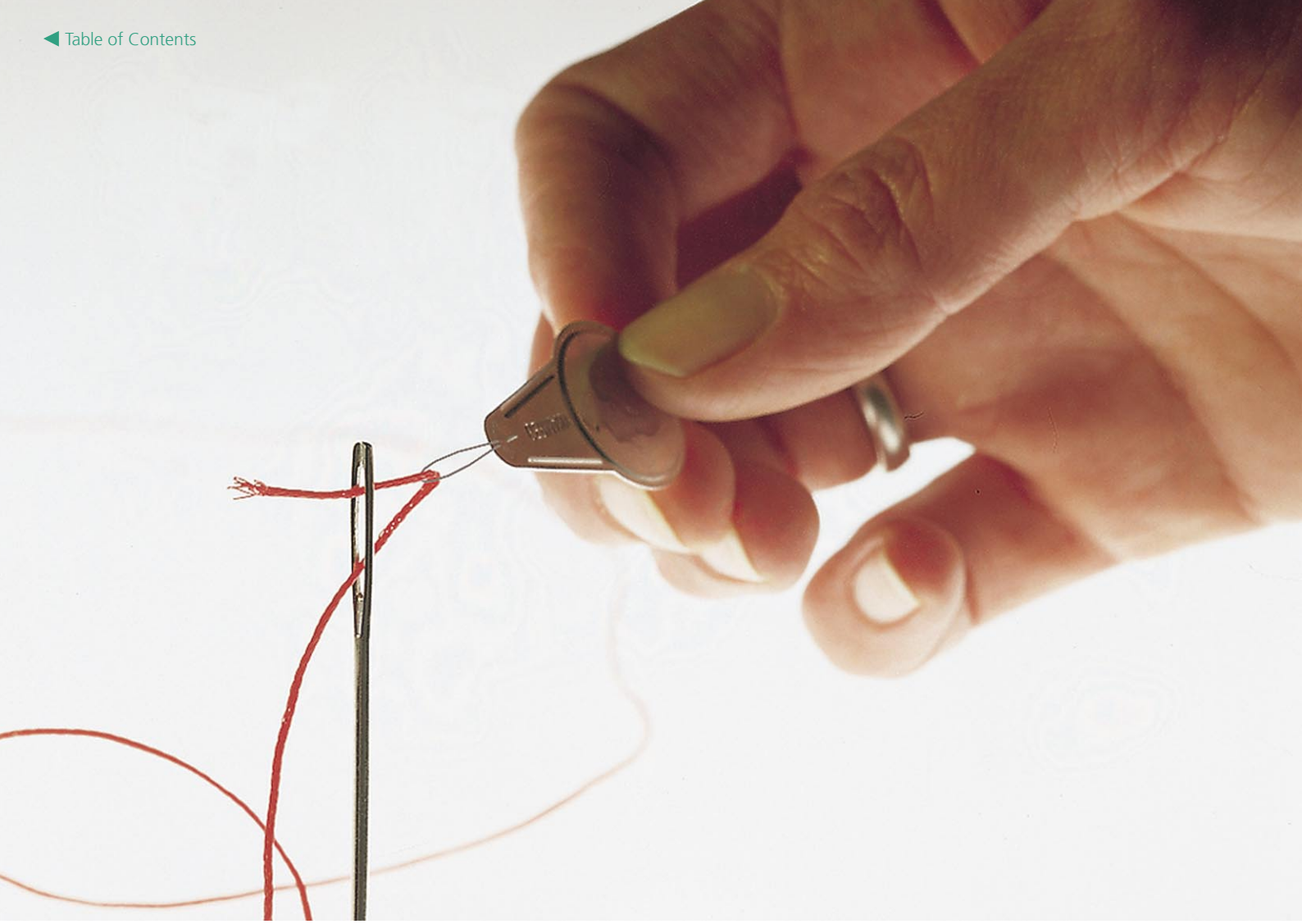


Development of IESE Personnel.

Personnel and Budget Development

During the course of the year, IESE had 199 employees, including 87 scientists, 2 guest scientists, 67 student research assistants, as well as 15 apprentices and interns. The proportion of women was 35%.

In the year 2007, the institute will continue to expand its scientific personnel.



Departments

Requirements and Usability Engineering (RUE)

Contact

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Jörg Dörr

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 leads 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 results 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.

Product Line Architectures (PLA)

Contact

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Dr. Dirk Muthig

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 exactly 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 in consideration of 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, high-performance 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.

Component Engineering (CE)

Contact

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Dr. Mario Trapp
(since January 2007)

Dr. Christian Bunse
(until December 2006)

Building Blocks for Success

Today, the functionality of technical products is often a complex interaction of hard- and software. In this context, control programs, which are almost completely responsible for the behavior of the overalll system, are particularly important. In addition to the functional requirements, they must usually fulfill stringent non-functional requirements such as performance, safety, security, and reliability, while making only minimal demands on their environment.

Developing systems by combining single components, which should be as freely adaptable as possible, via defined interfaces has many advantages. Usage scenarios, reusability, and non-functional characteristics of components are easier to optimize, and complexity problems are easier to handle by dividing large systems into independent sub-units.

With special emphasis on embedded systems and realtime systems, Fraunhofer IESE is working on the following main topics, with an orientation towards practical application:

- **Infrastructures for implementation** can be used profitably in many cases for the systematic development of component-based systems. Especially UML, Corba, J2EE and other technologies promise individual benefits regarding savings in effort and product characteristics, and permit rapid development of systems with a pre-defined quality.
- **Embedded systems** profit particularly from systematic component-based development strategies, e. g., through the consistent reuse of already proven sub-systems.
- **Non-functional characteristics** are just as important as the functionality itself and must be taken into consideration during all phases of system development. Formal methods can help to specify and verify these characteristics during model-based development.
- **Resource optimization,** e. g., with regard to memory demand or energy consumption, is possible for embedded systems with the same modeling processes that are also used in hardware or software development (e. g., UML).
- **Efficient technology transfer** is the basic prerequisite for the profitable use of component-based development in an organization.

Competence in Software and Systems Engineering

The strength of Fraunhofer IESE's software engineering research lies mainly in the engineering-style combination of new software engineering methods, respectively methods further developed or adapted upon customer request, with a focus on the problem at hand. Thus the synergies of the various processes can be used optimally:

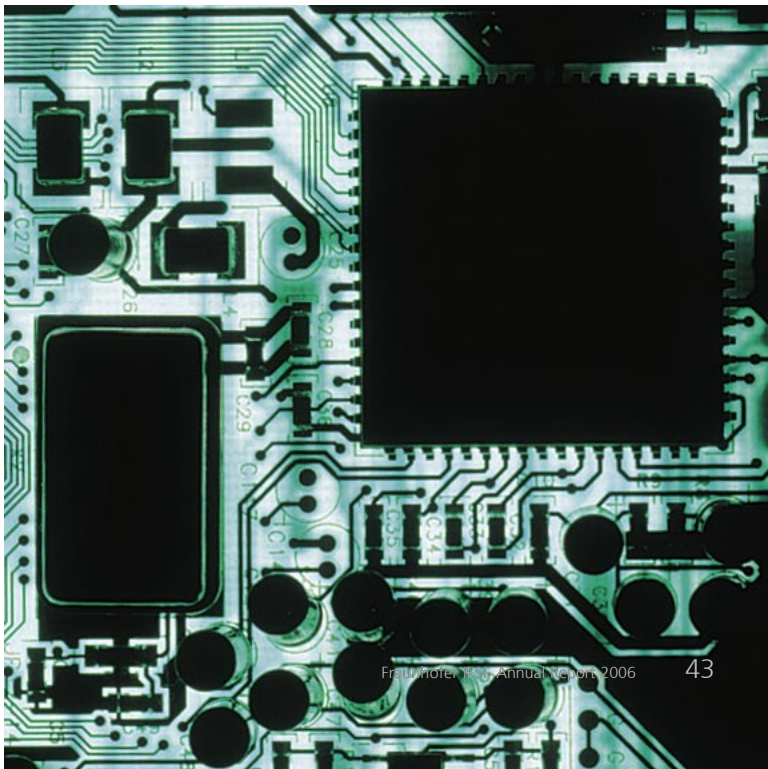
- **Methodological support**: Empirical processes during component-based system development permit goal-oriented optimization of processes, allow companies to profit from practical experience gained in other projects, and avoid known mistakes. Agile methods can also be used, significantly accelerating system development.

- **Hardware-software co-design**: Suitable construction models enable the development of monolithic systems, whose components interact without a problem and which can be developed in a particularly effort-efficient way. Methods and tools for model control (e. g., SPIN) enable automatic correctness checks; so-called Early Development Models permit exact estimation and optimization of resource usage.
- **Perspective-based development**: Depending on the application case, the focus in system development and optimization can be set individually. Which system characteristics receive special emphasis is a question of the customer's perspective.
- **Cost-benefit analyses** show which development strategies have the highest potential in the specific application case.

Products and Services

Software and Systems Engineering is the key to winning a competitive edge in a hard-fought market. Fraunhofer IESE offers a comprehensive range of support for system developers to design high-quality components and arrange them into complex systems:

- **System analyses**: Detailed studies performed by Fraunhofer IESE experts provide an insight into the performance behavior of existing systems and show improvement potentials, e. g., regarding possibilities for further modularization, resource usage, as well as realtime behavior. Options for systematic tool support can be selected in this context, and techniques for the self-analysis of performance-reducing factors in embedded systems can be taught.
- **Method introduction**: Successful system development is a question of selecting the right procedure. Fraunhofer IESE helps in introducing component-based processes into existing development processes, e. g., the KobrA method for component-based product families or MARMOT especially for embedded systems. In addition, the institute offers comprehensive support for model-based system development via object-oriented analysis and object-oriented design.
- **Training and coaching**: The Fraunhofer IESE specialists teach component-based development know-how first-hand in training sessions, workshops, web-based learning courses or by direct coaching in the user project. This includes a wide variety of offers involving the Unified Modeling Language (UML), the KobrA method, Agile Methods, and Extreme Programming, as well as techniques for the development and analysis of realtime systems. Target groups include both practitioners from the development and implementation field and project managers tasked with decision-making.
- **Optimization of technology transfer**: Especially in the development of software-based systems, quantitative statements on the profitability of certain methods are indispensable. Adapted empirical processes together with the expertise of the Fraunhofer IESE specialists permit reliable estimation.



Processes and Measurement (PAM)

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Dr. Jürgen Münch

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 minimzed.
- **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 optimally used:

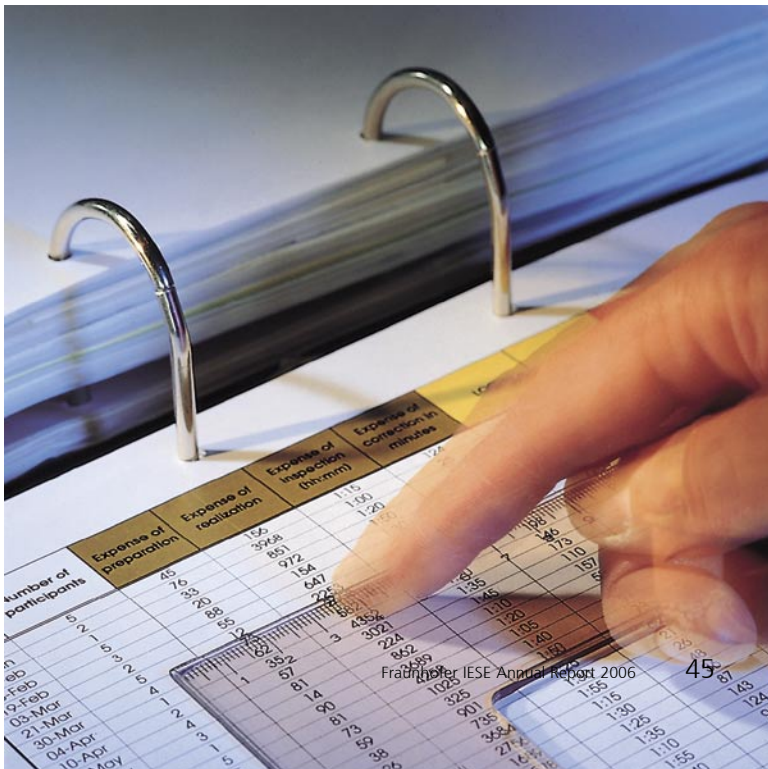
- **Goal-oriented measurement**: Custom-tailored measurement systems make it possible to focus on relevant measurement data, on the selection of suitable measurement processes, on minimizing the cost of data elicitation, and on the analysis of data with regard to business, project, and improvement goals.
- **Project control centers**: They provide the stakeholders of a system development project online with measurement data packaged and visualized in a meaningful way, data that, through exact adaptation to the development environment, 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 according to FAME® – the tried and proven Fraunhofer Assessment Method, and guarantees conformity to standards, e. g., IAW ISO/IEC 15504 (SPiCE). 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, for example, introductory courses or assessor training IAW ISO/IEC 15504, as well as courses on issues such as product metrics, empirical studies, or cost estimation.



Testing and Inspections (TAI)

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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 savings in costs 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.

Security and Safety (SAS)

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Risks Come in Many Forms – So Do Safety and Security

In many areas of our lives, software-based systems increase productivity and raise our level of comfort, but they also entail risks, either by failing or malfunctioning in practical operation, or through malicious manipulation by third parties. The more complex the technology used, the more difficult it gets to see all problems emerging in the area of security and safety and to construct systems that prove to be reliable and safe on the one hand (safety), while offering maximum resistance against attacks, intrusion, and manipulation attempts on the other hand (security).

Often, an unreasonably high amount of effort is necessary to stabilize or safeguard finished systems that are unreliable or unsecure by construction. The main goal of system development is therefore to take security and safety requirements into consideration in the earliest possible phases of the development process, thus realizing systems with built-in security and safety ("security and safety by construction"). In this context, Fraunhofer IESE is working on the following main topics, with an orientation towards practical application:

- **Security- and safety-related requirements engineering** elicits system requirements regarding security and safety completely and systematically, respectively analyzes system design quantitatively with respect to whether such requirements are fulfilled.
- **Design and construction patterns** support the system designer in designing reliable and secure software-based systems.
- **Security and Reliability Analyses** evaluate systems from individually determined points of view and requirements.
- **Security and Safety Assessments and Consulting** for system development in conformance to standards, prior to certification, and for optimization of security and safety to be performed by the user on his own.

Competence in Software and Systems Engineering

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

- **Safety from the start**: Analysis and design models, technology assessments, and suitable system architectures ensure (embedded) systems that run smoothly.
- **Provable reliability**: Safety analyses and standard conformity tests to quantitatively determine individual system characteristics or to assess the overall quality of the system.
- **Quality models**: Examination of critical hardware and software systems for relevant security and safety characteristics.

- **Development coaching**: Coaching by experts during all process phases in the development of safety- or security-critical systems, including the possibilty for certification.
- **Secure IT network structures and network monitoring**: Design and analysis of secure infrastructures with tool-supported vulnerability recognition.

Products and Services

In the area of security and safety, as in other areas, software and systems engineering is one key to winning a competitive edge in a hard-fought market. Fraunhofer IESE helps to optimize development processes in multiple ways while improving reliability and security at the same time:

- **Security audits for active network components**: Webservers, routers, firewalls, and operating system configurations must fulfill high requirements especially with regard to security against manipulations. Fraunhofer IESE's tool-supported processes detect even hidden security leaks, which would not be found with a purely manual process, despite high effort.
- **Safety and reliability analyses**: Qualitative and quantitative processes check system designs in accordance with custom-tailored checking criteria: fault trees (component and state event fault trees), FMEA, and other methods are used and supported with tools developed by us or by others. In addition, training on this method is offered.
- **Process and product assessment**: In-depth assessments of development processes and resulting products through experts from the institute provide insight into the security and safety level during system development. In preparation for certification or evaluation regarding conformity to standards, pertinent standards can be considered (e. g., IEC61508, 21 CFR Part 11).
- **Definition of development processes**: Fraunhofer IESE supports organizations in designing development processes for critical systems with special requirements regarding reliability and security against manipulations.
- **Training sessions and workshops**: Decision makers and practitioners in system development learn about security and safety first-hand in special events. As a result, companies are able to address future issues regarding reliability and system security on their own.

Experience Management (EM)

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Successful by Experience

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

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

Competence in Software and Systems Engineering

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

- **Process and tool integration**: Many practical problems and high effort result from a "side-by-side existence" of system or software development process and experience management. Seamless integration, however, reduces effort, helps maintain the overview, and prevents existing experience from remaining unused. Smart tool support enables necessary experience management steps such as collecting and categorizing experience and making it available in an unobtrusive, yet consistent manner.
- **Scaling and adaptation**: There cannot be one single solution for all application scenarios in experience management, since the requirements of software and system developers on the one hand, and the prerequisites of various development processes for the introduction of methods and tools on the other

hand, vary too much. High-quality approaches are therefore characterized by the ability to first start off with less functionality and then extend it incrementally according to the requirements at hand.

- **Model-based development of EM systems** permits performing the requirements analysis and design of an experience management system in less than one tenth of the time required with conventional methods.
- **Measurement programs**: Experience management has to be integrated into the workflow and must be efficiently maintained in order to remain ready for use at any time. Suitable tools automatically collect the measurement data necessary for optimization during use. Thus, nothing stands in the way of technical, respectively economic, improvement.

– 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 scaleability 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.

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

Education and Training (EAT)

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Prof. Dr. Frank Bomarius
(since February 2007)

Dr. Patrick Waterson
(until January 2007)

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, respectively 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:

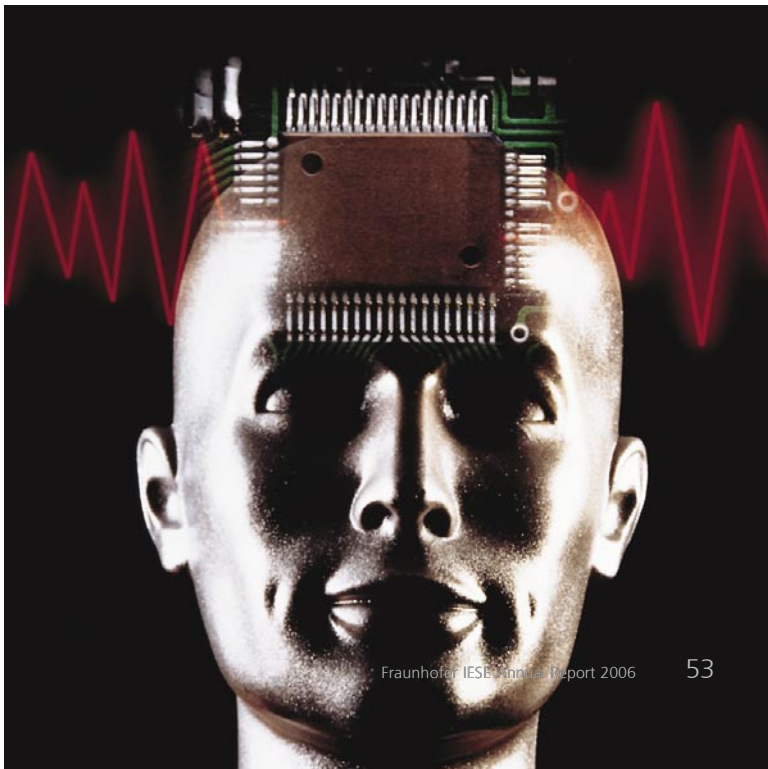
- **Development of courseware and process engineering**: Starting with the requirements analysis and the scoping of the educational needs, qualification programs, (mainly electronic) learning materials, and documentations are designed, implemented, and evaluated in an engineering-style manner. This procedure 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, respectively 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 courseware 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.




GZ
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Business Areas

Automotive and Transportation Systems

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Software Technology for a World in Motion

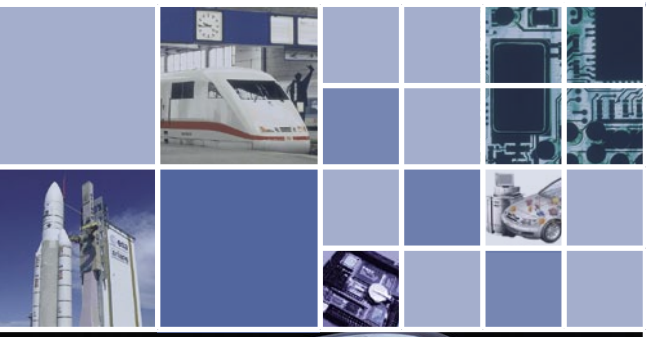
The business area "Automotive and Transportation Systems" especially aims at manufacturers and users of embedded systems, primarily in automotive and rail technology as well as aerospace. Automotive Software Engineering comprises processes, techniques, methods, and tools adapted specifically to the requirements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

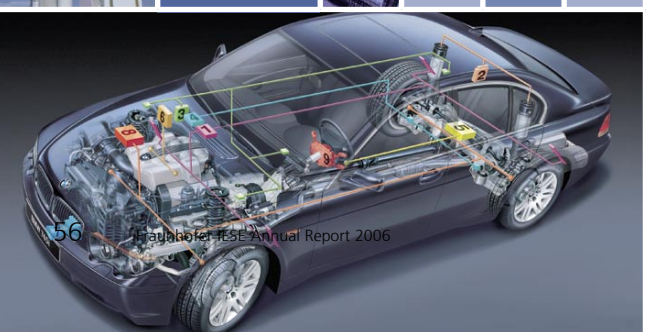
Automotive Software Engineering defines a holistic approach that includes all development activities, starting from automobile-specific process models on the basis of established standards (ISO/IEC 12207, IEC 61508) and the use of maturity level models (ISO/IEC 15504, Automotive SPICE, CMMi). Product 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 Competences in Software and Systems Engineering

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

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 RequisitePro™ or 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 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 and Verification

Process Assessments and Assessment Preparation
We assist you in planning and implementing improvement measures based upon CMMi and Automotive SPICE and perform norm-conformant assessments in accordance with ISO/IEC 15504.

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.

Testing of Distributed Systems
The testing and diagnosis of distributed systems constitutes a special challenge in automotive or other transportation systems. 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 that must, for example, fulfill certain SIL levels of ISO/IEC 61508 or ISO-WD

Telecommunication, Telematics and Service Providers

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Dr. Volker Hübsch

Confidence in Critical Systems

Fraunhofer IESE currently has four business areas specializing in the application and wide-spread dissemination of the technologies developed in the research departments. They make the institute's entire range of research accessible to the various branches of industry and application domains.

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 scaleable, 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 webservers, 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.

Medical Systems

Contact

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Software-based Systems for Health and Quality of Life

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

Our software and systems engineering approach supports you all the way from the elicitation of requirements on the medical product to validation. Together with our customers, we develop innovative solutions for software development that efficiently fulfill the requirements of IEC 62304, DIN EN 60601-1-4, and ISO 12207, and provide assistance in systematically implementing them in daily practice. We integrate future-oriented methods and techniques that ensure quality requirements (e. g., in accordance with ISO/IEC9126) efficiently and economically. Safety is the top priority in this respect. We use new methods to support you in performing risk management according to ISO 14971 for software, and to use techniques such as FMEA and FTA for the analysis of 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 life cycle-wide risk management process, especially also for embedded 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.

Developent 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
The quality of software can be checked even before testing: semi-automated with appropriate models, or by using structured reviews (software inspections). Together with you, we define appropriate and innovative processes for verification in parallel to development.

Testing of Distributed Systems
The testing and diagnosis of distributed systems constitutes a special challenge. We support you in modeling and planning test processes, in developing test cases, and in evaluating system quality. Runtime diagnosis processes, in particular, are custom-tailored to your context.

Model-based Testing and Test Automation
The testing of executable models, respectively the development of test cases and their execution based on models, are recognized principles of early quality assurance. 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
With the help of innovative processes, we support you in making software quality measurable and objectively assessable. 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 and Public Sector

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Business and Administration in the Age of Information

Information systems permeate our daily lives in various ways. Especially in the area of eCommerce and eBusiness, online shops, auction platforms, and banking resp. stock exchange systems, as well as company-internal information systems such as ERP and CRM, perform millions of transactions every day. Operators as well as users hardly take notice of the technology of these highly complex software-based systems and their multitude of interactions, and yet, modern business life is simply unthinkable without functional, secure, and user-friendly software running in the background. In parallel to the expansion of eBusiness, Public Sector institutions and their development partners are also in the process of optimizing the efficiency and quality of administrative processes and services through the use of modern information and communication technology.

As long as information systems or eGovernment solutions are functioning smoothly, their benefit is undeniable. However, if minor malfunctions can already cause major effects, and if the systems to be designed are very complex, then the only option is an engineering-style method. Otherwise, the risk of major financial losses, incalculable legal consequences, or long-term loss of trust or image is just too great – for example, if bank transfers are wrongly routed, or if electronically processed tax forms end up in the wrong hands.

Competence in Software and Systems Engineering

Fraunhofer IESE supports organizations that develop, maintain, and use company information systems in the design, implementation, quality assurance, and introduction phases, with the goal of increasing the cost efficiency of the development processes of these information systems as well as that of the business processes that are automated by them. Other major goals of Fraunhofer IESE include the achievement of improved software and service quality as well as faster time to market. The range of our customers in this area extends from banks and insurance companies to organizations offering web-based services or ERP systems. Last, but not least, Fraunhofer IESE is a competent partner of the Public Sector when it comes to the incremental transition from conventional administrative processes and services to modern, user-defined eGovernment processes.

Our special emphasis is on fulfilling the high demands on quality, regarding, for example, safety and security, usability, reliability, and maintainability, which characterize the software-based systems in the application domains mentioned above.

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:

- **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 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.
- **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 procurment**, 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.

Products and Services

Software and Systems Engineering is one key to gaining a competitive edge in a hard-fought market. Fraunhofer IESE helps to establish information systems in all areas of industry and business and develops efficient solutions in the area of electronic business for public institutions:

- 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.
- With **PuLSE® – Product Line Software Engineering,** our customers get brand quality when it comes to designing product lines and profit from lower costs per unit and faster time to market for new products.
- Requirements 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 online 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.

Projects

Payment via Mobile Phone – M-Payment made easy and secure

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Cybits Systems Security GmbH
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July Systems, Inc.
www.julysystems.com

"Look, click, buy": Nowadays, shopping via Internet has become as simple, fast, and problem-free as advertisements imply. Increasingly, small amounts, in particular – for songs, videos, or information documents, for example – are paid via mobile phone. Here, the customer comfortably pays the amount due via his monthly phone bill or his prepaid balance. Cumbersome bank transfers or direct debits are not necessary, nor are credit cards needed. Thus, almost every mobile phone provider offers "mobile payment" (M-Payment) today, in order to enable its customers to pay for various products without cash, right on the spot.

This development, which is, in principle, customer-friendly, has long been followed with critical eyes by privacy advocates and consumer protection agencies. Especially in its beginnings, mobile payment made headlines. Undesired long-term subscriptions entered into by minors, low price and provider transparency, as well as dubious offers seriously tarnished the image of mobile phone providers.

E-Plus Mobilfunk GmbH & Co. KG headquartered in Düsseldorf therefore turned to Fraunhofer IESE to have the technology and workflows of selected sub-components of its newly developed mobile phone payment service analyzed in advance. Before introducing this service to the market on a wide scale, its security and usability were to be checked.

In the context of this cooperation project, the company Cybits Systems Security GmbH, Mainz, was asked by E-Plus Mobilfunk to have its component "age verification" and the component's interaction with the internal billing system checked by Fraunhofer IESE in the context of a pilot project. The integration of the various components (age verification, billing interface E-Plus) was performed by July Systems, Inc., Santa Clara, USA. This first resulted in a certified solution for Web applications, which includes the entire value chain. Later it is to be expanded to WAP applications. During limited trial operation, the Fraunhofer IESE experts analyzed the usability of the payment steps and the payment masks used for this pur-

pose on the one hand, and checked the logical workflow of the payment process and its technical implementation with regard to potential security vulnerabilities on the other hand.

Even though no positive inspection certificate could be issued yet during the first run based on the results available, the customer is very satisfied with the results achieved so far: "The careful and intensive analyses of Fraunhofer IESE have not only contributed a lot to increasing the security and usability of the new payment service. The results have also provided an incentive for reworking central components of the underlying system framework and for hardening them with regard to security aspects", says Denis Kliefken, the responsible project manager at E-Plus Mobilfunk.

The implementation of the project results is currently being analyzed and assessed in the context of a follow-up check. Furthermore, E-Plus Mobilfunk has indicated that due to the successful project work, Fraunhofer IESE can expect to be commissioned with further projects.

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More than just making phone calls, comfortably and secure: Pushing a few buttons is enough to pay a bill. However, invisible to the user, M-Payment is based on a complex process chain, which needs to be checked for possible weak points.

Careful analyses help to avoid bad surprises!

Benefit- and Domain-oriented eGovernment in Rheinland-Pfalz: Systematic Identification of Potential in Business and Public Administration

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State of Rheinland-Pfalz
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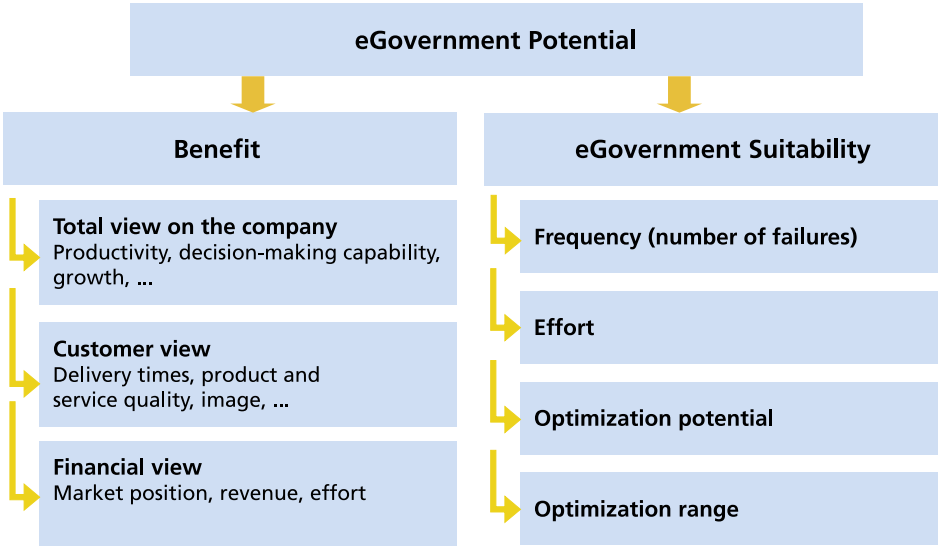
The German state of Rheinland-Pfalz was one of the first German states that declared the benefit- and domain-oriented approach as the leading principle of its eGovernment strategy. The implementation of benefit-oriented and domain-specific eGovernment is one of the key elements of the "eGovernment Action Plan" approved by the state government in 2005. Under the guiding principle of benefit-orientation, the Plan aims to seamlessly integrate administrative processes and industrial value chains so that administrative processes are optimized and red tape for business is further reduced.

The realization of the eGovernment action plan poses the question: What are the processes at the interface between public administration and business for which IT support would yield high economic and strategic benefits for industry and administration alike? To find answers to this question, the action plan suggests that public administration and industry jointly identify the most promising processes. In the summer of 2005, the state government of Rheinland-Pfalz therefore launched a project for the systematic analysis of eGovernment potential in public administration and industry. The Fachhochschule für Öffentliche Verwaltung (Academy for Public Administration) in Mayen was commissioned by the state's Ministry for the Interior and Sport to carry out the survey on the administrative side; supported by the state's Ministry for Economic Affairs, Transportation, Agriculture and Viniculture, Fraunhofer IESE conducted the analysis on the business side. The study concentrated on the chemical/mineral materials and automotive domains, which generate the highest revenues in Rheinland-Pfalz, as well as on the agricultural sector with its high degree of regulation.

In the context of the business analysis conducted by Fraunhofer IESE, the first step of the survey involved identification of the interactions between the companies and the public administration of Rheinland-Pfalz. This resulted in over one hundred types of administrative contacts being identified on the part of the companies. In the second step, the potential for eGovernment inherent in these contacts was investigated. On the one hand, the relevance of the administrative interactions for the achievement of business goals was evaluated using a Balanced Scorecard approach while, on the other hand, an assessment of the potential benefits to be expected from IT support was carried out. Relevance and benefits then formed the two key dimensions of a subsequent portfolio analysis.



Benefit and suitability are important factors that must be studied when determining eGovernment potential in business and public administration.

A total of 19 types of interaction were identified between the companies and the state administration that displayed both medium to high relevance for the companies and medium to high benefits to be gained. Seven of these 19 types of interaction were also found among the 20 most highly rated administrative processes identified by the survey on the administrative side.

The State Government of Rheinland-Pfalz will use the project findings for identifying the processes to be considered and for prioritizing them with regard to their implementation within the framework of benefit- and domain-oriented eGovernment, and will drive forward further implementation in dialogue with industry and science.

eGovernment for less bureaucracy and more efficient workflows!

Engine Control Systems in All Variants

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Hitachi is one of Japan's corporate groups that is active in diverse business areas including information systems and telecommunication systems, power and industrial systems, or electronic devices. One of its current business goals is to expand its automotive systems business area. Hitachi's automotive business aims to increase its market share and release many high-quality products to its customers within a short period of time. To reach this ambitious goal, the Automotive R&D laboratory has started focusing on software product line engineering: the domain of engine control systems (ECS) has been selected as the primary target domain, and Fraunhofer PuLSE® was chosen as the enabling technology.

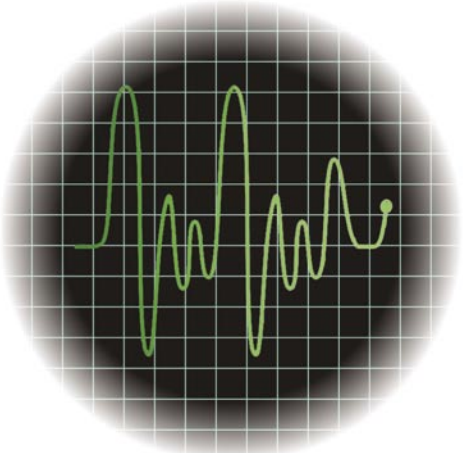
Hitachi has released many variants of ECS to diverse car manufactures. From an external viewpoint, these releases share a significant portion of common properties; also, many future variations for different customers and market segments can be predicted in advance. The collaboration between Hitachi and Fraunhofer IESE has explored how future ECS variants can thus be designed to systematically exploit this situation and keep cost as low as requested from the business point of view. Hence, cost will be reduced while at the same time, current quality levels are maintained. It is worth noting that ECS is a safety-critical system. Hence, the migration also has to keep safety in mind as an important aspect of the end products.

The first phase performed goal-oriented assessments of existing systems from the reuse point of view. That is, using measurements, the reusability of the existing system was assessed and then an action plan was derived for improving the existing system in order to foster reuse in the future. This action plan was complemented by an economic analysis to work out a product line adoption and migration strategy.

Innovative: SAVE – Software Architecture Visualization and Evaluation won the Innovation Award of the state of Rheinland-Pfalz and continues to prove itself in practical usage.

The assessments started with a tool-supported identification of key developers per software component based on history information provided by the underlying configuration management systems. Nearly the complete ownership situation could be correctly identified from Germany without any effort required by the running project teams in Japan. This ownership information was then used to interact efficiently with the team while comparing several architectures of existing product variants, as well as evaluating them against the intended reference architecture. These analyses were supported by the Fraunhofer SAVE tool suite, which won the Innovation Award of Rhineland-Palatinate in 2004. The results gave clear indications about which components from diverse products could be easily merged into generic, reusable components for an ECS product line. However, in some areas merging was more difficult and less attractive than expected.

The structures and complexity of current ECS implementations strongly indicated the need for raising the abstraction level during development. Therefore, Hitachi decided to emphasize model-driven development to complement the focus on product lines. Consequently, subsequent joint activities will focus on the definition of a model-driven product line approach that supports smooth migration of existing assets into future product strategies.



PuLSE® – Product Line Software Engineering is the name of the product line methodology developed by Fraunhofer IESE and proven in industry.

Software Product Lines: Flexible, functional, profitable!

Model-based and Statistical Testing: How Good Is Software?

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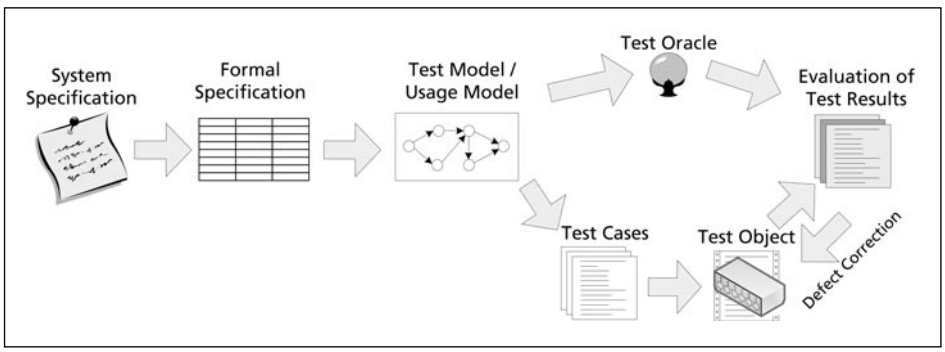
Since the 1970s, systematic software test procedures have been the subject of intensive research. In the meantime, they have been accepted by large parts of industry as a compulsive need. However, a test is usually just a small sample taken from the possible usage scenarios of the software to be checked. The reasons for this are feasibility and complexity: Many test cases make the testing process more expensive and make it more difficult to keep an overview regarding consistency and possible redundancies. Another important requirement on tests is the possibility to automate test case generation, test execution, and test evaluation.

The ideal software test thus is based on a small, preferably automatically generated, yet still defect-sensitive set of test cases. How can this be achieved?

In a way that is similar to software development, developers have come to realize during the past few years that in testing, too, it makes sense to first develop a model of the test. Models can be checked much faster and easier for inconsistencies and redundancies than fully implemented and integrated software systems.

Another advantage of model-based testing is its great potential for automating the generation, execution, and evaluation of test cases, which enables an economical increase of the test cases that can be executed simultaneously and thus an enlargement of the sample. The significant enlargement of this sample through automation will then even permit conclusions regarding non-functional quality properties of the software. By means of statistical methods and estimation procedures, data such as remaining defect content, reliability, or availability are accessible with acceptable cost effort.

In cooperation with companies formthe automotive domain, Fraunhofer IESE has evaluated the practical usability and performance of model-based and statistical testing. On the basis of the specifications of systems currently under development, test models were developed incrementally. In the context of the projects it was shown that manual effort is only required for creating the test model. The subsequent activities such as test case derivation, test execution, and test evaluation could then be automated completely. Overall, several hundred test cases were executed in



Statistical testing workflow model with usage data for quantitative reliability statements on software.

Tested and found to be good:
Modern automobiles cannot function without complex electronic control devices. The embedded systems consisting of hardware and software make the highest demands on the developers – systematic and partially automated testing procedures check whether these requirements have actually been fulfilled.

each case, and various inconsistencies between the specified behavior of the system and behavior determined in the test were detected. In some cases, defects could already be detected during the creation of the test model.

A complex software system consisting of many components usually requires a complex test model. Since the complexity of future systems will continue to increase, the development of component-based approaches to the construction and analysis of adequate test models will play an important role. The transition from software models to system models (for example, for embedded systems) will also gain priority in the future. Fraunhofer IESE will therefore concentrate future research work on industry-relevant component terms and system models with regard to their practical usability.

So that software will really do what it is supposed to do!

On the road again...
The car continues to be the epitome of mobility. The seemingly endless multitude of available models makes the customer happy, but poses special challenges to the suppliers of electronic systems. They must offer their components in a correspondingly large number of variants, and do so in a competitive way without ever losing sight of quality.

Fun-of-Use – Is It Allowed for Business Applications to be Fun?

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DCON Software & Service AG
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a3 systems GmbH
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Further Information

The Fun-of-Use Project
www.fun-of-use.de

Very often, products in the area of consumer goods are successful if they trigger positive feelings in the user. Here, fun-of-use is just as important as reliability and functionality. Automotive manufacturers, for example, have recognized this and have adapted their product advertisement accordingly.

When it comes to software in business environments, higher user acceptance is a synonym for more productivity. In order to use this effect profitably, one must get a better understanding of the importance of positive emotions in connection with software products. Using the knowledge gained, software development can systematically take into account those very specific "non-functional" requirements, so that the user of business software will ultimately work with higher motivation and thus faster and/or better.

The project transfers the basic concept described above into business applications by

- making the meaning of the term "Fun of Use" concrete for business applications,
- developing guidelines in the form of proven solutions for user interfaces (so-called interaction patterns), which describe concrete implementations of the concept "Fun of Use" in a software, and
- enriching existing development methods and environments with suitable interaction patterns.

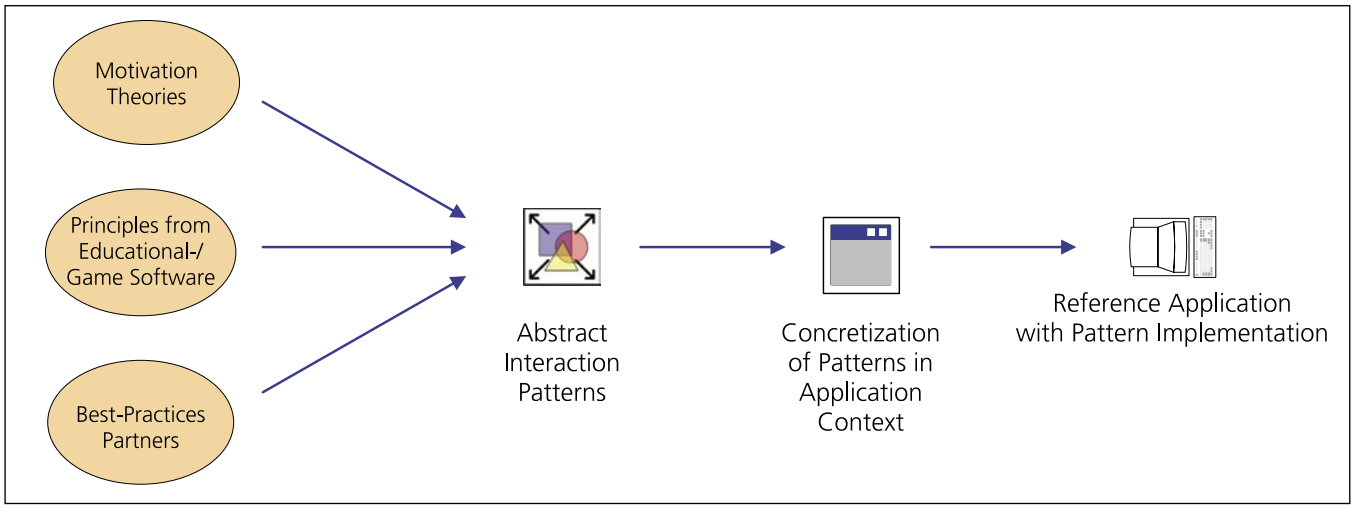
As expected, the "design element joy" makes particular sense for business application when users work faster or better. Joy is thus intended to increase user motivation to complete a task using the software, respectively promote creativity and concentration. Through the systematic analysis of existing systems with a high fun factor (e. g., computer games, educational software, and other solutions of the participating consortium partners), the needed characteristics could be derived and described as interaction patterns.

Many application scenarios can be envisioned: For example, users of a call center software might get more personalization rights to their electronic working environment if the number of jobs completed increases (pattern: "make functions available"). Another application would be the visualization of jobs completed combined with incentives for the employees, e. g., in the form of a reward after X complaints processed (pattern: "status display with incentives").

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

BMBF Grant No.: 01 IS E06 A



From theory to implementation:
The illustration shows the identification and implementation of the interaction patterns in the context of the Fun-of-Use project.

Currently, the first implementations of such interaction patterns are being empirically evaluated in a laboratory environment with regard to their acceptance, effect, and impact on the accomplishment of tasks, before they are integrated into the industrial partners' customer projects. Patterns were integrated into reference applications from different domains (call center software, software for processing customer service orders in the area of IT, and others).

One focus of future work will be the integration of the interaction patterns into the systematic software development process. This includes methodological support describing

- how suitable interaction patterns can be selected based on software requirements and
- how interaction patterns can be integrated into software development environments in terms of code generation.

People who like to work, perform better!

Motivation for more productivity:
Particularly in routine work, fun and verve are needed to achieve good results in a short time. The work environment and thus also the application software used can make an important contribution to motivating employees – not only in Call Centers.

Ambient Assisted Living – Intelligent Assisted Living Systems for Living a Self-Determined Life in Old Age

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Further Information

The BelAmI Project
www.belami-project.org

The expected ageing of society is predicable and scientifically proven. Even today, it already has serious effects on the lives of the persons affected, the health care sector, and the associated costs. Significantly more elderly people will make use of medical services or will have to leave their homes to move into an assisted living facility or a nursing home. This usually entails a loss of quality of life for elderly persons and their families – not to mention the considerable costs.

Under the term "Ambient Assisted Living", Fraunhofer IESE and partners from industry and science are performing research on intelligent assistance systems aimed at enabling elderly persons or those requiring care to live a self-determined life in their familiar environment for as long as possible. Using Ambient Intelligence approaches, innovative solutions are developed that "get to know" a resident in his home environment and support him in his daily life. In addition to research on technical problems such as suitable sensors, information processing, reliability, and adaptivity, the usability and acceptance of such systems is also being investigated.

In order to not only study the development and integration of innovative Ambient Intelligence technologies, but also the feasibility of the solutions found for everyday life, Fraunhofer IESE has established its own Assisted Living Lab. This lab enables the simulation and evaluation of concrete scenarios in a realistic environment. At the official opening of the Assisted Living Lab in October 2006, the following scenarios could be demonstrated:

Life Assistance

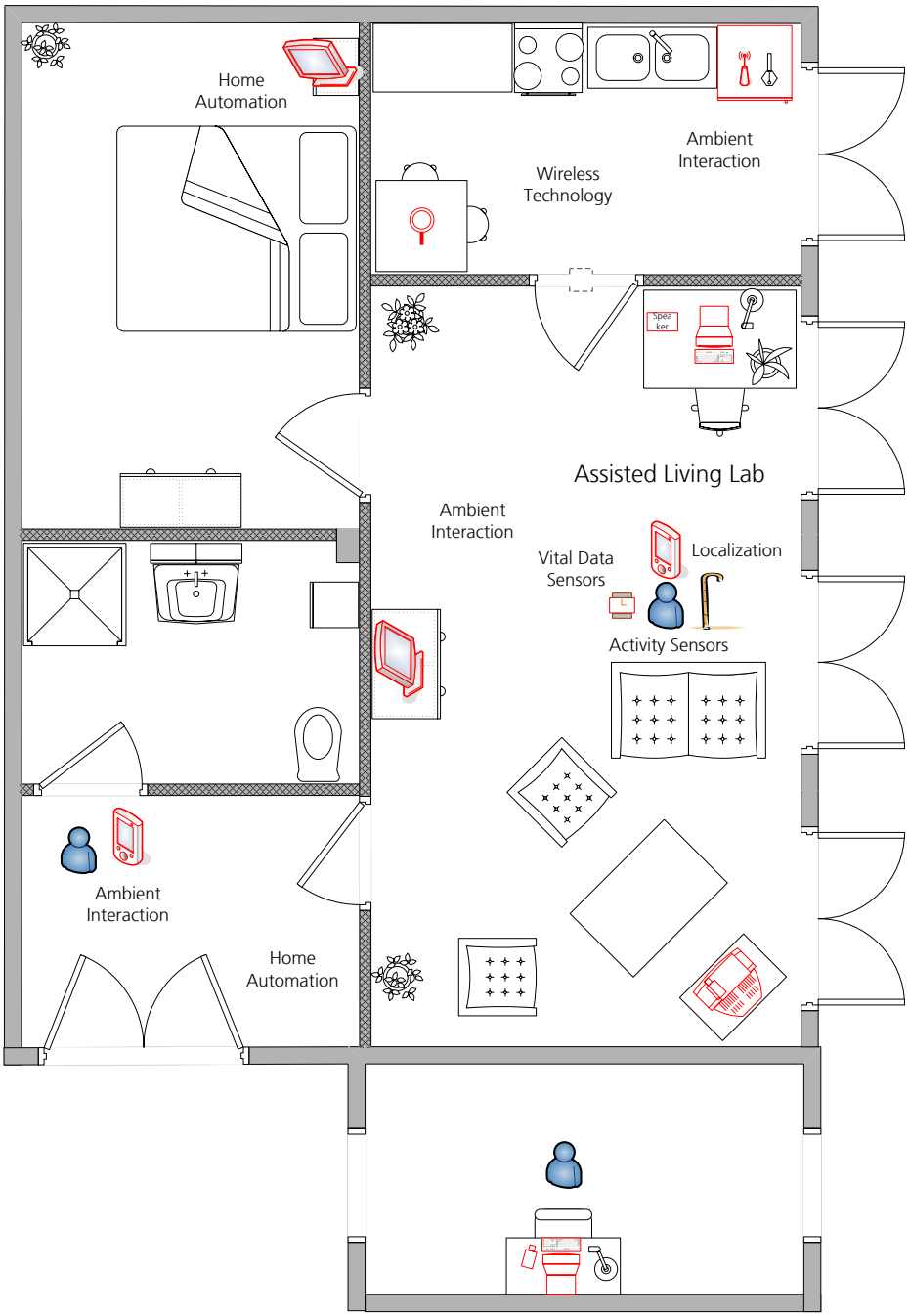
- Reminders: In order to counteract possible dehydration, for example, the amount of fluids consumed is traced with the help of an "intelligent" cup, which issues a reminder to drink more, if necessary.
- Risk prevention: An RFID (Radio Frequency Identification) system integrated into the refrigerator monitors the expiration dates of food items and indicates possible problems.

Emergency Assistance

- Recognition of movement patterns: The positions and movements of persons and objects can be traced using various localization solutions such as a Smart Carpet with RFIDs. Based on comparison with typical movement patterns, potentially dangerous situations can thus be recognized.
- Fall detection: By means of sensors, the system registers potential falls, checks in a dialog with the user whether there was an actual fall, and, if necessary, establishes contact with family members or emergency medical services.

The special characteristic of the Ambient Intelligence approaches are either permanently installed or mobile (micro-)sensors that are as unobtrusive as possible.

In addition to further extensions to the functionality, future research shall encompass especially the evaluation of the solutions in everyday use, on site in nursing homes and private homes. The results achieved so far are encouraging: Ambient Assisted Living solutions provide sustained improvement to an individual's quality of life. People remain longer in their own homes, which also has a positive impact on the development of public health care costs.



Ambient Intelligence – unobtrusively integrated, intelligent, networked systems offer support in everyday situations. The application of AmI technology in the Assisted Living Lab supports especially elderly people and handicapped persons.

Technology that proactively reacts to emergencies!

Soft-Pit and RiskVis: Project Control Centers Bundle Information

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Collaboration Partners Soft-Pit

Federal Ministry of Education and Research
www.bmbf.de

T-Systems Multimedia Solutions GmbH
www.t-systems-mms.com/

LogControl GmbH
www.logcontrol.de

OrgaTech GmbH
www.orgatech.org

SQS Software Quality Systems AG
www.sqs.de

FUJITSU Enabling Software Technology GmbH
www.est.fujitsu.com

BTU Cottbus
Software Systems Engineering Research Group
www-sst.informatik.tu-cottbus.de/LS-SST

Further Information

Soft-Pit
www.soft-pit.de

Collaboration Partner RiskVis

Siemens AG - Corporate Technology
www.ct.siemens.de

Process transparency is becoming more and more important when it comes to the development of software-intensive systems. Project control centers ensure the necessary overview. They help to recognize and reduce risks early on – resulting in increased adherence to budgets and schedules. Project control centers contribute to systematically packaging information already available in an organization, to controlling distributed development projects, and to basing management decisions on solid data.

The establishment and introduction of project control centers requires great methodological care. Usually, the procedures and characteristics of development projects or application domains are so different that the control center must be adapted to the respective organizational and project level. Development projects are also characterized by a large degree of creative activities that cannot be automated. Thus, fully automatic elicitation of information is not sufficient for obtaining a comprehensive overview.

An important step towards the introduction of project control centers is the determination of measurement goals and the derivation of suitable measurements for eliciting data. Here, a systematic analysis must be performed of the data already being elicited in an organization, and how these data can contribute to the measurement goals. A widely accepted method is the Goal-Question-Metric approach (GQM) for goal-oriented measurement, which provides precise instructions on how to formulate goals, supports the systematic derivation of measurements, and enables the subsequent analysis and interpretation of measurement results.

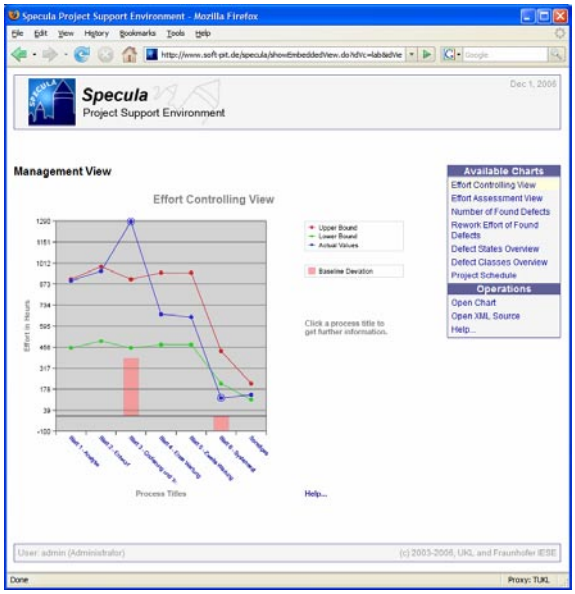
Soft-Pit

Experiences made in projects to introduce control centers have shown that an exhaustive analysis of a company's goals and situation, the derivation of measurements, as well as the selection and adaptation of interpretation and visualization mechanisms are of particular importance. Open research questions such as the efficient combination of controlling building blocks or the optimized visual representation of the results are currently being worked on in the context of the project Soft-Pit, which is funded by the German Federal Ministry of Education and Research and coordinated by Fraunhofer IESE. The other consortium partners include T-Systems Multimedia Solutions GmbH, LogControl GmbH, OrgaTech GmbH, SQS Software Quality Systems AG, Fujitsu Enabling Software Technology GmbH, as well as the chair of Software Systems Engineering Research of BTU, Cottbus.

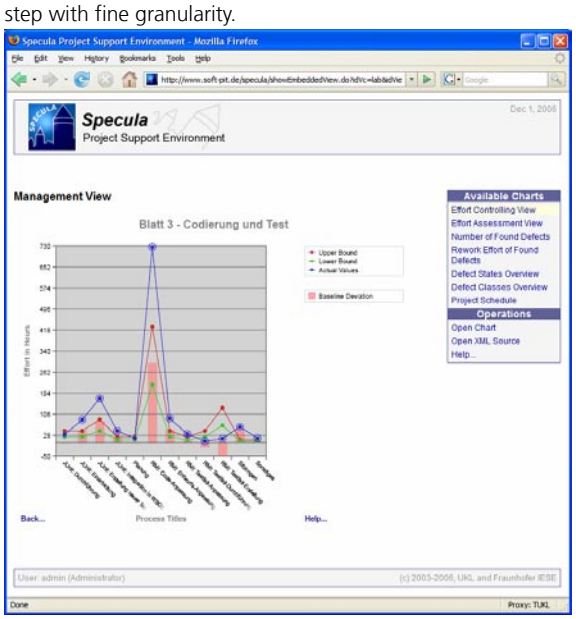
RiskVis

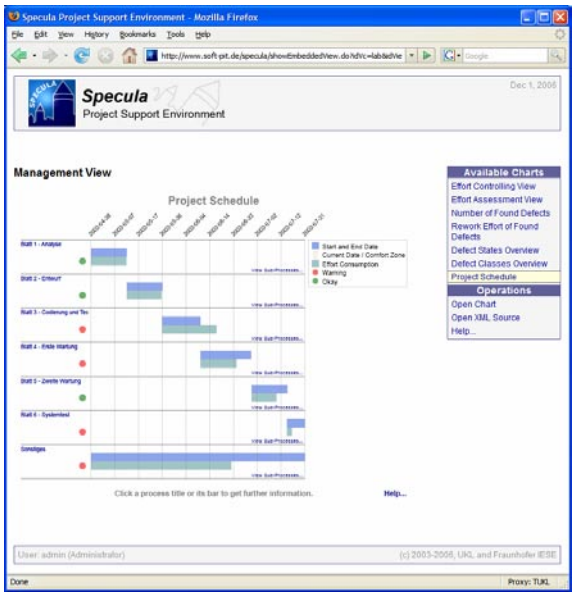
The goal of this project, which is being performed by Fraunhofer IESE together with Siemens AG, Corporate Technology, is the development of a project control center focusing on the temporal development of project risks and the planning of measures to reduce risks. Advanced visualization techniques support the earliest possible detection of project risks, so that suitable measures for avoiding, respectively reducing, risks can be taken on time. This gives project managers and higher-level management an effective early warning system regarding project goals that might be in jeopardy. In addition, the project control center makes it possible to visualize the effectiveness of countermeasures taken and their optimization.

Effort under control: Project managers can see at a glance which development step took how long – and, if necessary, can take countermeasures on time.

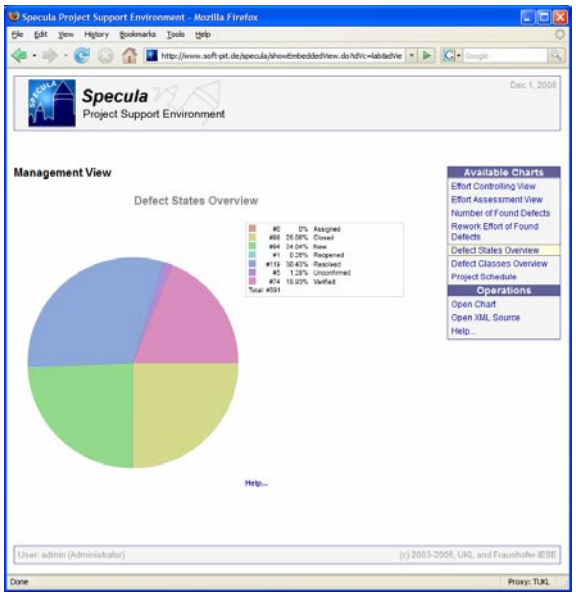


Taking a close look at the process: Like everywhere else, in software and systems development, the devil is often in the details. Visualization therefore allows presenting each process step with fine granularity.





What is next? The integrated activity overview of the visualization tool makes additional project management software expendable here.



Defect report: Despite the best planning, defects can never be fully excluded. Thus, it is important for system developers to know at all times what the processing status of detected defects is. Especially in complex development projects, this prevents products containing known defects from being shipped.

Achieve project success with the right overview!

PESOA: Service-oriented Product Lines for the Efficient Support of Process Variants

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Collaboration Partners

Bundesministerium für Bildung und Forschung
www.bmbf.de

DaimlerChrysler AG
www.daimlerchrysler.de

eHotel AG
www.ehotel.de

Delta Software Technology GmbH
www.d-s-t-g.com

Hasso-Plattner-Institut für Softwaresystemtechnik
Business Process Technology Group
bpt.hpi.uni-potsdam.de

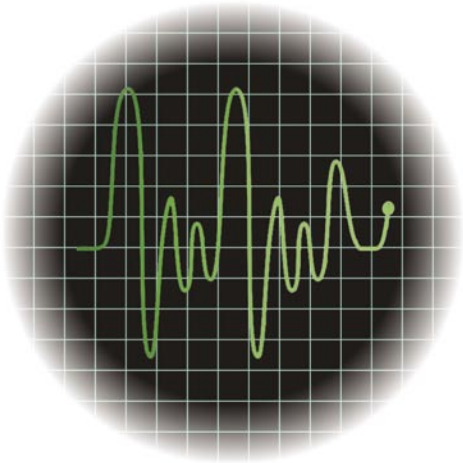
Universität Leipzig
Institut für Wirtschaftsinformatik
www.uni-leipzig.de/wifa/iwi/

Further Information

PESOA - Process Family Engineering in Service-Oriented Applications
www.pesoa.de

In many application domains, products mainly differ in the characteristics of the processes they support. Variants of technical control processes for engine control systems pose similar problems as different workflows used for travel planning in the Internet domain. Yet, depending on the domain, there are different ways to create variants. Manufacturers of embedded systems favor generic platforms specialized by process instances. Information system providers strive for service-oriented architectures in order to variably combine identical services for different workflows.

The task of the project PESOA – Process Family Engineering in Service-Oriented Applications, which was funded by the German Federal Ministry of Education and Research BMBF, was to investigate an optimal combination of these solutions. For this purpose, a product line described by process variants was prototypically analyzed and implemented in each of the two domains. Especially those processes, techniques, and tools were identified that can be used across domains for this type of product line. With DaimlerChrysler AG, Stuttgart, and ehotel AG, Berlin, industrial partners from the affected domains were directly involved in the project as experts for the product lines that were studied. The general product line support was defined and practically implemented by the partners.



A description technique for generic processes was developed in order to specify the products of a product line in the form of process descriptions. Thus, when several related systems of a system family are studied, the focus is on processes. The process descriptions can be used to capture the commonalities of and differences between the systems of the two domains under investigation. Differences are made explicit and can be resolved with the help of the development tools created in the project for the purpose of specifying a concrete system.

The modeling languages supported include the activity and state diagrams of the Unified Modeling Language UML, Matlab/Simulink models, and the Business Process Modeling Notation (BPMN). For each of these notations, those necessary variability mechanisms that can be uniformly used with the product line approach adapted to the project at hand were integrated into the respective modeling language. The necessary tool support was realized on the basis of the Open Source platform Eclipse and was validated in case studies.

The solutions developed were also integrated into the well proven methodology for product line support of Fraunhofer IESE, PuLSE®. They are now available to all industrial partners for the introduction of product line technology. Furthermore, the results are used and evolved in the context of the competence center "Virtual Office of the Future" (see report on page 102).

What do information systems and engine control systems have in common? Both systems exist in numerous variants; service-oriented product lines provide help for efficient development.

The right architecture is essential!

PESOA

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

BMBF Grant No.: 01 IS C34 E

No Chance for Software Defects with Systematic Code Inspections

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The later a defect is detected in a software project, the more expensive its removal. A long as software is still being specified, possible defects can still be eliminated relatively easily and cheaply by updating the specification. During the design phase, more effort is already required: Ideally, both the specification and the design would have to be changed. Costs for eliminating defects rise again significantly as soon as the software is going through the various test phases. Once the software has been finished in its major parts or even delivered, any change can become very expensive.

These are the reasons why Giesecke & Devrient GmbH wanted to introduce inspection techniques for the code. By systematically checking the code, defects are found easier and faster – and the costs for corrections decrease.

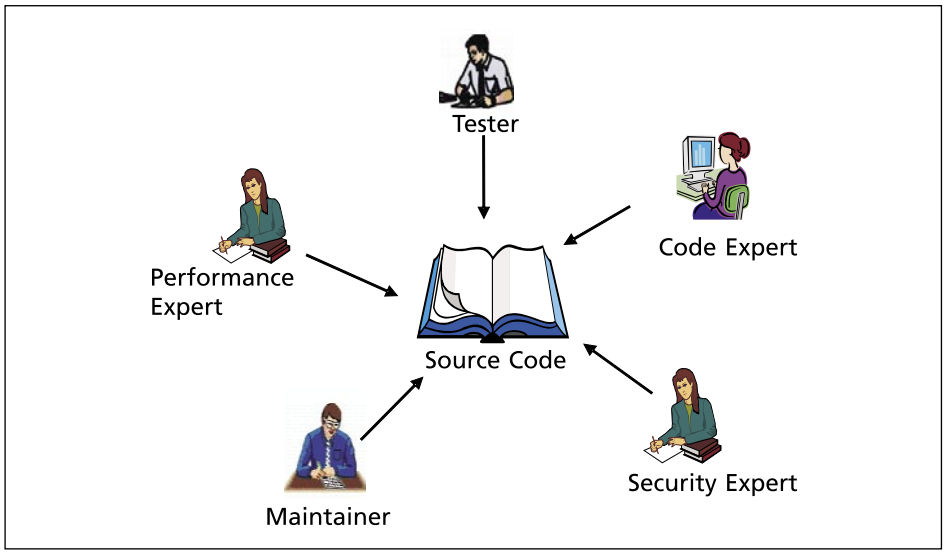
High quality and efficiency of software solutions signify high customer satisfaction. Realizing this, companies attempt to achieve high quality levels for their major processes; this also includes early quality assurance measures in development processes. Customers thus are sure to get technically innovative solutions that fulfill the highest demands on quality.

So far, inspections were performed by the company's own employees in-house according to a process. External consultants, too, did inspections and reviews, resulting in double quality assurance. The task of Fraunhofer IESE was to improve the defect detection rates by "tightening" the review criteria and the review process. Measures taken for this purpose included the development of the "tightened" criteria on the one hand, and training in the improved process on the other hand.

Fraunhofer IESE analyzed the inspection process of Giesecke & Devrient GmbH on-site using stakeholder identification and stakeholder questioning, and eliciting the quality requirements on the individual project documents. Based on the results of this analysis, focused checklists were derived containing the "tightened" review criteria. By using this procedure, our institute was able to adapt the tools used for checking exactly to the company's quality demands.

The improved review process and the focused checklists were presented and introduced in training sessions. During these events, the customer's real code documents were used as sample and working materials.

Early defect detection reduces development costs!



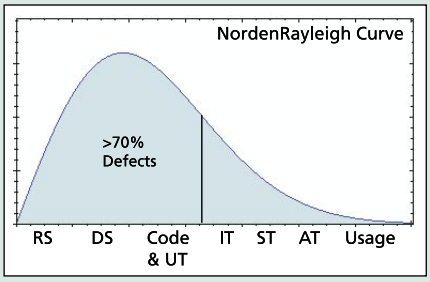
Extensive project groups distribute their tasks to different roles in modern software projects. A large degree of systematic procedure is needed for the proverbial "cooks" not to spoil the "broth".

Even in the training sessions, more defects were already found in the code documents through the use of focused checklists than had been previously found with traditional techniques, respectively with external consultants. In a continuation of the project, the application area for inspections shall be extended from code to requirements documents.

Comment by Dieter Weiss, Director of Core Development of Giesecke & Devrient GmbH: "Through the use of the Fraunhofer IESE methods, the efficiency of the code reviews was significantly improved. Our employees were able to optimally contribute their expertise in the reviews through focused checklists. Furthermore, the effort per employee was significantly lower due to this procedure. Taken together, these two things have led to a major increase of our employees' motivation during reviews."

General information on defects and early quality assurance

If no early measures are taken for quality assurance, an average of about 50 - 70% of the defects contained in a software product are normally only found late during the testing phase. Additional costs are incurred, which could have been prevented if the defects had been detected early. Costs increase even more if defects are only discovered when the software is used in practice. Sometimes, the cost factor increases up to one hundred times. It would be optimal to bring the defect detection curve into the form of the well-known NordenRayleigh Curve.



Good cards: Around the globe, cards by Giesecke & Devrient are in use – for monetary transactions, in mobile communication, and in transportation. In order to ensure that the systems associated with them, such as teller machines, work just as safely and reliably as the cards themselves, systematic software and systems engineering is a must.

Quality in Use: Measuring User Satisfaction Early and Taking It into Account in Product Development

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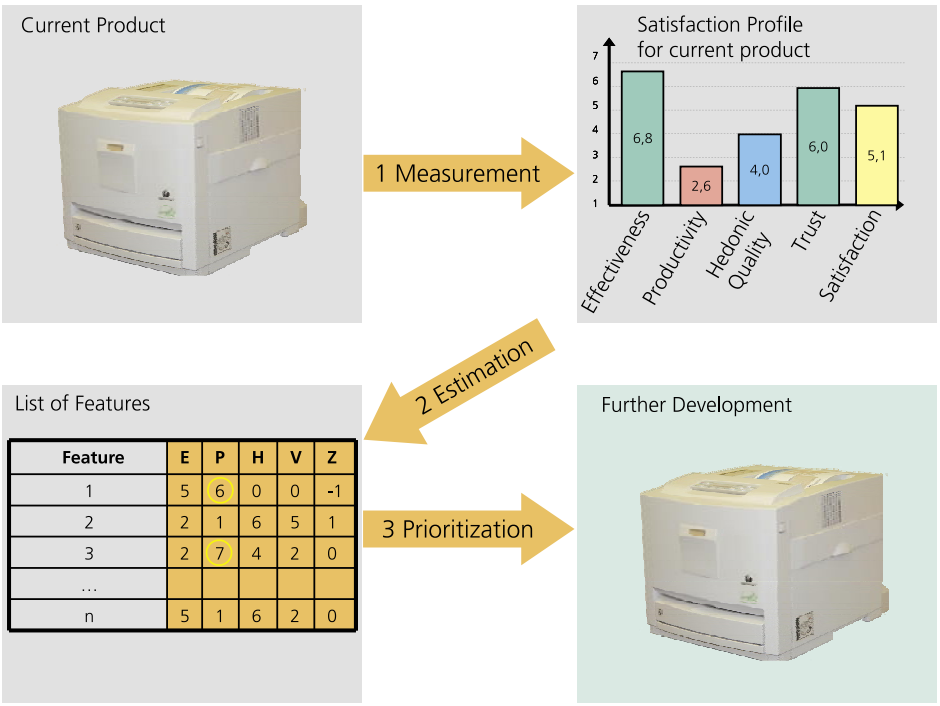
Siemens CT SE1 (Corporate Research & Technology, Software & Engineering, Development Techniques)

A product is successful if users are satisfied with it – this is equally true for hardware, software, or software-based systems. Satisfied users increase sales figures, improve the image of the manufacturer, and influence the price that can be obtained for the product. Satisfaction is influenced by different factors. Functionality, services provided by the manufacturer, or the so-called "fun factor" have a major impact on whether the buyer will like a product. Every system manufacturer faces the same problem, though: The features of a product (i.e., performance and usage features) must already be determined prior to the start of manufacturing. However, the issue of which features will ultimately lead a product to success can usually only be answered with sufficient accuracy after the product has been introduced on the market. The possible effects of the implemented features on user satisfaction and thus on the success of a product are not always analyzed systematically and traceably. In the context of the cooperation project "Quality in Use", an approach was sought to elicit the abstract value of user satisfaction, to monitor it, and to take it into account as early in the product's life cycle as possible.

In collaboration with the research department of Siemens AG in Munich and the application partner Siemens AG Corporate Research & Technology, such an approach was developed and tested under the name "AMUSE – Appraisal and Measurement of User Satisfaction". The core of AMUSE is a questionnaire used to analyze user satisfaction early in the product (version) life cycle and monitor it throughout the entire life cycle. The questionnaire is designed such that it actually elicits the satisfaction of the end user and not that of the purchaser, decision-maker, or service employee. Due to its methodological design, this questionnaire is already meaningful even if only few copies are completed and returned. With the help of the AMUSE questionnaire, the product characteristics perceived by the user for the current test object, e. g., a computer software, are measured first. In order to improve characteristics perceived as inaccessible for a new release, the product features are then assessed with regard to their contribution to the product characteristics. This is done by means of already existent documents or prototypes with the help of the AMUSE estimation and counting method. Thus, a prioritization is created, and with

its help, exactly those features can be selected that make the strongest contribution to the desired product improvement. In this way, project leaders or project managers always know exactly how the users perceive product characteristics and can

- take user satisfaction into account early on in the development process,
- select performance and usage features for new products and versions more consciously and more confidently,
- reduce unnecessary development effort for less important features, and finally,
- develop products that will really satisfy the customer.



Feature	E	P	H	V	Z
1	5	6	0	0	-1
2	2	1	6	5	1
3	2	7	4	2	0
…					
n	5	1	6	2	0

Typical use of AMUSE in the product life cycle:
Current user satisfaction with the current product is measured with the help of the questionnaire. This results in a satisfaction profile. The features matching the profile are assessed in terms of their contribution to the various product characteristics. Finally, the features for further development are selected, taking into account the satisfaction profile.

User satisfaction pays off!

International Collaborations and Projects

Research and Globalization

Fraunhofer IESE is one of the leading research institutions in the area of software engineering. To a large extent, Fraunhofer IESE owes its worldwide reputation to the international cooperation with other research institutions and project partners, which by now comprises five continents:

- North America, with our sister organization "Fraunhofer Center Maryland FC-MD", in close cooperation with the University of Maryland and many partners from the International Software Engineering Research Network (ISERN) in the U.S. and Canada
- Europe, with numerous strategic projects (e. g., with Hungary in the area of "Ambient Intelligence")
- Asia, with the focus on Japan, Korea, and India
- Australia, with our close cooperation with the National ICT Australia (NICTA)
- South America, with our partners within ISERN

In all regions of the world mentioned, projects with industrial companies and public institutions have been initiated. In the following section, some examples of our participation in international collaborations as well as in global networks will be presented.

Institutional Collaboration with the Fraunhofer Center Maryland (FC-MD)

Fraunhofer Center – Maryland (FC-MD) located in College Park, Maryland is a leading competence center for applied research and technology transfer in experimental software engineering. FC-MD supports research and development in the field of software engineering and its enabling technologies. It collaborates with private-sector companies, government agencies, and academic institutions to develop innovative, actionable approaches to address their software issues.

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

Fraunhofer FC-MD conducts research to advance the state of the art in empirically validated software engineering technologies and provides project support for organizations that develop, acquire, and base their business on software. Project customers include government agencies such as the Department of Defense and NASA and companies like Boeing, Motorola, DaimlerChrysler, ABB, Nokia, Bosch, and Fujitsu. FC-MD also supports small- and medium-sized software companies through its close cooperation with the Maryland Department of Business and Economic Development.

FC-MD also strives to advance the state of the practice in the evolving world of software development and acquisition by applying state-of-the-art research results. The following list of approaches are the fundamental principles by which FC-MD achieves its goals:

- Applying empirical methods to evaluate processes and products,
- Identifying improvement areas and proposing new changes,
- Understanding the impact of these changes on measures of success,
- Utilizing experience to guide technical and management choices,
- Tailoring solutions to meet specific customer contexts,
- Transferring proven technologies into practice.

Competencies

- Measurement and Knowledge Management
  Contact: Dr. Forrest Shull
- Software Management and Process Improvement
  Contact: Ms. Kathleen Dangle
- Software Architecture and Embedded Software
  Contact: Dr. Mikael Lindvall

Business Areas

- Department of Defense (DOD)
  Contact: Kathleen Dangle, Frank Herman
- NASA
  Contact: Frank Herman
- Small & Medium-Sized Business Process Improvement
  Contact: Kathleen Dangle
- Automotive
  Contact: Dr. Rance Cleaveland
- Medical
  Contact: Dr. Rance Cleaveland

Close cooperation:
Fraunhofer IESE collaborates with the Fraunhofer Center in Maryland

Projects in Progress

Best Practice 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 FC-MD, the Defense Acquisition University (DAU), and the Office of the Secretary of Defense (OSD).

Testbed for Experimentation

Experimenting with new software technologies is critical in understanding their costs and benefits. However, experimentation is often costly.

FC-MD has built a testbed to facilitate experimentation, as part of NASA's High Dependability Computing Program (HDCP). In addition, in collaboration with various research partners, FC-MD designed and conducted a number of experiments on this testbed. In order to minimize the cost and effort of future experimentation, the testbed itself as well as the designs of the experiments and their results are stored in an experience base.

The testbed is based on the Tactical Separation Assisted Flight Environment (TSAFE), which is a new concept for Automated Air Traffic Control. TSAFE was developed at NASA Ames Research Center, implemented at MIT, and then instrumented and packaged for experimentation by FC-MD in collaboration with the University of Maryland.

FC-MD researchers added a number of experimentation features, such as synthesized faults that can be seeded in order to characterize and evaluate defect detection technologies. A tool to create artificial test data is also available. FC-MD also produced documentation and other artifacts in order to facilitate understanding of how TSAFE works.

The testbed has been used for numerous experiments and studies on various technologies, for example design inspections, architecture evaluation, model checking, and model-based development.

In 2006, FC-MD investigated how non-embedded software components can be modeled, validated, and verified in a model-driven environment typically used by embedded system designers. Two software components of TSAFE were modeled in Simulink® and tested using Reactis®. The integration of Simulink® models and its generated source code with the software architecture and code of TSAFE was also studied.

FC-MD experiences with the TSAFE testbed show that it is a very effective tool that facilitates experimentation with technologies, for example in order to transfer them from the research laboratory to industrial use.

REPERTUS

Companies and government agencies have large and continually growing collections of electronically stored information in different formats. This information represents years of captured knowledge and experience that is invaluable to the organization. External information resources, such as search engines and public databases, increase the amount of available data. As a result, it becomes more and more difficult for employees to quickly find the right information in order to reuse it, answer a certain question based on it, or learn from it. To avoid drowning in the information flood, more sopisticated search and retrieval mechansims are needed.

In the internal research project REPERTUS, FC-MD is developing an open and flexible search and retrieval architecture as a solution to this problem. The architecure builds upon the results of our Focus-Oriented Information On Demand project and supports users in finding the right information from various sources using one common interface. The system can be combined with commercial off-the-shelf (COTS) search engines, custom search engines, local drives, network drives, databases, and experience bases, thereby offering a flexible and up-to-date solution for organizational knowledge management issues.

NASA Space Network Project

FC-MD is currently providing support to the NASA Goddard Space Flight Center for the development of the Space Network Access System (SNAS) and the Space Network IP Services (SNIS) of the NASA Space Network Project (SNP). The Space Network (SN) is a data communication system comprised of a constellation of Tracking and Data Relay Satellites (TDRSs) in geostationary orbit and a ground terminal complex employing high-gain microwave antennas. The ground stations send and receive commands and data to and from the TDRSs, which in turn receive and relay data from a multitude of Low Earth Orbit (LEO) satellites. The combination of elements comprising the SN provide global telecommunication services for telemetry, tracking, and command between LEO spacecraft and customer control and data processing facilities. SNAS provides a network-based system that allows SN customers to schedule SN support just prior to the required period and also to have support tools facilitate scheduling for long-term planning.

FC-MD's role in the SNAS development effort is in two primary areas:

1.) Provide expertise to SNP by supporting the management of selected systems engineering and software development effort(s) in accordance with SNP policies and establish processes necessary to estimate and track cost and schedule, and evaluate software development progress. FC-MD also serves as the primary point of contact with the acquiring organizations and the development contractors.

2.) Develop the SNP Software Management Experience Base (SMEB) by maintaining and updating the size, effort, and schedule estimation process developed by FC-MD for SNP to include additional SNP systems under development and maintenance as well as historical data from other relevant sources. The major activities performed by FC-MD in this area are the function point analysis of relevant SNP systems under development and maintenance, the refinement of the current SMEB for estimating the effort and cost for software systems under development, and the definition of a process for estimating the effort and cost for systems under maintenance.

NASA Metrics Program

FC-MD staff continued to play a significant role in advancing a high-profile metrics program for NASA Headquarters. The FC-MD metrics team created indicator models for the proposed set of metrics to be collected across the Agency. In support of the metrics program and the process improvement initiative, FC-MD delivered two key training courses: Managing Software Projects with Metrics and Formal Inspections. The FC-MD staff also performed and presented the annual Software Inventory Analysis on behalf of Headquarters Software Working Group. FC-MD continues to be a significant player in deploying the Metrics Program at NASA Headquarters as well as within individual Centers.

Small Business Process Improvement

FC-MD helps organizations to achieve their software process improvement goals through baseline assessments, process modeling, action planning, consulting, and auditing services. Staff expertise in risk management and lessons learned for process improvement in small organizations and non-traditional software environments plays a significant role in the delivery of these services. Staff are certified by the Software Engineering Institute in performing Software Capability Evaluations and are experienced in assisting organizations to achieve compliance with the Capability Maturity Model® (CMM) and Capability Maturity Model-Integration® (CMMI).

As a not-for-profit technology transfer organization affiliated with the University of Maryland, FC-MD deliberately and actively reaches out to practitioners with the intent of identifying and propagating better ways to build systems and software. In addition to the experience sharing conveyed in day-to-day project work for specific customers, FC-MD uses a variety of forums to broaden its reach in the community and communicate state-of-the-art and state-of-the-practice techniques and methods. In addition to conference presentations, workshops, and journal articles, in 2006 FC-MD launched a public training program initiative to help practitioners learn about specific topics and interact on a course-by-course basis. FC-MD's initial offerings include:

- Introduction to the CMMI® (Staged and Continuous)
- Managing Enterprise Experience Successfully
- Revitalizing Software Inspections: A Practical Quality-Driven Approach

In addition to these stand-alone courses, in 2006 FC-MD developed a long-term process improvement program aimed at helping organizations implement changes and improve performance through the implementation of practices defined in the Software Engineering Institute's Capability Maturity Model Integration (CMMI) Levels 2, 3, and more. This comprehensive training and implementation program, the Process Improvement Program for Organizational Change, will be launched in 2007 and sets forth an integrated, structured set of activities that demonstrate how participating organizations can better their processes and products through business-driven improvement initiatives. This program is set up as a consortium that provides a software engineering resource for participating organizations in advancing the practices of system and software engineering and improving the quality of their software-related products and services. The program integrates research and experience into practical improvement, creates opportunities to develop and disseminate improvement practices, enhances the competitiveness of member companies, accelerates new software technology adaptation, leverages member company experience, and promotes inter-corporate cooperation of member organizations in addition to providing training and education.

® CMMII and Capability Maturity Model (CMM) are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

GQM+Strategies®

GQM+Strategies® is a new measurement approach under development by software measurement experts at FC-MD and Fraunhofer 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 in widespread use today for creating and establishing 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 GQM+Strategies® 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.

FC-MD and Fraunhofer 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.

Fraunhofer IESE and FC-MD are also devloping 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

FC-MD and Fraunhofer 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

Technology Infusion of Software Architecture/Code Consistency Evaluation Tools and Methodologies

Under a technology infusion grant from the NASA Goddard Space Flight Center, FC-MD collaborated with the Johns Hopkins University (JHU) Applied Physics Laboratory (APL) to apply the Fraunhofer-developed Software Architecture Visualization and Evaluation (SAVE) tool and process to the JHU/APL Common Ground software for satellite control.

The JHU/APL Space Department develops Missions Operations Center (MOC) system software for all JHU/APL-supported NASA missions using a shared architecture called Common Ground. The architecture is 10 years old and difficult to maintain and evolve for current and future missions. Thus, there is a need to preserve the architectural goals in order to avoid further maintenance and evolution problems. To address this need, NASA established a Technology Infusion project with the goal of creating a framework that allows JHU/APL to align the actual architecture of Common Ground with its planned architecture.

The technology infusion goal was achieved by applying the SAVE tool and process to the Common Ground software. The process comprised defining a planned architecture including architectural goals and design rationale, generating a high-level description of the actual architecture from the legacy software, identifying deviations between the planned and actual architecture, creating a new target architecture, and creating a roadmap to align ongoing system development and maintenance with the new target architecture.

The project was highly successful and was well received by both JHU/APL and NASA. A report, which is available and will be presented at the 2007 IEEE Aerospace conference in Big Sky, Montana, summarizes JHU/APL's experiences in using the SAVE tool and process to capture the originally planned architecture, compare the actual Common Ground software to the plan, create a new target architecture, and guide ongoing development to bring the planned and actual architectures into alignment.

Flexible High Quality Design for Software

Responding to late software changes is one of the key areas of risk in software development, but it is often unavoidable. Thus, responding to late software changes becomes a problem that has to be dealt with during software design, making sure the software design is flexible enough to support future changes as the need arises. That such flexibility is too often not achieved can be seen in the fact that major studies of today's software-intensive systems consistently find surprisingly large numbers of failed, late, or excessively expensive systems. Late changes contribute to these failed systems both directly (developers simply cannot produce a system of sufficient quality that meets the requirements by the delivery date) and indirectly (the requirements can be met but only at the cost of degrading the software to the point where future evolution becomes unworkable).

To improve this situation, FC-MD is collaborating with the University of Maryland and Mississippi State University, on NSF-funded basic research that explores the relationship between software design and the ease or difficulty of supporting changes to the software. Some of the issues investigated by this research include the influence design has on the relative difficulty of different types of changes or enhancements to software functionality, the ways in which making various types of changes affect the design and can increase or decrease types of risks for future changes, and the costs and effects of various practices that attempt to evaluate or improve design flexibility. All of the above are basic phenomena which are not yet well understood but are essential parts of a "science of design" in which the relationship between design process and the quality of the resulting product (i.e., the finished software) is clear.

In the first two years of this grant, the project investigated these issues using a mixture of experimentation "in the laboratory," that is, using small-scale controlled design artifacts to test and refine theories, as well as studies of designs on real, large-scale projects, to understand how these theories were likely to scale up and to get a baseline understanding of state-of-the-art design practices. For example, one effort led by FC-MD developed tools capable of analyzing hundreds of changes over multiple years from a large-scale software system. The tools analyze each change and its impact on the software design, then input that data to a visualization tool that presents to the user an easy-to-understand representation summarizing the experiences found with different types of changes on the system over time. Using this tool, the user can manipulate the view, zoom in or out for more detail, and generally

explore the data looking for patterns in the project's past history that would allow him or her to learn lessons relevant to future work.

Future phases of our work are focused on using the lessons learned so farfrom the analyses and studies to develop tools that can provide decision support to developers in the field as they contemplate future changes to their software. The focus here is on data-driven decision making, that is, providing a rigorous basis for future decisions based on what has already been learned about a given software design throughout its history. The ultimate aim is to use measurement to quantify past experiences, to abstract useful lessons learned from experiences over time, and to use visualization to help developers to understand the impact of changes on the future evolution of the system.

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, FC-MD is conducting a pilot study 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:

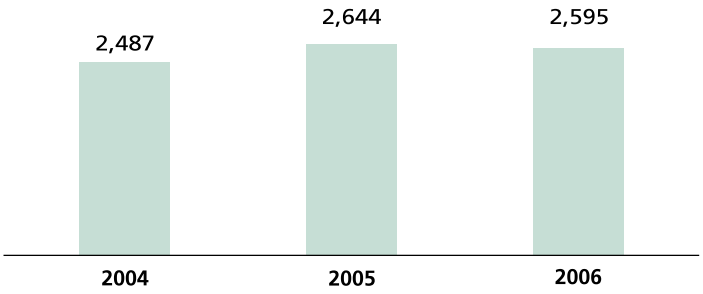
- Formalization of requirements as executable "monitors"
- Instrumentation of controllers with these monitors
- Automated test generation based on predefined model-coverage criteria in order to search for possible requirements violations.

The technical work in the project will involve 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.

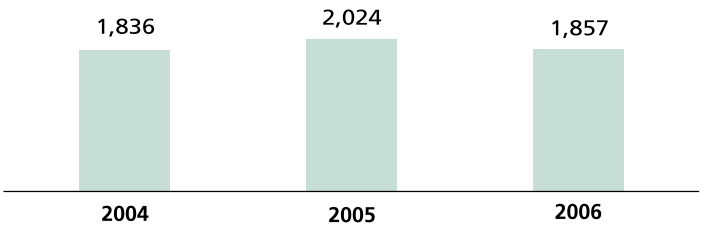
An initial investigation will also be carried out to determine whether the tools and techniques being used at FC-MD can be combined with approaches in checking non-functional quality requirements being explored by Bosch, especially the Bosch Rapid Architecture Prototyping Tool (RAPT) for software architecture design.

FC-MD in Figures

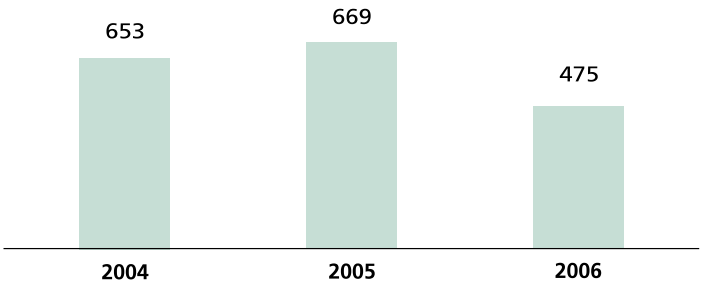
Due to extremely high competition for National Science Foundation (NSF) grants and FC-MD's diversification efforts into new competence areas, FC-MD experienced a slight decrease in revenues in 2006 from the previous year. FC-MD invested approximately 25% of its retained earnings into new initiatives, specifically training offerings and GQM+Strategies®, that will position it for more substantial growth in 2007 and beyond. Third party revenue in 2006 accounts for 72% of the total revenue.



Total revenue (in T US dollars)



Third party revenue (in T US dollars)



Retained earnings (in T US dollars)

University Partners

- University of Maryland, Experimental Software Engineering Group
- University of Maryland, Center for Reliability Engineering
- University of Maryland 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.
- CeBASE – Center for Empirically Based Software Engineering
- DAU – Defense Acquisition University
- Northrop Grumman
- BAE SYSTEMS
- Johns Hopkins University Applied Physics Laboratory

Multinational European Union Collaborations

Since the founding of Fraunhofer IESE in 1996, cooperation projects that are funded by the European Union have created not only international visibility, but also extensive synergy effects by establishing research networks on a European level. These projects with considerably varying amounts of funding primarily serve to market new products and methods and also support the research community with numerous publications at meetings and conferences, in professional journals and books. Scientific research in the context of European consortia increases competitiveness and improves the market opportunities of industry in Europe through up-to-date and demand-oriented research results. At the same time, existing resources can be optimally used in research activities that are coordinated on the European level, and the unavoidable risks for the individual consortium partners can be kept to a manageable level.

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ReDSeeDS: Requirements-Driven Software Development System

Project Topic: Create an open framework consisting of a scenario-driven development method, a repository for reuse of software cases described by requirements, and tool support throughout.

Keywords: Requirements, meta-model, model transformation, systematic reuse

Cooperation Partners: Infovide S.A. IV (Poland), Warsaw University of Technology (Poland), Hamburger Informatik Technologie Center e.V. (Germany), University of Koblenz-Landau (Germany), Institute of Mathematics and Computer Science, University of Latvia (Latvia), Vienna University of Technology (Austria), Algoritmu sistemos, UAB (Lithuania), C/S Enformasyon Teknolojileri Limited Sirketi (Cybersoft) (Turkey), PRO DV Software AG (Germany), Heriot-Watt University (UK)

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Grant Number: FP6-IST-33596

Software development industry, while being the key driver of modern economy has an unacceptably high level of failures, caused to large extent by high complexity (interdependencies and variability) of requirements. Software development industry has significant problems with managing this complexity – with keeping track of changes and reusing knowledge from previous projects. The main barrier in overcoming these problems is lack of widely accepted and easy to apply mechanisms for expressing and reusing coherent solutions to problems formulated as user requirements.

The main objective of the project is thus to create an open framework consisting of a scenario-driven development method (precise specification language and process for the "how-to"), a repository for reuse and tool support throughout. The basic reuse approach will be case-based, where a reusable case is a complete set of closely linked (through mappings or transformations) software development technical artefacts (models and code), leading from the initial user's needs to the resulting executable application.

A new problem description in the form of a requirements model can be matched with previous requirements models. The solution information (models and code) of the most similar problem can then be taken for reuse and adapted to even only partially developed requirements. Unlike for other approaches, the effort associated with preparing reusable solutions with this framework is kept to the minimum.

To develop the ReDSeeDS framework, the project will combine and enhance state of the art in the areas of requirements engineering, meta-modelling, model transformation and querying and inference techniques. This combination, while innovative by itself, will enable a completely new approach to software development based on this form of case-based reuse. Such approach should be an enabling factor for starting a true reuse-oriented software development community, based on openly available case query engines and solutions validated in practice.

International Projects Funded by the European Union

Upskilling to UML

Project Topic: Development of online and offline material for UML training and new concepts for work-based training in close cooperation between content and educational experts and practitioners in industry. "Upskilling to UML" is co-funded by the European Vocational Training programme „LEONARDO DA VINCI", priority: developing relevant and innovative e-learning content.

Results/Goals: Online and offline training material for UML in several European languages; new training concepts (work-based learning).

Keywords: UML, vocational training, SME

Cooperation Partners: National College of Ireland (Dublin, Ireland), Institut National Polytechnique (Toulouse, France), New Bulgarian University (Sofia, Bulgaria), Softwin SRL (Bucharest, Romania).

Contact: Sonja Trapp; sonja.trapp@iese.fraunhofer.de

Grant Number: PP 146 369

The software industry is increasingly turning to object-oriented and component-based software development approaches that provide benefits such as improved reuse, short development cycles, and a larger return on software development effort. However, in order to really benefit from object technology, it has to be applied correctly. Therefore, developers do not only have to "think in objects" but also have to be well educated in the relevant technologies. The Unified Modeling Language in its latest version is to become a standard for the whole software domain. The need for upskilling UML applies to the software business as a whole, and to SMEs in Europe in particular, as they are facing the threat of IT services being offshored in order to save costs.

However, "traditional" education is not only cost intensive, but also time consuming. Especially small and medium-sized enterprises with tight development schedules and short release rates will appreciate innovative training concepts that allow on-the-job qualification through work-based learning and training.

Further Information:

www.up2uml.org

Adaptive Service Grids (ASG)

Project Topic: Development of an open platform for the adaptive identification, development, combination, and execution of software-based services

Results/Goals: Adaptive Services Grids (ASG) is a European research project funded in the context of the Sixth Framework Programme of the European Union. The aim of ASG is the development of an open platform for software-based services. The underlying idea is to make services available in a transparent manner, analogous to making electricity available in power networks. Users of the ASG platform describe the services they desire by means of semantic descriptions. The corresponding services are then made available to them by the platform finding existing services, respectively combining existing ones into more complex ones, or by generating new services from the semantic description. Service providers can use the open ASG platform to disseminate their services.

Fraunhofer IESE supports the ASG consortium with its competence in the area of method development: Fraunhofer IESE coordinates the development of the ASG platform on the one hand, and on the other hand, an ASG application development method is being created on the basis of the methods PuLSE® and KobrA, which were developed at Fraunhofer IESE. With the help of this development method, service providers can develop applications for the ASG platform.

Keywords: Grid Computing; service-oriented applications

Cooperation Partners: Hasso Plattner Institute (HPI) at the University of Potsdam (Germany); University of Leipzig (Germany); University of Innsbruck (Austria), DaimlerChrysler Research (Germany); National University of Ireland (Ireland); TranSIT GmbH (Germany); NIWA (Austria), Telenor (Norway); Siemens AG (Germany); Rodan Systems (Poland); University of Jyväskylä (Finland); Telekomunikacja Polska (Poland); Marketplanet (Poland); University of Koblenz-Landau (Germany); ASTEC Group (Poland); Poznan University of Economics (Poland); University of Applied Sciences Furtwangen (Germany); Polska Telefonia Cyfrowa (Poland); University of Potsdam (Germany).

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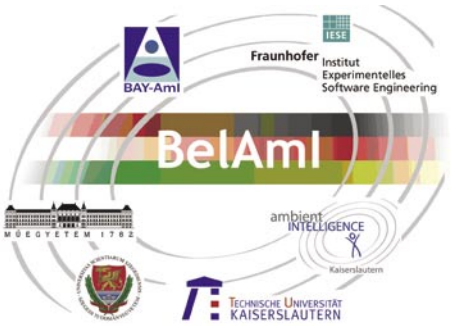
Grant number: FP6-IST-004617

Fraunhofer IESE in Worldwide Projects

Omnipresent microprocessors:
With Ambient Intelligence, the number of computer systems that are almost invisibly integrated into our daily lives will increase even more.



Top research thrives on international cooperation and competition – preferably in worldwide research projects. Fraunhofer IESE has been pursuing this strategy for many years, with great success in numerous countries worldwide. The following pages present some of our more extensive international collaborations.

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Cooperation with Hungary in the Area of "Ambient Intelligence"

Project Topic: Technologies for improving energy efficiency, communications systems suitable for AmI, development methods for adaptive systems with strict requirements on service quality, safety and security engineering, architectures & platforms for AmI systems as well as innovative human-machine interfaces

Keywords: strategic networks, ambient intelligence, ubiquitous computing, pervasive computing

Cooperation Partners: Inter-University Centre for Telecommunications and Informatics ETIK, Budapest (Hungary); Technical University of Kaiserslautern (Germany)

Contact:
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Professor Nehmer and Professor Rombach (Department of Computer Science) visited the Technical University of Budapest with the objective of increasingly expanding research collaborations towards Eastern Europe. Due to existing research foci on both sides, a joint topic for cooperation was quickly found: Ambient Intelligence. Due to the wide range of competencies on both sides, technologies for improving energy efficiency, communications systems suitable for AmI, development methods for adaptive systems with strict requirements on service quality, safety and security engineering, architectures & platforms for AmI systems as well as innovative human-machine interfaces were selected as the scientific model projects.

Due to its attractiveness, the resulting project proposal was selected by the Office of the German Chancellor as a pilot project for future-oriented research collaboration with Hungary. The BelAmI pilot project – under the leadership of the Fraunhofer Institute for Experimental Software Engineering (IESE) in Germany and the Inter-University Centre for Telecommunications and Informatics (ETIK) in Hungary – was presented to the public in Budapest by the Office of the Chancellor, on the occasion of the 15th anniversary of the day that East German citizens were granted permission to leave the country via the German embassy. In the context of a visit to Hungary by German Chancellor Gerhard Schröder, German Federal Research Minister Edelgard Bulmahn and the Hungarian Minister of Education Magyar Bálint signed a joint agreement in Budapest on 15 September 2004 to further develop and intensify their collaboration in scientific research and technological development.

The investments for the pilot project in the amount of six million euros will be born in equal parts by the two countries. On the German side, the funds are provided by the German Federal Ministry of Education and Research (BMBF), the state of Rhineland-Palatinate as well as the Fraunhofer-Gesellschaft. The pilot project will be funded for a duration of four years.

In Kaiserslautern, the work of the German-Hungarian research team is integrated into the research focus "Ambient Intelligence" of the University of Kaiserslautern. In October 2004, the first of a series of four workshops to date on joint scientific model topics and projects already took place in Budapest. Research is concentrated on concrete application scenarios in the areas of Assisted Living, Assisted Working, Assisted Training, Assisted Driving, and Assisted Transportation, according to which the project results are demonstrated in practice.

Collaborations with Japan

The close scientific relationships between Fraunhofer IESE and top Japanese universities in Osaka and Nara, which have existed for many years, and recently also our relationship with the Japanese Ministry of Economy, Trade and Industry METI on the issue of software engineering, have already led to intensive collaborations in the past, such as contract research with companies like Ricoh Co., Ltd. and Fujitsu.

After Fraunhofer IESE signed a collaboration agreement with the Japanese Ministry of Economy, Trade and Industry (METI) in November 2004, more industrial collaborations on various software engineering topics are now getting established.

This intensified cooperation with Japanese research institutes and companies – complemented by the exchange of scientists and students – will strengthen the international reputation of Fraunhofer IESE as a leading software engineering competence center even more. For more than 10 years, there has existed close scientific cooperation with the Nara Institute of Science and Technology NAIST in Nara. Fraunhofer IESE is involved as a partner in the EASE project of the Japanese Ministry of Education (MEXT) under the leadership of Prof. Koji Torii.

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The Virtual Office of the Future

Project Topic: Development of future software-based products and services for the virtual office

Keywords: strategic alliances, ambient intelligence, ubiquitous computing, pervasive computing, intelligent office applications, reference architectures

Cooperation partners: Ricoh Co., Ltd. (Japan); German Research Center for Artificial Intelligence (DFKI); and others

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During the past few years, scenarios were developed in many application domains that benefit from the idea of "ambience". One of these is the "Virtual Office of the Future", in which diverse pieces of end user equipment interact on their own – either because certain persons are identified, messages are received from other equipment, or based on the status of higher-level business workflows. According to current prognoses, the market for such "intelligent" office applications, which also include eGovernment applications, will experience strong mid-term growth.

In the competence center "Virtual Office of the Future", which is funded by the state of Rhineland-Palatinate, Fraunhofer IESE is establishing fundamental research competencies for demonstrating the visions of a Virtual Office, and is developing future software-based products and services for this domain in cooperation with industrial partners.

In the context of this project, comprehensive competence is being built up in the area of flexible software architectures, which will be a decisive factor for the efficient technical realization of office environments. Beyond that, research is necessary regarding (semi-) automated support of the workflows and processes in an organization. It takes these to provide office end equipment with the context information needed to support the user in a proactive and "intelligent" manner.

In light of these prospects, the work of the research partners and the collaborating industrial companies from the office application systems domain focused on requirements, reference architectures, and quality assurance. Work concentrated on system- and software engineering aspects dealing with the development and adaptation of IT-based office services and their support through flexibly adaptable office end equipment.

After an analysis of the application domain and after identification of the services, functionalities, and properties of office infrastructure and end equipment that are typical today, the requirements on future infrastructures were exemplarily juxtaposed to these results. This enabled precise identification of the central new aspects of the approach for the competence center "Virtual Office of the Future". The crucial difference to previous applications – in addition to efficient and maximal adaptability of all system components and office equipment – is that the office infrastructure is informed about the current workflows and thus offers context-sensitive services that can be reasonably combined with parallel or subsequent workflows. For example, a telephone "thinks" by interpreting the meaning of its speed dial buttons depending on the appointment schedules that have been installed. Depending on whether a colleague is in the office, at home, or on the road, the telephone will dial the appropriate number.

The reference architecture designed in the subsequent step should fulfill the requirements of future office infrastructures and office systems, while allowing as much flexibility as necessary in order to be efficiently adaptable to the individual needs of different office organizations. This resulted in a generic solution for realizing a product line for office environments.

The resultant reference architecture is also an initial fixed point for all companies that want to develop, install, and operate future office infrastructures in cooperation with the competence center. It defines a framework for the different roles, such as office organizations (i.e., end customers), smaller and large suppliers (i.e., partners who provide individual system components), system integrators as well as maintenance companies or other service providers.

For the reference architecture, suitable quality assuring measures were identified and assessed with regard to their usability and usefulness in the area of office applications. Taken together, these result in a generic quality strategy, which is an inherent part of the reference architecture. In order to do justice to the highly flexible reference architecture, static and dynamic quality assurance techniques were developed, which can be used in various contexts.

Strategic Cooperation with the Japan Aerospace Exploration Agency JAXA

Project Topic: Analysis and optimization of highly efficient development processes for software-intensive aerospace systems

Keywords: strategic alliances, international competence networks, aerospace

Cooperation Partner: Japan Aerospace Exploration Agency JAXA, Tokyo (Japan)

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In the context of this cooperation, Fraunhofer IESE and the Japan Aerospace Exploration Agency JAXA analyze software development procedures and processes at JAXA and determine their improvement potential. Fraunhofer IESE supports JAXA in organizing internal process assessments and designing an improvement program for the development of safety-critical aerospace applications. This includes the development of a measurement system for the development of highly reliable software and for optimizing system integration processes. Cooperation is further intensified through training sessions and workshops. In this context, Fraunhofer IESE can make valuable experiences regarding the use of established methods in a sensitive and critical context. The know-how created together with the Japanese development experts will also benefit other Fraunhofer IESE projects in the context of the European aerospace domain.

Information-technology Promotion Agency (IPA) / Software Engineering Center (SEC) in Japan

Project Topic: Support of the Japanese Software Engineering Center (SEC)

Keywords: strategic alliances, international competence networks

Cooperation Partners: Japanese Ministry of Economy, Trade and Industry METI, Tokyo (Japan), Universities of Osaka and Nara (Japan)

Contact: Prof. Dieter Rombach;
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A long-term collaboration agreement exists between the Japanese Ministry of Economy, Trade and Industry (METI) and the Fraunhofer Institute for Experimental Software Engineering (IESE). The topic of the cooperation is support for the Japanese Software Engineering Center (SEC). The SEC is intended as a Japanese research and technology transfer platform for the promotion of industrial software engineering.

In the context of this cooperation, Fraunhofer IESE together with Japanese universities and companies will perform research into software development methods and further develop these; it will also support technology transfer into Japanese companies. From the perspective of Fraunhofer IESE, the agreement with the Japanese ministry of trade serves the goal of further strengthening our own competencies in the exchange with the best scientists in Japan and establishing more industrial collaborations with Japanese companies. First projects were performed on the topics of "Project Effort Estimation" and "Quantitative Project Management". The methods and tools OSR (Optimised Set Reduction) and CoBRA (Cost Estimation, Benchmarking, and Risk Assessment) on measurement-based development of effort estimation models, which were developed by Fraunhofer IESE, were used here. Currently, the analysis and adaptation of process assessment procedures for the use in Japanese companies is in progress.

Various pilot projects with Japanese service providers such as OKI Electric Industry Co., Ltd. have already been performed; additional industrial collaboration projects, e. g., with Toyota Motor Corporation, are under preparation.

Collaborations with Korea

1st German-Korea Product Line Workshop on Software Product Lines

Background

As one of the collaboration programs of German-Korean research partnership, which is supported by the German Ministry of Education and Research (BMBF), the 1st Workshop on Software Prod-uct Lines was held at Sogang University in Seoul, Korea. The workshop was hosted by two re-search institutes at Sogang University: the Research Institute for Applied Science and Technology and the Research Institute of Information and Technology. Fraunhofer IESE organized the work-shop in conjunction with Pohang University of Science and Technology (POSTECH).

Workshop program

The workshop program included seven presentations: four by Korean and three by German participants. The presentations covered various aspects of product line engineering from recent research issues and technologies to industrial practices in each country. The first talk by Dirk Muthig (Fraunhofer IESE) introduced the general aspects of Fraunhofer-Gesellschaft, the PuLSE method, which highlighted the core competence of product line engineering of Fraunhofer IESE, and industrial case studies. The second talk by Prof. Sooyong Park (Sogang University) presented the survey results of the product line activities in Korea. His talk included the status of product line related projects funded by industry and the Korean government, and research activities in academia. Also, he introduced some cultural perspectives of Korean industry in terms of individualism, uncertainty avoidance, and long-term orientation. The remaining five talks focused on technical issues in product line engineering such as service-oriented paradigm, aspect-oriented product line asset development, CASE tool support, and business process modeling.

Participants

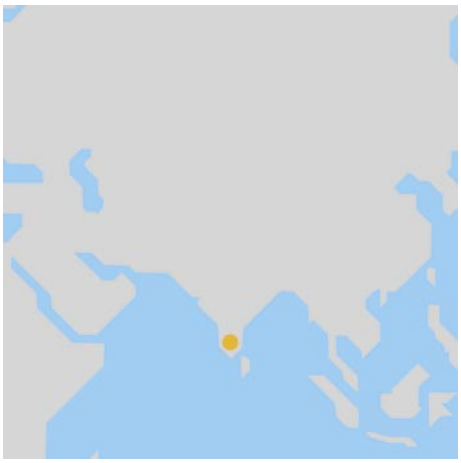
The total number of workshop participants was thirty four, from various organizations: eighteen from academia, eleven from industry, and five from research institutes. (Three participants were from Fraunhofer IESE and belonged to the research institute category.) The participating indus-trial organizations included major Korean companies such as Samsung Electronics, Samsung SDS, LG Electronics, and LG CNS. They all showed great interest in product line engineering, with several of them expressing particular interest in the Fraunhofer PuLSE™ method and further collaboration with Fraunhofer IESE.

Achievements and Outlook

Major challenges to establishing international collaboration are finding the right persons to contact and establishing a human network. From this perspective, the workshop was a great success. Through this event, participants from both countries could get to know the key players in product line engineering from each country as well as their key competencies. The fact that two potential collaboration projects are currently under consideration is evidence of this success.

There was a strong consensus on the necessity of continuing this workshop with a broader agenda and more participating organizations, as the demand for product line engineering practitioners in Korea is growing rapidly, not only in software-oriented industries but also in manufacturing industries such as automobiles, steel products, and cellular phones. As the first fulfillment of such a commitment, the organizing committee decided to plan the 2nd workshop in Korea or in Japan with enhanced programs that may attract even more industrial participants.

Contact: Dr. Dirk Muthig
dirk.muthig@iese.fraunhofer.de



Collaborations with India

The still young IT industry on the Indian subcontinent has achieved very high maturity since it came into being. Many software companies are categorized as CMMI Level 5, which includes, in particular, quantitative, i.e., measurable tracking of all process steps. In India, companies can choose from a large reservoir of highly motivated and well trained professionals, who develop software at an interesting cost-/performance ratio. One of the outstanding characteristics of the emerging software industry in India is its constant ambition to maintain its own high standards and elevate these even more with the help of modern software engineering processes. Fraunhofer IESE currently provides support for CMMI Level 5-certified Siemens Information System Ltd. SISL in Bangalore to further optimize its development processes, which are all characterized quantitatively.

Contact: Prof. Peter Liggesmeyer
peter.liggesmeyer@iese.fraunhofer.de

COMPAS: What comes after capability level 5?

(**C**ooperation **o**n **M**easurement-based quantified **P**rocesses for **A**ctivities in **S**oftware Engineering)

Project Topic: Identification of quantitative relationships between software processes and products

Keywords: data-based project management, business intelligence for software organizations

Cooperation Partner: Siemens Information System Ltd. (SISL), Bangalore (India)

Contact: Prof. Peter Liggesmeyer
peter.liggesmeyer@iese.fraunhofer.de; Michael Ochs
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One characteristic feature of mature software development processes is the enrichment of the process steps, which are initially merely defined qualitatively, with quantitative data (metrics) and, eventually, the control and optimization of the development process on the basis of measurements.

Siemens Information System Ltd. (SISL) in Bangalore has achieved CMMI Level 5, the highest level of capability. The prerequisites for an effective measurement system have been fulfilled; quantitative tracking of all process steps is well established throughout the entire organization. Measurement data are not only being elicited continuously during development, but are also used to influence the process in the sense of a feedback loop.

Nevertheless, even such mature processes offer the potential for optimization that is interesting in both a technical and an economic sense – in the sense of efficiency and effectiveness. The wish of the cooperation partner to optimize the measurement program on their own based on the measurement data elicited and to make accurate predictions regarding properties that cannot be measured directly by using existing data is the basis of the collaboration project with Fraunhofer IESE.

In the context of the cooperation with Siemens Information System Ltd. (SISL), the task is to produce suitable prediction models for the quantitative control of operative projects by combining empirical measurement processes and analyzing the resulting data. How will the effort for the employees change if the development process is performed differently than before in certain areas? Which defect rate will result after release? How will costs and quality change if more or less project management is used?

Whereas in the past, these issues were rather the subject of speculations and purely qualitative estimations, the objective of COMPAS is to find quantitative answers and corroborate them with traceable, measured facts. The transfer of the appropriate competence in these methods through Fraunhofer IESE enables Siemens Information System Ltd. (SISL) to draw conclusions from existing measurement processes and data in order to optimize both their own measurement programs and those products and development processes that clearly go beyond the definition of CMMI Level 5.

Other Collaborations

In addition to the collaborations mentioned above, Fraunhofer IESE has contacts to other research and industry partners in various software engineering contexts. To provide a complete list of all collaboration projects would go beyond the scope of this report; however, upon demand, we will be glad to inform you about our worldwide activities. Below you will find a sample list of running or recently concluded projects in Europe.

Software Inspections Guarantee Quality in Bioinformatics

Project Topic: Definition of customer- and application-specific inspection processes

Keywords: life sciences, software inspections, process engineering

Cooperation partner: LION bioscience Ltd., Cambridge (Great Britain)

Contact: Ralf Kalmar; ralf.kalmar@iese.fraunhofer.de

International Exchange of Experience via the Software Experience Center (SEC)

Project Topic: International exchange of experience while protecting corporate interests

Keywords: international competence networks

Cooperation partners: ABB Asea Brown Boveri Ltd. (Switzerland); The Boeing Company (USA); DaimlerChrysler Corporation (Germany / USA); Motorola, Inc. (USA); and Nokia (Finland).

Contact: Dr. Dirk Muthig; dirk.muthig@iese.fraunhofer.de

Fraunhofer IESE in International Networks

Fraunhofer IESE is active in various international research networks. There is a real need for these networks, since usable statements on software engineering methods, especially under different conditions, can only be obtained and then consolidated if they have been applied and observed multiple times. Another objective of worldwide networks is to promote an intensive exchange of experience in the area of software engineering, including, in particular, such an exchange between research and application. The most important software engineering network that is committed to the experimental paradigm is the International Software Engineering Research Network (ISERN). ISERN is under the main direction of Fraunhofer IESE. Furthermore, Fraunhofer IESE is engaged in NICTA (National ICT Australia), JSEC (Japanese Software Engineering Competence Center), in the EASE project (Empirical Approach to Software Engineering) in Japan, in LERO (The Irish Software Engineering Research Centre) in Ireland, and in additional collaborations with SEI in the USA, as well as with partners in Korea and China. Within these collaborations, there is a lively exchange of scientists and students. Within the ISERN network, in particular, Fraunhofer IESE is engaged in an intensive mutual exchange of experience with the following partners: Dr. Frank Houdek (DaimlerChrysler, Germany), Prof. Dr. Marvin Zelkowitz (University of Maryland / Fraunhofer Center Maryland, USA), Prof. Dr. Jyrki Kontio (Helsinki University of Technology, Finland), Prof. Dr. Koji Torii (NAIST, Japan), Mr. Masafumi Katahira (JAXA, Japan), Prof. Dr. Natalia Juristo (Politechnico Madrid, Spain), Prof. Dr. Victor Basili (University of Maryland, USA), Prof. Dr. Ross Jeffery (University of New South Wales, Australia), Prof. Philip Johnson (University of Hawaii, USA), Prof. Dr. Guenther Ruhe (University of Calgary, Canada), Prof. Dr. Dag Sjøberg (University of Oslo, Norway), Prof. Reidar Conradi (NTNU, Norway), Prof. Dr. Markku Oivo (University of Oulu, Finland), Prof. Dr. Barry Boehm (University of Southern California, USA). A list of all ISERN partners completes this overview.

ISERN
International Software Engineering Research Network
Quality Improvement

International Software Engineering Network (ISERN)

Project Topic: Exchange of experience and personnel between internationally operating software engineering research groups

Keywords: international competence networks

Collaboration Partners:

- Blekinge Institute of Technology (BTH)
  http://www.bth.se/eng/
  Sweden
- Computer Science and Systems Engineering Program COPPE, Federal University of Rio de Janeiro
  http://www.cos.ufrj.br/english/
  Brazil
- DaimlerChrysler Research Center
  http://www.daimlerchrysler.com
  Germany
- Fraunhofer Center Maryland
  http://fc-md.umd.edu/
  USA
- Fraunhofer Institute for Experimental Software Engineering
  http://www.iese.fraunhofer.de/
- Helsinki University of Technology
  http://www.hut.fi/English/
  Finland
- Japan Manned Space Systems Corporation (JAMSS)
  http://www.jaxa.jp/index_e.html
  Japan
- Japan Aerospace Exploration Agency (JAXA)
  http://www.jaxa.jp/index_e.html
  Japan
- Lucent Technologies – Bell Laboratories
  http://www.lucent.com/
  USA
- Lund University
  http://www.tts.lth.se/
  Sweden
- Microsoft Research
  http://research.microsoft.com
  USA
- Mississippi State University
  http://cse.msstate.edu
  USA
- Nara Institute of Science and Technology
  http://www.naist.jp/index_en.html
  Japan
- North Carolina State University
  http://www.ncsu.edu/
  USA
- Northrop Grumman
  http://www.northropgrumman.com
  USA
- NRC Institute for Information Technology
  http://iit-iti.nrc-cnrc.gc.ca/index_e.html
  Canada
- Norwegian University of Technology & Science
  http://www.idi.ntnu.no/english/
  Norway
- NTT Data Corporation
  http://www.nttdata.co.jp/en/index.html
  Japan
- Osaka University
  http://www.osaka-u.ac.jp/eng/
  Japan

- SINTEF, Norway
  http://www.sintef.no/
  Norway
- SUN Microsystems
  http://www.sun.com
  USA
- University of Kaiserslautern
  http://www.uni-kl.de/
  Germany
- Universidad Politécnica de Madrid
  http://www.upm.es/
  Spain
- Universidad Politécnica de Valencia
  http://www.upv.es/index-en.html
  Spain
- Universidade de São Paulo (USP)
  http://www2.usp.br/ingles
  Brazil
- Universita' degli Studi di Roma "Tor Vergata"
  http://www.uniroma2.it/
  Italy
- University of Alberta
  http://www.ualberta.ca/
  Canada
- University of Bari
  http://www.uniba.it/index_n.php
  Italy
- University of Calgary
  http://www.ucalgary.ca/
  Canada
- University of Castilla-La Mancha
  http://www.uclm.es/
  Spain
- University of Hawaii
  http://www.ics.hawaii.edu/
  USA
- University of Maryland, Baltimore County
  UMBC
  http://www.umbc.edu/
  USA
- University of Maryland at College Park
  http://www.cs.umd.edu/
  USA
- University of New South Wales
  http://www.unsw.edu.au/
  Australia
- University of Oslo
  http://www.uio.no/english/
  Norway
- University of Oulu
  http://www.tol.oulu.fi/english/
  Finland
- University of Sheffield
  http://www.usc.edu/
  United Kingdom
- University of Southern California (USC)
  http://www.usc.edu/
  USA
- University of Strathclyde
  http://www.cis.strath.ac.uk/
  Scotland, U.K.
- University of Technology Sydney
  http://www.uts.edu.au/
  Australia
- University Politecnico di Torino
  http://www.polito.it/index.en.php
  Italy
- Vienna University of Technology
  http://www.tuwien.ac.at/
  Austria
- VTT Electronics
  http://www.vtt.fi/ele/indexe.htm
  Finland

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ISERN on the Internet:
www.iese.fraunhofer.de/ISERN

ISERN is an international research network whose objective is the promotion of empirical software engineering based on the joint awareness that software cannot be produced with one standard technology that applies to everything. Instead, software needs to be developed using suitable technologies. Suitable means that the technologies must be adapted to the goals and characteristics of particular projects. Consequently, software engineering research needs to be performed in an experimental context that allows us to observe and experiment with the technologies in use. Only systematic observation allows recognizing a technology's inherent strengths and weaknesses and makes it possible to try to understand their effects. This knowledge is necessary to systematically adapt technologies. Overall, the experimental approach together with empirically gained experience that is packaged for the target group improves the potential for technology transfer in software development.

Several software engineering research groups have made the paradigm shift to an experimental software engineering view and have joined forces in the International Software Engineering Research Network (ISERN). The purpose of ISERN is to promote the exchange of results and personnel between these groups. Specific emphasis is placed on experimentation with development technologies in different environments; the repetition of experiments across environments; and the development and exchange of methods and tools for model building, experimentation, and assessment. The long-term expectation is that such cooperation will enable the abstraction and unification of environment-specific results and knowledge with the objective of generating the basic components of our discipline.

The founding ISERN members chose the Quality Improvement Paradigm (QIP) as a reference model. The QIP is an experimental framework for software development, based on scientific methods and instantiated in the TAME project at the University of Maryland. It views measurement as essential to the capture and effective reuse of software experience, and assumes that the process is a variable based on the characteristics and goals of the project and organization. This framework views software engineering as a laboratory science, which must be supported by the effective cooperation between academia and industry in order to achieve significant improvements.

ISERN is open to other academic and industrial groups worldwide that are active in experimental software engineering research and are willing to adopt the experimental framework. There is no membership fee. The individual network members are responsible for funding the collaboration through existing local or future joint grants.

Contact

How to find us

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www.iese.fraunhofer.de

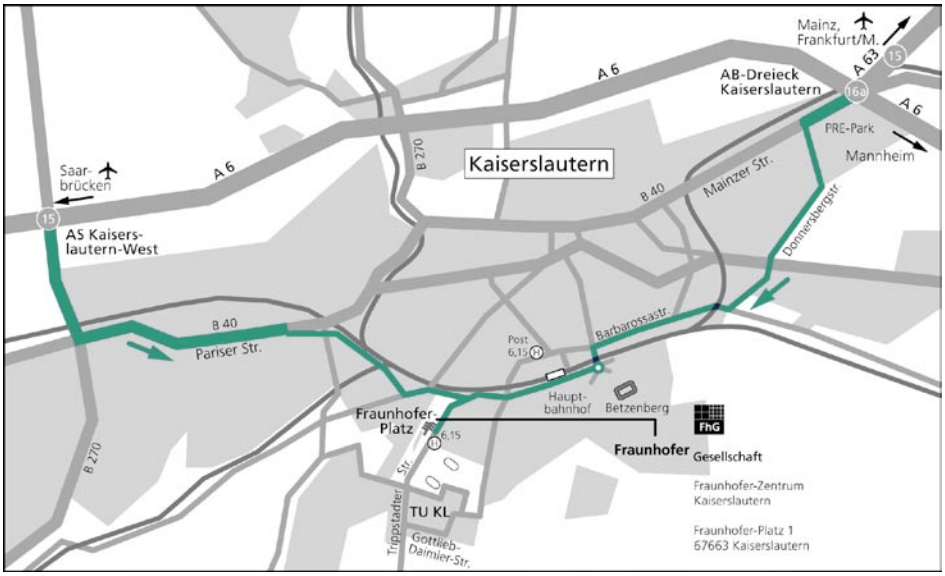
By car
Coming from the West on Autobahn A6, take the exit Kaiserslautern-West (15), then go towards downtown and follow the signs towards the university. Before you get to the university, you will reach the building complex of the Fraunhofer Center a few hundred meters down Trippstadter Straße, on the 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. 6 (towards Mölschbach) or no. 15 (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).



Map of Kaiserslautern

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Experimental Software Engineering
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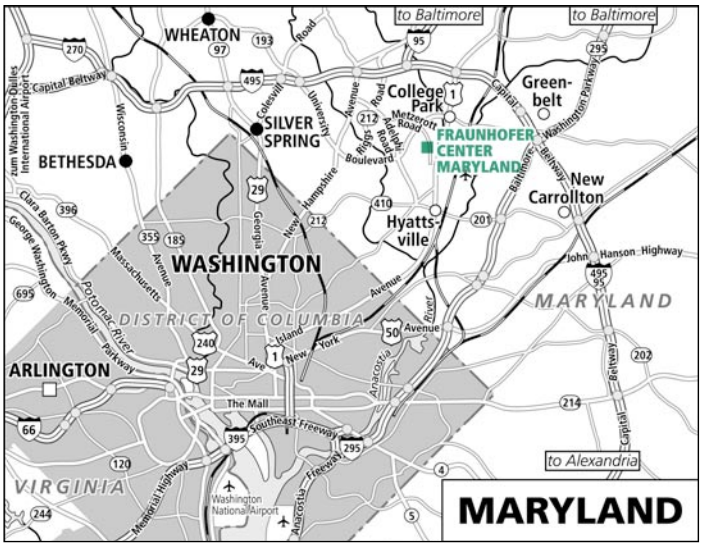
Phone: (301) 403-2705
Fax (301) 403-8976
info@fc-md.umd.edu
http://fc-md.umd.edu/fcmd/index.html



By car
Directions from Points North:
Follow I-95 South to the point where it merges with I-495. Follow the signs for Exit No. 27-Richmond (I-95/495 South). Then follow the Exit 27 signs staying to the left so you can take the special Rt.1/College Park exit lane. This will briefly put you back on I-95. Stay to the right and take Exit No. 25 onto Route 1 South (towards College Park).
For directions from this point on, see "Further directions" on this page!

Directions from Points South:
Follow I-95 North to the point where it merges with I-495. Follow the signs for Baltimore (I-95/495 North). Take Exit No 25 onto Route 1 South (towards College Park).
For directions from this point on, see "Further directions" on this page!

By train (15 minute walk)
Exit College Park Metro station by turning right after you exit the turnstile and going through a tunnel to Calvert Rd. Take Calvert Rd. for 4-5 blocks to Rt. 1. (Calvert ends there). Cross Rt. 1 and go right a block to Hartwick Rd. Turn right (there's a Kinko's Copy sign on the corner). Our building (4321) is on the left.

By plane
B.W.I. airport (about 45 minutes by car):
Exit the airport on I-195 (main road out of airport). After a few miles, take I-95 South towards Washington.
From this point, follow directions from Points North.

National Airport (about 90 minutes by car; also a stop on the Yellow Metro line):
Exit the airport towards I-395 North towards Washington, D.C. Continue on I-395 North to New York Avenue. Turn right onto New York Avenue (US Rt. 50 East) to MD Rt. 295/Baltimore-Washington Parkway for approximately six miles. Stay on BWI Parkway to the exit for Maryland Rt. 193. This is Greenbelt Road/Rt. 193. Take Rt. 193 East to Rt. 1 South.
For directions from this point on, see "Further directions" below!

Further directions:
Stay on Rt.1 South, going past the University of Maryland. After passing the University, you will encounter 2 stop lights – the 2nd one being Knox Rd. Take the next right after Knox onto Hartwick Rd (there's a Kinko's Copy sign on the corner). Our building (4321) is on the left – turn left past the building into the parking lot and park anywhere.

We're on the 5th floor – directly opposite the elevator.

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Further Information

- ❒ Annual Report 2006 of Fraunhofer IESE, print version (German)
- ❒ Annual Report 2006 of Fraunhofer IESE, print version (English)
- ❒ Annual Report 2006 of Fraunhofer IESE, CD-ROM version (German & English)
- ❒ Short films of Fraunhofer IESE DVD, German
- ❒ Short films of Fraunhofer IESE DVD, English
- ❒ Fraunhofer IESE: Overview
- ❒ The Fraunhofer-Gesellschaft from A-Z
- ❒ Annual Report of Fraunhofer-Gesellschaft
- ❒ STI Software Technology Initiative Kaiserslautern e.V.
- ❒ Please add my address to your information distribution list.

A pdf file of the Fraunhofer IESE Annual Report 2006 and other publications (e. g., technical reports, press releases, previous Annual Reports) are available at

www.iese.fraunhofer.de

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Return Address

Title

Last Name, First Name

Company

Position

Department

Address

Zip Code / City

Phone

Fax

E-mail

Date and Signature


soft ware (soft/wer/, soft/war/), n. 1 the plans
machinery to be manu
a computer syst
soft/wud/, soft/wüd/), n. 1 any
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oaks and

Appendix

Table of Content

Network in Science and Industry

Industrial Partners[1]

- ABB Corporate Research Ltd., Baden-Dättwill, Switzerland
- actano GmbH, Munich
- ADACORE SARL, Paris, France
- Alcatel SEL AG, Stuttgart
- ALTEC Information and Communication Systems S.A., Athens, Greece
- andrena objects ag, Karlsruhe
- Artemis International GmbH, Munich
- ASTEC SP.Z O.O., Zielona Gora, Poland
- Atmos MedizinTechnik GmbH, Lenzkirch
- Audicon GmbH, Düsseldorf
- Audi Electronics Venture GmbH, Gaimersheim
- a3 systems GmbH, Zweibrücken
- Beecon GmbH, Karlsruhe
- BMW AG, Munich
- brainbot Technologies AG, Mainz
- Büren & Partner Software Design GbR, Nuremberg
- CC GmbH, Wiesbaden
- Cosmos Finanzservice GmbH, Saarbrücken
- Cybits Systems Security GmbH, Mainz
- DaimlerChrysler AG, Ulm
- DCON Software & Service AG, Kaiserslautern
- Delta Softwaretechnologie GmbH, Schmallenberg
- Deutsche Telekom AG, Darmstadt
- Diamant Software GmbH & Co. KG, Bielefeld
- dynetic solutions, Kaiserslautern
- empolis knowledge management gmbh, Gütersloh
- EADS Defence & Secucity
- ESA European Space Agency, Darmstadt
- EUROCAT Gmbh, Darmstadt
- EWM Hightec Welding GmbH, Mündersbach
- Freudenberg Anlagen und Werkzeugtechnik GmbH, Laudenbach
- FUJITSU Enabling Software Technology GmbH, Munich
- FUJITSU Laboratories of Europe Ltd., Hayes, Great Britain
- GEF-RIS AG, Leimen
- Giesecke & Devrient GmbH, Munich
- Greengate AG, Windeck
- Hitachi Ltd., Tokyo, Japan
- Hofmann Maschinen- und Anlagenbau GmbH, Worms-Rheindürkheim
- Hottinger Maschinenbau GmbH, Mannheim
- Human Solutions GmbH, Kaiserslautern
- IBS AG engineering consulting software, Höhr-Grenzhausen
- ICTeam Internet Consulting AG, Trier
- IHK Zetis GmbH, Kaiserslautern
- imbus AG, Möhrendorf
- Inos Automatisierungssoftware GmbH, Herrenberg
- Insiders GmbH, Kaiserslautern
- Intershop Communications AG, Jena
- John Deere, Zweibrücken
- Josef Witt GmbH, Weiden
- Jyvaskylan Yliopisto, Jyvaskyla, Finland
- Kapsch CarrierCom AG, Salzburg, Austria
- KEIPER GmbH & Co. KG, Kaiserslautern
- Kugler Maag + Comp. Ltd. & Co. KG, Kornwestheim
- KUKA Schweissanlagen GmbH, Augsburg
- LogControl GmbH, Pforzheim
- Lucent Technologies Network Systems GmbH, Nuremberg
- Lufthansa Systems AS GmbH, Norderstedt
- market maker Software AG, Kaiserslautern
- maxess systemhaus gmbh, Kaiserslautern
- Mbtech, Sindelfingen
- method park Software AG, Erlangen
- Microsoft Deutschland GmbH, Unterschleißheim
- Microtool GmbH, Berlin
- MID Enterprise Software Solutions GmbH, Nuremberg
- Mitsubishi Research Institute, Tokyo, Japan
- Motorola, Inc., Schaumburg, USA
- MPDV Mikrolab GmbH, Römerberg
- Münchner Rückversicherungs-Gesellschaft AG, Munich
- NEC TOSHIBA Space Systems Ltd., Tokyo, Japan
- NewHyperG AG, Graz, Austria
- NIWA-WEB Solutions Niederacher & Wahler OEG, Vienna, Austria
- Nokia Corporation, Helsinki, Finland
- Pepite SA, Angleur, Belgium
- Polska Telefonia Cyfrowa SP. Z O.O., Watzawa, Poland
- proALPHA Software AG, Weilerbach
- PRO DV Software AG, Dortmund
- Psipenta Software Systems GmbH, Berlin
- OrgaTech Unternehmensberatung, Lünen
- Otwarty Rynek Elektroniczny S.A., Warsaw, Poland
- Polarion Software GmbH, Stuttgart
- QA Systems GmbH, Stuttgart
- Ricoh Company Ltd., Tokyo, Japan
- Robert-Bosch GmbH, Stuttgart
- Rodan Systems Spolka Akcyjna, Warsaw, Poland
- SAC Sirius Advanced Cybernetics GmbH, Karlsruhe
- SAP AG, Walldorf
- Schneider Electric GmbH, Seligenstadt
- Schraml GmbH, Vagen
- SHE Informationstechnologie AG, Ludwigshafen

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

- Siemens AG, Munich
- Siemens Information Systems Limited, Mumbai, India
- Siemens Medical Solutions Health Service AG, Erlangen
- Siemens VDO Automotive AG, Babenhausen
- SOFTEAM, Paris, France
- SOFTWIN S.R.L., Bukarest, Romania
- SPD Landesverband Rheinland-Pfalz, Mainz
- SQS Software Quality Systems AG, Cologne
- Steinbichler Optotechnik GmbH, Neubeuern
- SYSGO AG, Klein-Winternheim
- Teamtechnik, Freiberg
- Telekomunikacja Polska S.A., Warsaw, Poland
- Telenor ASA, Fornebu, Norway
- Testo AG, Lenzkirch
- T-Mobile International AG & Co KG, Bonn
- TNM Software GmbH, Neunkirchen
- T-Systems Business Services GmbH, Stuttgart
- T-Systems Enterprise Services GmbH, Kiel
- T-Systems Multimedia Solutions GmbH, Dresden
- Tynos, Bremen
- UAB Algoritmu Sistemos, Vilnius, Lithuania
- Valeo Schalter und Sensoren GmbH, Wemding
- Vision Tools GmbH, Waghäusel
- WIKON Kommunikationstechnik GmbH, Kaiserslautern
- ZEA Partners, Louvain-La-Neuve, Belgium
- 4soft GmbH, Munich

National Research Partners

- Arbeitsgruppe Softwaretechnik, Universität Bremen (Software Engineering Research Group, University of Bremen), Bremen
- Berufsakademie Karlsruhe (University of Cooperative Education Karlsruhe), Karlsruhe
- Brandenburgische Technische Universität Cottbus, (Technical University of Brandenburg), Cottbus
- 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 Gruppe Informations- und Kommunikationstechnik (IuK) (Fraunhofer Group Information and Communication Technology), 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 Mathematik und angewandte Informatik, Lehrstuhl für Intelligente Informationssysteme, Universität Hildesheim (Institute for Mathematics und Applied Computer Science, Laboratory of Intelligent Information Systems, University of Hildesheim), Hildesheim
- 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 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

International Research Partners

- Akademia Ekonomicczna 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
- École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
- Eidgenössische Technische Hochschule Zürich, Zurich, Switzerland
- Facultés Universitaires Notre-Dame de la Paix, Namur, Belgium
- Faculty of Informatics, University Dzemal Bijedic, Mostar, Boznia Herzegovina
- Faculty of Information Technology, University of Akureyri, Akureyri, Iceland
- Helsinki University of Technology, Espoo, Finland
- Heriot-Watt University, Edinburgh, United Kingdom
- Information-technology Promotion Agency, Tokyo, Japan
- Infovide Spolka Akcyjna, Warsaw, Poland
- Institut National Polytechnique de Toulouse, Toulouse, France
- Japan Aerospace Exploration Agency JAXA, Tokyo, Japan
- Jozef Stefan Institute, Ljubljana, Slovenia
- Katholieke Universiteit Leuven, Leuven, Belgium
- Kyungpook National University, Daegu, Korea
- Laboratory for Software Engineering Decision Support, University of Calgary, Calgary, Canada
- Latvijas Universitates Matematikas un Informatikas Instituts, Riga, Latvia
- 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, Harthorn, Australia
- Tampere University of Technology (Pori), Pori, Finland
- Technical University of Vienna, Vienna, Austria
- Technische Universiteit Eindhoven, Eindhoven, The Netherlands
- 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
- Wirtschaftsuniversität Wien, Vienna, Austria

International Software Engineering Research Network (ISERN)

- Blekinge Institute of Technology BTH, Sweden
- Computer Science and Systems Engineering Program COPPE, Federal University of Rio de Janeiro, Brazil
- DaimlerChrysler Research Center, Germany
- Fraunhofer Center Maryland, USA
- Fraunhofer Institute for Experimental Software Engineering, Germany
- Helsinki University of Technology Software Business Laboratory, Finland
- Japan Manned Space Systems Corporation JAMSS, Japan
- Japan Aerospace Exploration Agency JAXA, Japan
- Lucent Technologies – Bell Laboratories, USA
- Lund University, Sweden
- Microsoft Research, USA
- Mississippi State University, USA
- Nara Institute of Science and Technology, Japan
- North Carolina State University, USA
- Northrop Grumman, USA
- NRC Institute for Information Technology, Canada
- Norwegian University of Technology and Science, Norway
- NTT Data Corporation, Japan
- Osaka University, Japan
- SINTEF, Norway
- SUN Microsystems, USA
- Universidad Politécnica de Madrid, Spain
- Universidad Politécnica de Valencia, Spain
- University of Alberta, Canada
- University of Bari, Italy
- University of Calgary, Canada
- University of Castilla - La Mancha, Spain
- University of Hawaii, USA
- University of Kaiserslautern, Germany
- University of Maryland, Baltimore County, USA
- University of Maryland at College Park, USA
- University of New South Wales, Australia
- University of Oslo, Norway
- University Politecnico di Torino, Italy
- University of Oulu, Finland
- 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

Chinese Delegation; Yingtao Li, Vice President, Aidong Zhang, Director of R&D, Yue Chen, Director of Integrated Products, Pengwei Wang, Vice Director of Integrated Products, Tao Ma, Vice Director of R&D, Huawei Technologies Co., Ltd.; Jin Wang, Director of European Institute of Huawei Tech.; Xiaoding Han, Chief Representative of Fraunhofer Representative Office Beijing, Beijing, China, March 16

Minister Gernot Mittler, Ministry of Finance of Rhineland-Palatinate, Mainz, together with Social Democratic Party (SPD) City Council Parliamentary Party, Kaiserslautern, Germany, March 8

Toyota Delegation,
Fukui Mitsuhiro, Group Manager IT&ITS, Kondo Hiroshi, Managing Director, Takenouchi Masao, General Manager, Toyota Motor Coorporation; Tokyo, Japan
Sugawara Takao, General Manager, Morita Hiroshi, Senior Project Manager, Toyota Motor Europe;
Brussels, Belgium, March 7

Dr. Peter Freeman, Assistant Director, Larry Landweber, National Science Foundation for Computing and Information Science and Engineering, Arlington, Virginia, USA, March 6-7

Prof. Dr. Kyo Kang, Department of Computer Science and Engineering, Pohang University of Science and Technology POSTECH, Pohang, Kyoungbuk, R. O. Korea (South), June 8-11

Prof. Dr. Ross Jeffery, School of Computer Science and Engineering, Sydney, Australia, June 26

Patricia Costa, Dr. Mikael Lindvall, Fraunhofer USA CESE, College Park, MD, USA, June

Salvador Trujillo, ONEKIN Reseach Group, University of the Basque Country, San Sebastian, Spain, July 7 - September 31

Gentzane Aldecoa Anton, Computing Department MGEP, Mondragon University, Mondragon, Spain, July 7 - September 31

Staatssekretär Prof. Dr. Siegfried Englert, Ministry of Economc Affairs, Transportation, Agriculture, and Viniculture of Rhineland-Palatinate, Mainz, Germany, August 15

Kiyoshi Sakai, Corporate Executive Vice President, RICOH, Co. Ltd., Tokyo, Japan,
August 27-28

Prof. Dr. Jesse Poore, University of Tennessee, Department of Computer Science, Knoxville, TN, USA, August - December

Eduardo Almeida, Reuse in Software Engineering (RiSE) Group, Recife Center for Advanced Studies and Systems (C.E.S.A.R.), Recife, Brazil, September 8

Elena Hernandez Ruiz, Computing Department MGEP, Mondragon University, Mondragon, Spain, September 2006 - May 2007

Karina Barreto Villela, University of Salvador (UNIFACS), Brazil, Fellowship from Alexander von Humbold Foundation, October 2006 - October 2007

Junkkyo Fujieda, President and CEO, ReGIS Inc., Tokyo, Japan, October 27

Prof. Dr. Victor Basili, Fraunhofer USA CESE, University of Maryland, College Park, MD, USA, November 6-10

Christophe Piombo, Institut de Recherche en Informatique de Toulouse, École Nationale Supérieure d'Electrotechnique, d'Electronique, d'Informatique, d'Hydraulique et des Télécommunications, Toulouse, France, November 13-14

Masa Katahira, Tomomi Kawasaki, Yuko Miyamoto, Makoto Shizunaga, Japan Aerospace Exploration Agency (JAXA), Tokyo, Japan, December 11-15

Professional Contributions

Lecturing Assignments

Bomarius, B.:
Lecture
Informatik 2 – Introduction to Digital Computers,
Department of Engineering, University of Applied Sciences Kaiserslautern,
Summer 2006

Lecture
Informatik 4 – Computer Architecture,
Department of Engineering, University of Applied Sciences Kaiserslautern,
Summer 2006

Lecture
Informatik 1 – Introduction to Programming in C,
Department of Engineering, University of Applied Sciences Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Lecture
Informatik 3 – Object Orientation and C++,
Department of Engineering, University of Applied Sciences Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Eschbach, R.:
Lecture
Requirements Engineering,
Computer Science Department,
University of Kaiserslautern,
Summer 2006

Decker, B.:
Lecture
Schreibwerkstatt,
Computer Science Department,
University of Applied Sciences Mannheim, Winter 2006/2007

Dörr, J.:
Lecture
Requirements Engineering,
Computer Science Department,
University of Kaiserslautern,
Summer 2006

Liggesmeyer, P.:
Lecture
Sicherheit und Zuverlässigkeit eingebetteter Systeme,
Computer Science Department,
University of Kaiserslautern,
Winter 2006/2007

Lecture
Grundlagen Software Engineering,
Computer Science Department,
University of Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Münch, J.:
Lecture
Process Modeling,
Computer Science Department,
University of Kaiserslautern,
Summer 2006

Muthig, D.:
Lecture
Software Product Lines,
Computer Science Department,
University of Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Rombach, D.:
Lecture
Requirements Engineering,
Computer Science Department,
University of Kaiserslautern,
Summer 2006

Lecture
Project Management and Quality Assurance,
Computer Science Department,
University of Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Lecture
Empirical Model Building & Methods,
Computer Science Department,
University of Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Proseminar
Virtuelle Büros der Zukunft,
Computer Science Department,
University of Kaiserslautern,
Winter 2006/2007

Trapp, M.:
Lecture
Development of Embedded Systems,
Computer Science Department,
University of Kaiserslautern,
Winter 2005/2006 and
Winter 2006/2007

Editorial Boards

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

Liggesmeyer, P.:
Editor, it – information technology, Oldenbourg-Verlag, München, since 2003

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

Editor, Informatik – Forschung und Entwicklung, Springer-Verlag, 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

Member, Editorial Board, e-Informatica, since 2006

Rombach, D.:
Associate Editor, IEEE Transactions on Software Engineering, since 2003

Associate Editor, ACM TOSEM, since 2003

Member, Editorial Board, IEEE Computer Magazine, since 1999

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-Verlag, since 1993

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

Committee Activities

Ciolkowski, M.:
Co-Organizer, WSESE 2006, Amsterdam, The Netherlands, June 1

Member, Program Committee, Software Process & Product Improvement, EUROMICRO 2006, Dubrovnik, Croatia, August 28 - September 1

Member, Program Committee, ISESE 2006, Rio de Janeiro, Brazil, September 21-22

Member, Program Committee, EuroSPI 2006, Joensuu, Finland, October 11-13

Member, Program Committee, Workshop on Peer Reviews in Agile Development, Beijing, China, October 26-28

Decker, B.:
Member, Program Committee, SemWiki 2006, EWSC 2006, Budva, Montenegro, June 12

Member, Program Committee, STICA 2006, WETICE 2006, Manchester, United Kingdom, June 26-28

Program Chair, GWEM 07, WM 2007, Potsdam, Germany, March 28-30, 2007

Member, Program Committee, LSO 2007, WM 2007, Potsdam, Germany, March 28-30, 2007

Denger, C.:
Member, DKE Normungsgremium, Sicherheit von medizinisch genutzten Geräten in der vernetzten Anwendung, Frankfurt, Germany, since 2006

Member, Program Committee, Euromicro SEAA 2006 , SPPI-Track, Cavtat/Dubrovnik, Croatia, August 28 - September 1

Member, Program Committee, ICSEA 2006, Tahiti, October 29 - November 3

Grützner, I.:
Member, Program Committee, LOKMOL 2006, EC-TEL 2006, Limon Hersonissou, Crete, Greece, October 2

Jedlitschka, A.:
External Reviewer, PSW/ProSim, ICSE 2006, Shanghai, China, May 20-28

Co-Chair, WSESE 2006, Amsterdam, The Netherlands, June 1

Member, Program Committee, ESELAW 2006, ISESE 2006, Rio de Janeiro, Brazil, September 13

Member, Program Committee, ISESE 2006, Rio de Janeiro, Brazil, September 21-22

Co-Organizer, WS-SENE 2006, Joensuu, Finland, October 11

Member, Program Committee, IEEE RE 2006, RE & Others, Minneapolis, USA, May 19-20, 2007

Member, Program Committee, QUATIC 2007, Lisbon, Portugal, September 12-14, 2007

Poster Chair, ESEM 2007, Madrid, Spain, September 20-21, 2007

John, I.:
Doctoral Symposium Chair, SPLC Doctoral Symposium, SPLC 2006, Baltimore, MD, USA, August 21-24

Knodel, J.:
Member, Program Committee, WCRE 2006, Benevento, Italy, October 23-27

Kolb, R.:
Member, Program Committee, SPLiT 2006, SPLC 2006, Baltimore, MD, USA, August 21

Liggesmeyer, P.:
Member, Program Committee, MODELLIERUNG 2006, Innsbruck, Austria, March 21-24

Member, Program Committee, GI/ITG Workshop Non-Functional Properties of Embedded Systems, NFPES 2006, Nuremberg, Germany, March 27-29

Member, Program Committee, Software Engineering SE 2006, Leipzig, Germany, March 28-31

Member, Program Committee, Conquest 2006, Berlin, Germany, September 27-29

Member, Program Committee, Model-based Training MOTES 2006, Dresden, Germany, October 2-6

Member, Program Committee, Formale Ansätze zum Softwaretesten, GI-Jahrestagung, Dresden, Germany, October 2-6

Münch, J.:
Co-Organizer, WESoC 2006, Tokyo, Japan, February 24-27

Member, Program Committee, CSEET 2006, Hawaii, USA, April 19-21

Member, Program Committee, SMEF 2006, Rome, Italy, May 10-12

Member, Program Committee, SPW/ProSim 2006, Shanghai, China, May 20-21

Member, Program Committee, Experience Track ICSE 2006, Shanghai, China, May 20-28

Program Co-Chair and Member, Program Committee, PROFES 2006, Amsterdam, The Netherlands, June 12-14

Member, Program Committee, ICSR9, Torino, Italy, June 12-15

Member, Program Committee, Software Process & Product Improvement, EUROMICRO 2006, Dubrovnik, Croatia, August 28 - September 1

Member, Program Committee, Workshop Vorgehensmodelle in der Praxis – Formalisierung und Anwendung, GI-Tagung Informatik 2006, October 5

Member, Program Committee, EuroSPI 2006, Joensuu, Finland, October 11-13

Member, Program Committee, MetriKon 2006, Potsdam, Germany, November 2-3

Member, Program Committee, APSEC 2006, Bangalore, India, December 6-8

Member, Program Committee, WI-VM 2007, Munich, Germany, April 12-13, 2007

Member, Program Committee, SMEF 2007, Rome, Italy, May 9-11, 2007

Member, Program Committee, ICSP 2007, Minneapolis, USA, May 19-20, 2007

Member, Program Committee, Experience Track, ICSE 2007, Minneapolis, USA, May 20-26, 2007

Member, Program Committee, and Co-Organizer, SEE 2007, Munich, Germany, June 4-6, 2007

Member, Program Committee, TIM 2006, IEEE WETICE 2007, Paris, France, June 18-19, 2007

Program Co-Chair and Member, Program Committee, PROFES 2007, Riga, Latvia, July 2-4, 2007

Member, Program Committee, Software Process & Product Improvement, EUROMICRO 2007, Lübeck, Germany, August 27-31, 2007

Member, Program Committee, ESEM 2007, Madrid, Spain, September 20-21, 2007

Member, Program Committee, Workshop "Vorgehensmodelle in der Praxis – Reife und Qualität", GI-Tagung Informatik 2007, Bremen, Germany, September 24-28, 2007

Member, Program Committee, EuroSPI 2007, Potsdam, Germany, September 26-28, 2007

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

Muthig, D.:
Member, Program Committee, ICSE 2006, Shanghai, China, May 20-28

Workshop Co-Organizer, Variability Management, SPLC 2006, Baltimore, MD, USA, August 21

Member, Program Committee, SPLC 2006, Baltimore, MD, USA, August 21-25

Member, Program Committee, SAICSIT 2006, Cape Winelands, South Africa, September 6

Member, Program Committee, NetObjectDays 2006, Erfurt, Germany, September 18-21

Member, Program Committee, ICSEA 2006, Tahiti, French Polynesia, October 29 - November 1

Workshop Co-Organizer, 1st German-Korean Workshop on Software Product Lines, Seoul, South Korea, November 2

Member, Program Committee, WDBC 2006, Recife, Brazil, December 4-8

Member, Program Committee, VaMoS 2007, Limerick, Ireland, January 16-18, 2007

Member, Program Committee, MOMPES 2007, Braga, Portugal, March 31, 2007

Program Co-Chair, SPLC 2007, Kyoto, Japan, September 10-14, 2007

Member, Program Committee, QUATIC 2007, Lisbon, Portugal, September 13-15, 2007

Nick, M.:
Member, Program Committee, LSO&RE 2006, Hanover, Germany, March 27-28

Member, Program Committee, MRC2006, AAAI 2006, Boston, MA, USA, July 16-17

Member, Program Committee, FGWM 2006, LWA 2006, Hildesheim, Germany, October 9-13

Workshop Co-Organizer, MoRSe 2006, SET 2006, Warsaw, Poland, October 16

Member, Program Committee, WM 2007, Potsdam, Germany, March 28-30, 2007

Workshop Co-Organizer, GWEM2007, WM 2007, Potsdam, Germany, March 28-30, 2007

Workshop Organizer, LSO 2007, WM 2007, Potsdam, Germany, March 28-30, 2007

Ochs, M.:
Member, Program Committee, ICCBSS 2007, Banff, USA, February 26 - March 2, 2007

Member, Program Committee, PROFES 2006, Amsterdam, The Netherlands, June 1

Ras, E.:
Member, Program Committee, ProKW2007, WM 2007, Potsdam, Germany, March 28-30, 2007

Member, Program Committee, IWL 2006, I-KNOW2006, Graz, Austria, September 1

Workshop Organizer, LOKMOL 2006, EC-TEL 2006, Limon Hersonissou, Crete, Greece, October 2

Rech, J.:
Member, Program Committee, MoDSE 2007, Amsterdam, The Netherlands, March 20, 2007

Rombach, D.:
Member, Steering Committee, METRICS Conference Series, since 2002

Chair, Process Models Track, SQM 2006, Düsseldorf, Germany, May 10-12

Member, Program Committee, SQM 2006, Düsseldorf, Germany, May 10-12

Program Co-Chair, ICSE 2006, Shanghai, China, May 20-28

Program Chair, Experience Track, ICSE 2008, Leipzig, Germany, 2008

Trapp, S.:
Workshop Organizer, Workshop Blended Learning: the best mix for SMEs, EC-TEL 2006, Limon Hersonissou, Crete, Greece, October 1

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 Governor 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

Memberships in Industrial Advisory Boards

Münch, J.:
Member, Advisory Board, SASQIA / OrgaTech 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

Participation in Delegations

Forster, T.:
Member, Foundation of German-Korean Reseach Partnership, Seoul, Pohang, Korea, October 30 - November 3

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.

GDM – Gesellschaft für Didaktik der Mathematik

GI – Gesellschaft für Informatik

IEEE – Institute of Electrical and Electronic Engineers

IMA – Institute of Mathematics and its Application

LAP – Liberty Alliance Project

OMG – Object Management Group

STI – Software Technologie Initiative e.V.

Tekom – Fachverband für technische Kommunikation und Dokumentation

Keynotes

Armbrust, O.:
"Das V-Modell XT – Hintergrund, Zielsetzung und Zukunft", Seminar "Change Governance – V-Modell XT", Serena und IT-Verlag, Bonn/Berlin, October 17-18

Liggesmeyer P.:
"Software Quality Assurance: State of the Art and Trends", Swiss Testing Day, Zurich, Switzerland, March 15

"Quality Attributes of Distribution Systems", SAIG Conference, Braunschweig, Germany, May 18

"Software-Qualität: Theorie und Empirie, Standards und Konsens", imbus QS-Tag, Nuremberg, Germany, November 11

Münch, J.:
"Initiative Quality and Process Management", WESoC 2006, Tokyo, Japan, Feb 24

Becker, M.:
"Ambient Assisted Living, Multimedia, Information Technology and its Applications (MITA 2006)", Dahlian, China, July 4-6

Rombach, D.:
"Informationstechnologie Cluster in Kaiserslautern – Wissenschaftsstandort Kaiserslautern", SPD-Stadtratsfraktion, Kaiserslautern, Germany, March 6

"Informationsgesellschaft braucht E-Government, Strategie-Lounge, Rheinland-Pfalz-Stand", CeBIT 2006, Hanover, Germany, March 10

"Software Engineering Competence", Tongmyong University, Busan, Korea, March 16

Presentations

Armbrust, O.:
"V-Modell XT quo vadis – Erfolgreiche Einführung u. Anwendung des V-Modell XT", Panel Discussion, 2. Jahreskongress V-Modell XT, Munich, Germany, April 24

"Software Qualität messen", Talk, Polyspace User-Tag 06, Bernried, Germany, June 1

"V-Bench", Presentation, Statuskonferenz Forschungsoffensive Software Engineering 2006, BMBF, Leipzig, Germany, June 26-28

"Einführung u. Optimierung standardkomformer Entwicklungsprozesse", Talk, MID insight 06, Frankfurt, Germany, November 15

Bayer, J.:
"Methoden und Vorgehensweisen zur Entwicklung von Services und serviceorientierten Anwendungen", Industry Seminar, ASG Industry Workshop, University of Koblenz, Koblenz, Germany, July 6

"Service-Orientierung – Konzepte, Architekturen und Anwendungen", Industry Seminar, STI-Event, Fraunhofer IESE, Kaiserslautern, Germany, September 6

"Developing Services and – Services-oriented Applications", Conference Tutorial, net.objectdays 2006, Erfurt, Germany, September 19

Becker, M.:
"Approaching Ambient Intelligent Home Care Systems", Conference Presentation, Pervasive Health 2006, ACM, IEEE EMB Society, Innsbruck, Austria, December 1

Beletski, T.:
"Demonstration Project: Statistical Testing", Demonstration, JEITA-Workshop, Fraunhofer IESE, Kaiserslautern, Germany, November 27-28

Bella, F.:
"Software Process Definition for Multi-organizational Development in the Aerospace Domain", Paper Presentation, ICSSEA 2006, Paris, France, December 12

Ciolkowski, M.:
"Aggregation of Empirical Evidence", Talk, ISERN Annual Meeting 2006, Rio de Janeiro, Brazil, September 18

Decker, B.:
"Workshop Wissensmanagement-Potentiale", Industry Seminar, MPDV Mikrolab, Mosbach, Germany, November 20

Domis, D. J.:
"Physical Domain Model for the Developments of Dependable Embedded Systems", Presentation, SAE-Seminar, IASTED, Dallas, USA, November 13-15

Dörr, J.:
"Bausteinartige Prozessverbesserung als Schlüssel für erfolgreiches Anforderungsmanagement in KMUs", Talk, GI Fachgruppentreffen RE, Gesellschaft für Informatik, Munich, Germany, November 23

"Anforderungsprozessverbesserung: 3 Gründe für das Scheitern und Maßnahmen", Talk, SQS, SQM 2006, Düsseldorf, Germany, May 12

Dörr, J.; Kerkow, D.; Landmann, D.:
"Creativity", Workshop, Reconf 2006, Hood GmbH, Munich, Germany, March 6

Elberzhager, F.:
"Software Testing", Seminar, Berghof Automationstechnik GmbH, Eningen, Germany, Quarter 2

Eschbach, R.:
"Demonstration Project: Statistical Testing", Demonstration, JEITA-Workshop, Fraunhofer IESE, Kaiserslautern, Germany, November 27-28

"Sequence-Based Specification extended with String Rewriting", Workshop, SQRL Day 2006, UTK, Knoxville, TN, USA, December 7

Forster, T.:
"Tool Support for Product Line Engineering", Workshop, 1st German-Korean Workshop on Software Product Lines, Sogang University, Seoul, Korea, November 2

Förster, M.:
"Increased efficiency in the quantitative evaluation of state/event fault trees", Conference Presentation, INCOM 2006, IFAC, Saint-Etienne, France, May 17-19

Ganesan, D.:
"Starting a Software Product Line by Reengineering a Set of Existing Product Variants", Conference Presentation, SAE 2006, Detroit, USA, April 6

"Assessing Merge Potential of Existing Engine Control Systems into a Product Line", Conference Workshop, ICSE-SEAS 2006, Shanghai, China, May 23

"Goal-Oriented Performance Analysis of Reusable Software Components", Conference Presentation, ICSR 2006, Torino, Italy, June 12-15

"Predicting Return-on-Investment for Product Line Generations", Conference Presentation, SPLC 2006, Baltimore, MD, USA, August 21-24

"Defining a Strategy to Introduce a Software Product Line Using Existing Embedded Systems", Conference Presentation, EMSOFT 2006, Seoul, Korea, October 22-25

"Discovering Organizational Aspects from the Source Code History Log during the Product Line Planning Phase – A Case Study", Conference Presentation, WCRE 2006, Benevento, Italy, October 23-27

"Combining Reverse Engineering Techniques for Product Lines", Conference Workshop, WCRE PCODA 2006, Benevento, Italy, October 24

Grützner, I.:
"Blended Learning – Benutzerorientierte systematische Entwicklung, Durchführung und Qualitätssicherung", Kolloquium, Angewandte Informatik, Institut für Angewandte Informatik und Formale Beschreibungsverfahren, University of Karlsruhe, Karlsruhe, Germany, January 20

"Systematische Entwicklung von Medien zur Benutzerunterstützung und -schulung mit einem XML basierten Single-Source-Ansatz", Presentation, Multikonferenz Wirtschaftsinformatik 2006, University of Passau, Passau, Germany, February 21

"Einführung neuer Technologien in der Verwaltung mit Unterstützung von Lern-Software", Talk, 7. Kongress "Neue Verwaltung" mit Fachmesse, dbb Akademie, Leipzig, Germany, May 31

"Einführung in die Lernsoftware-Entwicklung mit IntView", Lehrveranstaltung, Berufsakademie, Karlsruhe, Germany, November 22

Grützner, I; Thomas, L.; Steinbach-Nordmann S.:
"Building re-configurable multilingual training media", Virtual Presentation, 4th International Conference on Multimedia and Information and Communication Technologies in Education, University of Sevilla, Sevilla, Spain, November 22-25

Guo, Z.:
"Test and Inspection", Workshop, PolySpace Workshop, PolySpace Technologies, Munich, Germany, September 19-21

Hamann, D.:
"Level 5 Überblick", Invited Talk, IT-Refresher, T-Mobile, Bonn, Germany, May 12

Jedlitschka, A.:
"The ISERN Experience Factory", Talk, ISERN Annual Meeting 2006, Rio de Janeiro, Brazil, September 18-19

"Experimentation and Decision Making in Software Engineering: How they are related?", Chair, ISERN Annual Meeting 2006, Rio de Janeiro, Brazil, September 18-19

"The Virtual Software Engineering Competence Network software-kompetenz.de", Talk, WS-SENE 2006, Joensuu, Finland, October 11

John, I.:
"A Practical Guide to Product Line Scoping", Conference Presentation, SPLC 2006, SEI, Baltimore, USA, August 21-24

Kalmar, R.; Ochs, M.; Trendowicz. A.:
"Goal-oriented Software Measurement", Tutorial, Ludwigsburg, Germany, November 15-16

Keuler, T.:
"Supporting Architectural Design by Early Aspects Identification", Conference Workshop, AOSD 2006, University of Bonn, Bonn, Germany, March 21-23

Kleinberger, T.:
"Notfallunterstützung für ältere Personen mit Ambient Intelligence", Heidelberger Innovationsforum, Heidelberg, Germany, May 8-9

Knodel, J.:
"Static Evaluation of Software Architectures", Conference Presentation, CSMR 2006, Università degli Studi di Bari, Bari, Italy, March 24

"SAVE – ein Werkzeug zum Verstehen von Software Architekturen", Industry Seminar, STI-Event, Fraunhofer IESE, Kaiserslautern, Germany, April 6

"Case Studies of Static Software Architecture Evaluations", Workshop, 8. Workshop Software-Reengineering, GI-Fachgruppe Software-Reengineering SRE, Bad Honnef, Germany, May 5

"ArQuE – Architecture-centric Quality Engineering", Poster Presentation, Statuskonferenz Forschungsoffensive Software Engineering 2006, BMBF, Leipzig, Germany, June 28

"Understanding Software Architectures by Visualization – An Experiment with Graphical Elements", Conference Presentation, WCRE 2006, Research Centre on Software Technology RCoST, Benevento, Italy, October 25

Kohler, K.:
"Qualitätsverbesserung durch frühzeitige Integration von Software Engineering und Usability Engineering", Industry Seminar, Vehicle Interaction Summit III, Fraunhofer IAO, Stuttgart, Germany, May 17

"FUN: Fun of Use für Geschäftsanwendungen", Presentation, Statuskonferenz Forschungsoffensive Software Engineering 2006, BMBF, Leipzig, Germany, June 28

"Software-Ergonomie: Das A und O in der Arbeitswelt von Morgen?", Industry Seminar, Innovatives Management 2006. Ziele – Chancen – Perspektiven, Mach AG, Lübeck, Germany, September 14

Kolb, R.:
"Goal-Oriented Performance Analysis of Reusable Software Components", Conference Presentation, ICSR 2006, Torino, Italy, June 12-15

"Making Testing Product Lines More Efficient by Improving the Testability of Product Line Architectures", Conference Workshop, ROSATEA 2006, Portland, ME, USA, July 17

"Experiences with Product Line Development of Embedded Systems at Testo AG", Conference Presentation, SPLC 2006, Baltimore, MD, USA, August 21-24

"Measuring and Analyzing the Performance of Reusable Software Components for Embedded Systems", Conference Presentation, QA&TEST 2006, Bilbao, Spain, October 18-20

Lee, J.:
"PL Research Projects", Workshop, 1st German-Korean Workshop on Software Product Lines, Sogang University, Seoul, Korea, November 2

"Re-engineering a Credit Card Authorization System for Maintainability and Reusability of Components – A Case Study", Conference Presentation, ICSR 2006, Torino, Italy, June 12-15

"A Feature-Oriented Approach to Developing Dynamically Reconfigurable Products in Product Line Engineering", Conference Presentation, SPLC 2006, Baltimore, MD, USA, August 21-24

Lehner, T.:
"Service-Orientierung – Konzepte, Architekturen und Anwendungen", Industry Seminar, STI-Event, Fraunhofer IESE, Kaiserslautern, Germany, September 6

Münch, J.:
"Towards a Software Engineering Platform for Euromediti", Talk, Kick-Off Meeting, Mediterranean Institute of Technology and Innovation, Valetta, Malta, January 14

"Process Evolution Support by Rationale: An Empirical Investigation of Process Changes", Paper Presentation, PSPW/ProSim 2006, Shanghai, China, May 21

"Effective Data Interpretation", Invited Talk, Intl. Workshop on Empirical Software Engineering, Seminar 06262, Schloss Dagstuhl, Wadern, Germany, June 28

"Integrated Vehicle and Process Lines", Talk, 2nd Workshop on Producibility Commercial Vehicle Cluster, DaimlerChrysler AG, Wörth, Germany, July 18

"Advancing Software Measurement Practices to Effectively Meet The Corporate Goals of JAXA", Talk, WOCS 2006, JAXA, Tokyo, Japan, November 15

Naab, M.:
"Static Architecture Evaluation of Open Source Reuse Candidates", Conference Presentation, net.objectdays 2006, Erfurt, Germany, September 18-20

Nick, M.:
"Reducing the Case Acquisition and Maintenance Bottleneck with User-Feedback-Driven Case Base Maintenance", 19th International Florida Artificial Intelligence Research Society Conference FLAIRS 2006, Melbourne, USA, May 11

"Enabling Application-Context-based Reasoning for Non-Context-based Reasoners using Flat Representations", Workshop Presentation, Workshop on Context Representation and Reasoning CRR 2006, Riva del Garda, Italy, August 29

"Integration von Qualitätsdaten für Produktionsanlagen Workshop on Knowledge Management", GI-Fachgruppentreffen Wissensmanagement FGWM 2006, Hildesheim, Germany, October 9

"Scenarios, Representation, and Usage Issues for Softare Case-oriented Comprehensive Reuse", First International Workshop on Model Reuse Strategies MoRSe 2006, Warsaw, Poland, October 17

Ocampo, A.:
"Characterization of Semantic Grid Engineering", Workshop Presentation, Workshop on Future Research Challenges for Software and Services FRCSS 2006, European Association of Software Science and Technology EASST, Vienna, Austria, April 2

"A Systematic Approach for Developing Process-Based Software Product Lines", Conference Presentation, 7th International Conference on Product Focused Software Process Improvement PROFES 2006, Amsterdam, The Netherlands, June 13

Patzke, T.:
"Modeling AmI Systems With KobrA", Presentation, AmI Joint Task 2 Meeting, AmI Meeting, Budapest, Hungary, April 22-26

Peine, H.:
"Security measures across the software development process", Inhouse Seminar, Fraunhofer CESE, College Park, MD, USA, March 16

"Faustregeln zur Entwicklung sicherer Software", Conference Tutorial, Software Engineeering 2006, GI, Leipzig, Germany, March 28

"Secure Software Engineering for Ambient Intelligence Systems", Inhouse Seminar, Fraunhofer IESE, Kaiserslautern, Germany, April 5

"SecFlow: Automatische Ermittlung sicherheitskritischer Datenflüsse in Quellcode", Conference Presentation, Statuskonferenz Forschungsoffensive Software Engineering 2006, BMBF, Leipzig, Germany, June 28

"Sicherheit von Webanwendungen", Online-Seminar, Mitarbeiter-Weiterbildungsprogramm, Fraunhofer-Gesellschaft, Germany, September 20-21, and November 8-9

"Opportunities to Introduce Security into a Software Development Process", Industry Seminar, One Access S.A., Paris, France, December 1

"Sichere Konfiguration von Apache und PHP", Online-Seminar, Mitarbeiter-Weiterbildungsprogramm, Fraunhofer-Gesellschaft, Germany, December 11

Ras, E.:
"Workplace Learning in Software Engineering Reuse", Presentation, i-KNOW 2006, Graz, Austria, September 6-9

Rech, J.:
"Präsentation des Arbeitskreises Architektur- und Entwurfsmuster AKAEM", Gründungstreffen der GI-Fachgruppe Softwarearchitektur, University of Karlsruhe, Karlsruhe, Germany, October 12-13

Robinson-Mallett, C.:
"State Identification and Verification using a Model Checker", Conference Presentation, SE 2006, GI, Leipzig, Germany, March 28

"rantest: Risikobasiertes Testen nichtfunktionaler Qualitätseigenschaften", Conference Presentation, Software Engineeering 2006, GI, Leipzig, Germany, March 28

"Grundlagen des systematischen Software Tests", Industry Seminar, STI Abendseminar, STI, Kaiserslautern, Germany, May 11, and October 18

"Achieving Communication Coverage in Testing", Scientific Workshop, A-MOST 2006, ACM, Raleigh, NC, USA, November 5

"D-MINT: Deployment of Testing in the Industrial Scale", Workshop, SQRL Day 2006, UTK, Knoxville, TN, USA, December 8

"Model-Based Testing of Distributed Systems", Workshop, SQRL Day 2006, UTK, Knoxville, TN, USA, December 9

Rombach, D.:
"Software Engineering Innovations", Invited Talk, DaimlerChrysler AG, Stuttgart, Germany, February

"eGovernment-Strategien und ihre Umsetzung", Panel Discussion, Strategie Lounge, Rheinland-Pfalz-Stand, CeBIT 2006, Hanover, Germany, March 10

"Das Auto der Zukunft – von A(irbag) bis Z(ylinder)", Panel Discussion, Branchenforum "auto connect", Mainz, Germany, March 21

"Industrial Impact through Education", Panel Discussion, CSEE, 19th Conference on Software Engineering Education and Training, Turtle Bay Resort, Hawaii, USA, April 19-21

"E-Government als Service für die neuen Wertschöpfungsketten der Wirtschaft e-Government", Invited Talk, e-Government Klausur, Potsdam, Germany, May 4

"Neue Technologien für eine neue Verwaltung, Wirtschaftliches eGovernment kooperativ gestalten", Panel Discussion, 7. Kongress mit Fachmesse "Neue Verwaltung", dbb akademie, Leipzig, Germany, May 30-31

"The Fraunhofer Institute for Experimental Software Engineering", Invited Talk, 4. Treffen der ehemaligen Vorstände und Institutsleiter der Fraunhofer-Gesellschaft, Fraunhofer IESE, Kaiserslautern, Germany, July 7

"Software-Produktlinien: Ein ingenieurmäßiger Ansatz für die Entwicklung von Software", Colloquium, University of Karlsruhe (TH), Department of Information Systems, Karlsruhe, Germany, July 14

"Demand-Driven E-Government", Invited Talk, NICTA Distinguished Lecture Series, NICTA, Canberra, Australia, September 14

"Notfallmedizin als Forschungspartner am IT-Standort Kaiserslautern", Invited Talk, Westpfalz-Klinikum Kaiserslautern, Kaiserslautern, Germany, November 9

Schwarz, R.:
"Security Requirements in the Context of AmI Systems", Presentation, SWAMI Conference, SWAMI Project, IST FP6, Brussels, Belgium, March 21-22

"Secure Software Engineering with a view on AmI software", Research Seminar, BelAmI Seminar, Fraunhofer IESE, Kaiserslautern, Germany, April 5

Steffens, P.:
"eGovernment mit Mehrwert für Wirtschaft und Verwaltung – Projektbeispiele aus Rheinland-Pfalz", Presentation, 4. Sitzung der Projektgruppe 2 "Informations- und Kommunikationstechnik" des Technologiebeirates Rheinland-Pfalz, Mainz, Germany, March 2

"Das Fraunhofer eGovernment Zentrum: eGovernment – von der Forschung in die Praxis", Panel Discussion, Strategie Lounge, Rheinland-Pfalz-Stand, CeBIT 2006, Hanover, Germany, March 9.

"Bestimmung von eGovernment-Potenzialen in der Wirtschaft", Presentation, CeBIT 2006, Hanover, Germany, March 13

"FLO*rlp* - Flächeninformationen Online für Landwirte und Verwaltung: Der Weg zur akzeptierten Lösung", Presentation, 7. Kongress mit Fachmesse "Neue Verwaltung", dbb akademie, Leipzig, Germany, May 30

"Die Wirtschaft im Fokus: Bestimmung von eGovernment-Potenzialen in Unternehmen", Presentation, 7. Kongress mit Fachmesse "Neue Verwaltung", dbb akademie, Leipzig, Germany, May 31

Steffens, P., Marx, R. (Ministry of the Interior und for Sports of Rheinland-Pfalz):
"Bestimmung von eGovernment-Potenzialen in Verwaltung und Wirtschaft – Vorgehensweise und Lösungsansätze", Presentation, Best Practice Forum, 10. Fachmesse und Kongress Moderner Staat, Berlin, Germany, November 28

Steinbach-Nordmann, S.:
"Applying Blended Learning in an Industrial Concept – An Experience Report", Workshop Presentation, First European Conference on Technology Enhanced Learning EC-TEL'06, Limon Hersonissou, Crete, Greece, October 1

Thomas, L.:
"Coaching Professional Software Developers – An Experience Report", Conference Presentation, 19th Conference on Software Engineering Education and Training CSEE&T 2006, Hawaii, USA, April 19-21

"Eight Years of Delivering Professional Education and Training for Software Engineering at Fraunhofer IESE: An Experience Report", Conference Presentation, 19th Conference on Software Engineering Education and Training CSEE&T 2006, Hawaii, USA, April 19-21

"Wiederverwendungsorientiertes Content Authoring nach dem Single-Source Prinzip", Conference Presentation, DELFI 2006, Fachgruppe e-Learning der Gesellschaft für Informatik, Darmstadt, Germany, September 17-20

"Regionale Netzwerke als Möglichkeit des Interorganisationalen Wissens- und Erfahrungsaustauschs", Workshop Presentation, Informatik 2006, Dresden, Germany, October 5

"Software Benutzerdokumentation mit DocBook – Teil 2: XSLT", Industry Seminar, T-Com, Darmstadt, Germany, October 17-18

Trapp, M.:
"Dynamische Adaption für die Entwicklung verlässlicher Softwaresysteme im Automobil", Presentation, Entwicklerforum Kfz-Elektronik, Design & Elektronik, Ludwigsburg, Germany, May 16

Trapp, S.:
"Blended Learning Concepts – a Short Overview", Workshop Presentation, First European Conference on Technology Enhanced Learning EC-TEL'06, Limon Hersonissou, Crete, Greece, October 1

Trendowicz, A.:
"CoBRA – Cost Estimation, Benchmarking and Risk Analysis. The Method Overview", Talk, WESoC 2006, Tokyo, Japan, February 23-27

"Software Cost Estimation Methods. An Overview", Talk, WESoC 2006, Tokyo, Japan, February 23-27

"Development of a Hybrid Cost Estimation Model in an Iterative Manner", Paper Presentation, ICSE 2006, Shanghai, China, May 20-28

Zeckzer, D.:
"Towards Empirically Validated Software Architecture Visualization", Poster Presentation, SoftVis 2006, ACM Symposium, Brigthon, UK, September 4-5

Scientific Publications[2]

Books

Münch, J.; Vierimaa, M. (eds.):
7th International Conference on Product Focused Software Process Improvement, Profes 2006, Proceedings.
Berlin, Springer-Verlag, 2006
(Lecture Notes in Computer Science 4034)

Schwenkler, T.:
Sicheres Netzwerkmanagement: Konzepte, Protokolle, Tools.
Berlin, Springer-Verlag, 2006
(x.systems.press)

Smialek, M.; **Nick, M.;** Kalnins, A.; Pooley, R.; Falb, J. (eds.):
Model Reuse Strategies. Can requirements drive reuse of software models?, First International Workshop MoRSe 2006, Proceedings.
Stuttgart, Fraunhofer IRB Verlag, 2006

Articles in Books

Atkinson, C.; **Bunse, C.;** Kamsties, E.; Zettel, J.:
Principles of UML-Based Component Modeling.
In: de Cesare, S. (ed.), et al.:
Development of Component-Based Information Systems.
Armonk, M. E. Sharpe, 2006, pp. 70-85
(Advances in Management Information Systems Vol. 2)

Bayer, J.; Gerard, S.; Haugen, O.; Mansell, J.; Møller-Pedersen, B.; Oldevik, J.; Tessier, P.; Thibault, J.-P.; Widen, T.:
Consolidated Product Line Variability Modeling.
In: Käkölä, T. (ed.), et al.:
Software Product Lines. Research Issues in Engineering and Management.
Berlin, Springer-Verlag, 2006,
pp. 195-241

Bella, F.; Forchino, F.; Kalaoja, J.; **Münch, J.; Ocampo, A.;** Negro Ponzi, M.; Torchiano, M.:
Pilot Projects.
In: Morisio, M. (ed.), et al.:
Developing Services for the Wireless Internet.
New York, Springer-Verlag, 2006,
pp. 131-156

Bella, F.; Ihme, T.; Kalaoja, J.; Kallio, P.; Negro Ponzi, M.; **Ocampo, A.;** Tikkala, A.; Torchiano, M.:
WISE Experience Pearls.
In: Morisio, M. (ed.), et al.:
Developing Services for the Wireless Internet.
New York, Springer-Verlag, 2006,
pp. 100-13

Heidrich, J.; Münch, J.; Riddle, W. E.; Rombach, H. D.:
People-oriented Capture, Display, and Use of Process Information.
In: Acuña, S. T. (ed.), et al.:
New Trends in Software Process Modeling.
Singapore, World Scientific, 2006,
pp. 121-179
(Series on Software Engineering and Knowledge Engineering 18)

John, I.:
Capturing Product Line Information from Legacy User Documentation.
In: Käkölä, T. (ed.), et al.:
Software Product Lines. Research Issues in Engineering and Management.
Berlin, Springer-Verlag, 2006,
pp. 127-159

Knodel, J.; Muthig, D.:
The Role of Rationale in the Design of Product Line Architectures – A Case Study from Industry.
In: Dutoit, A. H. (ed.), et al.:
Rationale Management in Software Engineering.
Berlin, Springer-Verlag, 2006,
pp. 297-312

Kolb, R.; Muthig, D.:
Techniques and Strategies for Testing Component-Based Software and Product Lines.
In: de Cesare, S. (ed.), et al.:
Development of Component-Based Information Systems.
Armonk, M. E. Sharpe, 2006,
pp. 123-139
(Advances in Management Information Systems Vol. 2)

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

Liggesmeyer, P.; Rombach, H. D.:
Software Engineering.
In: Bullinger, H.-J. (ed.):
Technologieführer. Grundlagen – Anwendungen – Trends.
Berlin, Springer Verlag, 2007, pp. 166-169

Ocampo, A.; Bella, F.; Münch, J.:
Software Development Processes.
In: Morisio, M. (ed.), et al.:
Developing Services for the Wireless Internet.
New York, Springer-Verlag, 2006, pp. 9-32

Rombach, H. D.; Steffens, P.:
Die Wirtschaft im Fokus. Nutzen- und branchenorientiertes eGovernment in Rheinland-Pfalz.
In: Jahrbuch Monitoring eGovernment & Verwaltungsmodernisierung Deutschland 2006 / 2007
Berlin, Wegweiser, 2006, pp. 118-119

Articles in Journals

Auer, M.; **Trendowicz, A.;** Graser, B.; Haunschmid, E.; Biffl, S.:
Optimal Project Feature Weights in Analogy-Based Cost Estimation: Improvement and Limitations.
In: IEEE Transactions on Software Engineering 32 (2006), 2, pp. 83-92

Bomarius, F.; Becker, M.; Kleinberger, T.:
Embedded Intelligence for Ambient Assisted Living.
In: ERCIM NEWS (2006), 67, pp. 19-20

Broy, M.; Jarke, M.; Nagl, M.; **Rombach, H. D.:**
Manifest: Strategische Bedeutung des Software Engineering in Deutschland.
In: Informatik Spektrum 29 (2006), 3, pp. 210-221

Bunse, C.:
Using patterns for the refinement and translation of UML models:
A controlled experiment.
In: Empirical Software Engineering 11 (2006), 2, pp. 227-267

Denger, C.:
Software-Qualität frühzeitig sicherstellen.
In: Medizintechnik 126 (2006), 4, pp. 129-135

Dörr, J.; Kerkow, D.; Koenig, T.; Olsson, T.:
Qualität in Software und Systemen: Ein praxiserprobter Ansatz zur Erhebung und Spezifikation von Nichtfunktionalen Anforderungen – und was kommt jetzt?
In: Softwaretechnik-Trends 26 (2006), 1, pp. 3-4

Falessi, D.; **Becker, M.;** Cantone, G.:
Design Decision Rationale: Experiences and Steps Ahead Towards Systematic Use.
In: ACM SIGSOFT Software Engineering Notes 31 (2006), 5, 8 pp.

Kerkow, D.; Schmettow, M.:
Neugestaltung eines städtischen Internet-Portals.
In: Der Städtetag (2006), 1, pp. 35-37

Knodel, J.; Lindvall, M.; Muthig, D.; Naab, M.:
Case Studies of Static Software Architecture Evaluations.
In: Softwaretechnik-Trends 26 (2006), 2, pp. 95-96

Kolb, R.; Muthig, D.; Patzke, T.; Yamauchi, K.:
Refactoring a legacy component for reuse in a software product line: a case study.
In: Journal of Software Maintenance and Evolution Research and Practice 18 (2006), 2, pp. 109-132

Lee, J.; Muthig, D.:
Feature-Oriented Variability Management in Product Line Engineering: Implementing feature-oriented variability modeling throughout the life cycle.
In: Communications of the ACM 49 (2006), 12, pp. 55-59

Peine, H.:
Websicherheitswerkzeuge auf dem Prüfstand.
In: ix Magazin für professionelle Informationstechnik (2006), 10, pp. 62-68

Robinson-Mallett, C.; Liggesmeyer, P.; Mücke, T.; Goltz, U.:
Extended state identification and verification using a model checker.
In: Information and Software Technology 48 (2006), 10, pp. 981-992

Schmid, K.:
A Study on Creativity in Requirements Engineering.
In: Softwaretechnik-Trends 26 (2006), 1, pp. 20-21

Trendowicz, A.; Heidrich, J.; Münch, J.; Ishigai, Y.; Yokoyama, K.; Kikuchi, N.:
Development of a Hybrid Cost Estimation Model in an Iterative Manner.
In: SEC journal (2006), 7, pp. 10-21

Contributions to Conference Proceedings

Althoff, K.-D.; **Decker, B.;** Hanft, A.; Mänz, J.; Newo, R.; **Nick, M.; Rech, J.;** Schaaf, M.:
Intelligent Information Systems for Knowledge Work(ers).
In: Perner, P. (ed.):
Advances in Data Mining. Applications in Medicine, Web Mining, Marketing, Image and Signal Mining. 6th Industrial Conference on Data Mining, ICDM 2006, Proceedings.
Berlin, Springer-Verlag, 2006, pp. 539-547
(Lecture Notes in Artificial Intelligence, Subseries of Lecture Notes in Computer Science 4065)

Bayer, J.; Bella, F.; Ocampo, A.:
Characterization of Semantic Grid Engineering.
In: Margaria, T. (ed.), et al.:
Workshop on Future Research Challenges for Software and Services, FRCSS 2006.
Vienna, 2006, pp. 112-124

Bayer, J.; Kose, M.; **Ocampo, A.:**
Improving the Development of e-Business Systems by Introducing Process-Based Software Product Lines.
In: **Münch, J. (ed.),** et al.:
7th International Conference on Product Focused Software Process Improvement, Profes 2006, Proceedings.
Berlin, Springer-Verlag, 2006, pp. 348-361
(Lecture Notes in Computer Science 4034)

Bayer, J.; Muthig, D.:
A View-Based Approach for Improving Software Documentation Practices.
In: IEEE Computer Society:
13th IEEE International Conference and Workshop on the Engineering of Computer-Based Systems, ECBS 2006, Proceedings.
Los Alamitos, IEEE Computer Society, 2006, pp. 269-278

Becker, M.; Werkman, E.; **Anastasopoulos, M.; Kleinberger, T.:**
Approaching Ambient Intelligent Home Care Systems.
In: 1st International Conference on Pervasive Computing Technologies for Healthcare 2006.
2006, 10 pp.

Bomarius, F.; Feldmann, R. L.:
Get Your Experience Factory Ready for the Next Decade: Ten Years After "How to Build and Run One".
In: **Münch, J. (ed.),** et al.:
7th International Conference on Product Focused Software Process Improvement, Profes 2006, Proceedings.
Berlin, Springer-Verlag, 2006, pp. 466-471
(Lecture Notes in Computer Science 4034)

Bunse, C.; Grützner, I.; Peper, C.; Steinbach-Nordmann, S.;
Vollmers, C.:
Coaching Professional Software Developers – An Experience Report.
In: Port, D. (ed.), et al.; IEEE Computer Society:
19th Conference on Software Engineering Education and Training, CSEE&T 2006, Proceedings.
Los Alamitos, IEEE Computer Society, 2006, pp. 123-130

Decker, B.; Nick, M.:
A Model for CBR Systems that Adapt to Rapidly Changing Context.
In: Minor, M. (ed.); Universität Trier:
8th European Conference on Case-Based Reasoning, ECCBR 2006, Workshop Proceedings.
Trier, 2006, pp. 273-286

Denger, C.; Kolb, R.:
Testing and Inspecting Reusable Product Line Components: First Empirical Results.
In: 5th ACM-IEEE International Symposium on Empirical Software Engineering, ISESE 2006, Proceedings.
Los Alamitos, IEEE Computer Society, 2006, 184-193

Denger, C.; Kolb, R.; Schulz, T.:
LifeCycleQM - Ziel- und lebenszyklusorientiertes Qualitätsmanagement wieder verwendbarer Software.
In: Statuskonferenz Forschungsoffensive "Software Engineering 2006", 2006, 13 p.

Domis, D. J.; Schäfer, C.; Trapp, M.:
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Supervisor: **Kerkow, D.**

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Jeswein, T.:
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Ganesan, D.:
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Trendowicz, A.:
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Heidrich, J.:
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Lamersdorf, A.:
The Fraunhofer IESE 2006 Award for Thesis Excellence

Kaiser, B.:
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Graf, V.:
The Fraunhofer IESE 2006 Award for Infrastructure Excellence

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External

Naab, M.:
Diploma Thesis Award, Kreissparkasse Kaiserslautern, Kaiserslautern, Germany, June

Lamersdorf, A.:
Bachelor Thesis Award, DASMA e.V., Potsdam, Germany, November

Appointments and Honors

Schmid, K.:
Professorship, University of Hildesheim, Germany, September

Bunse, C.:
Professorship, International University in Germany, Bruchsal, Germany, January 2007