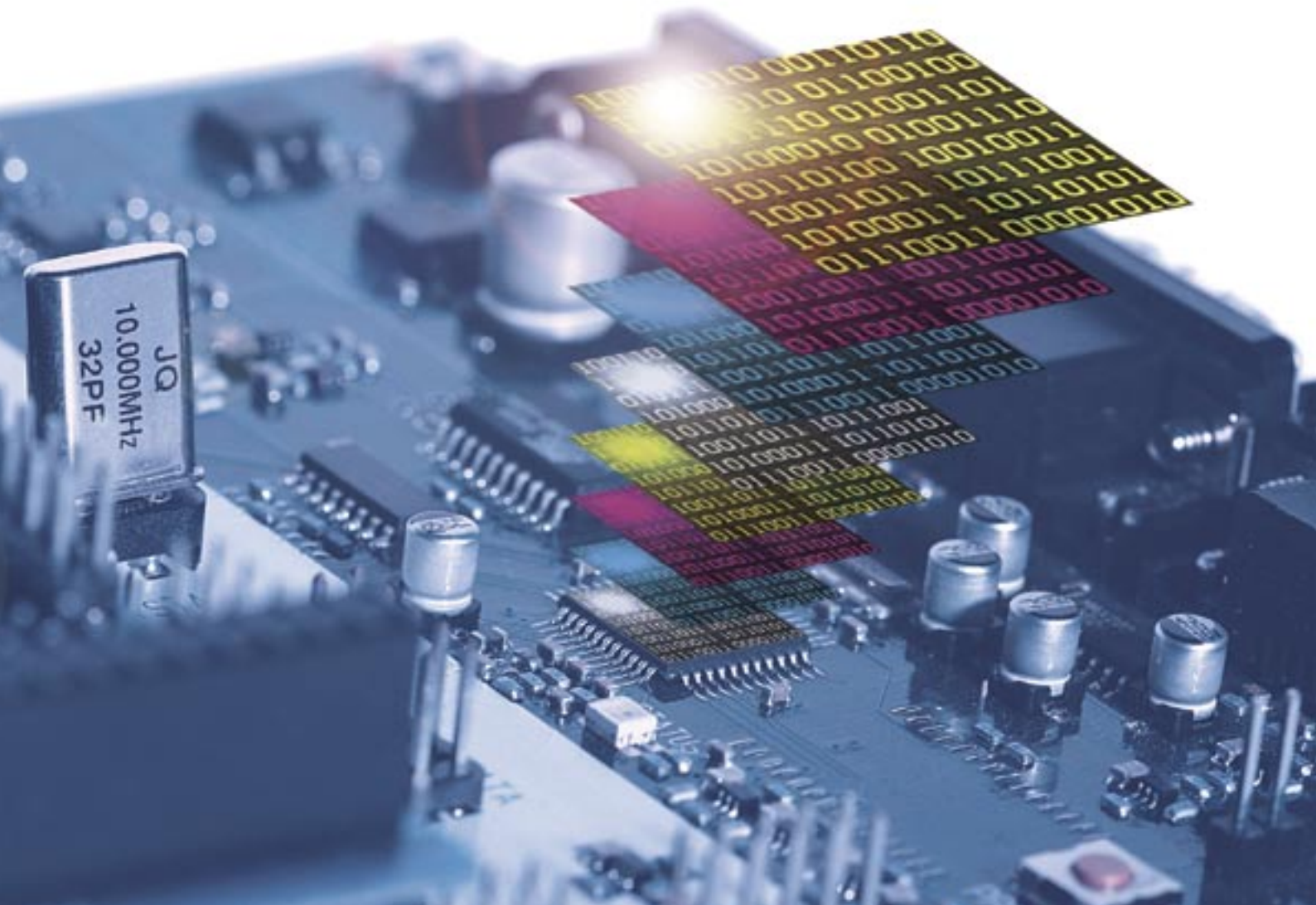




**Fraunhofer** Institut  
Experimentelles  
Software Engineering

# Annual Report 2007



# The Fraunhofer Institute for Experimental Software Engineering

## Fraunhofer Institute for Experimental Software Engineering

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### Executive Director

Prof. Dr. Dieter Rombach

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Prof. Dr. Peter Liggesmeyer

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

Fraunhofer IESE is one of the world-wide leading research institutes in the area of software and systems development. A major portion of the products offered by our collaboration partners is defined by software. These products range from automotive and transportation systems to telecommunication and telematics equipment, from information systems and medical devices to software systems for the public sector.

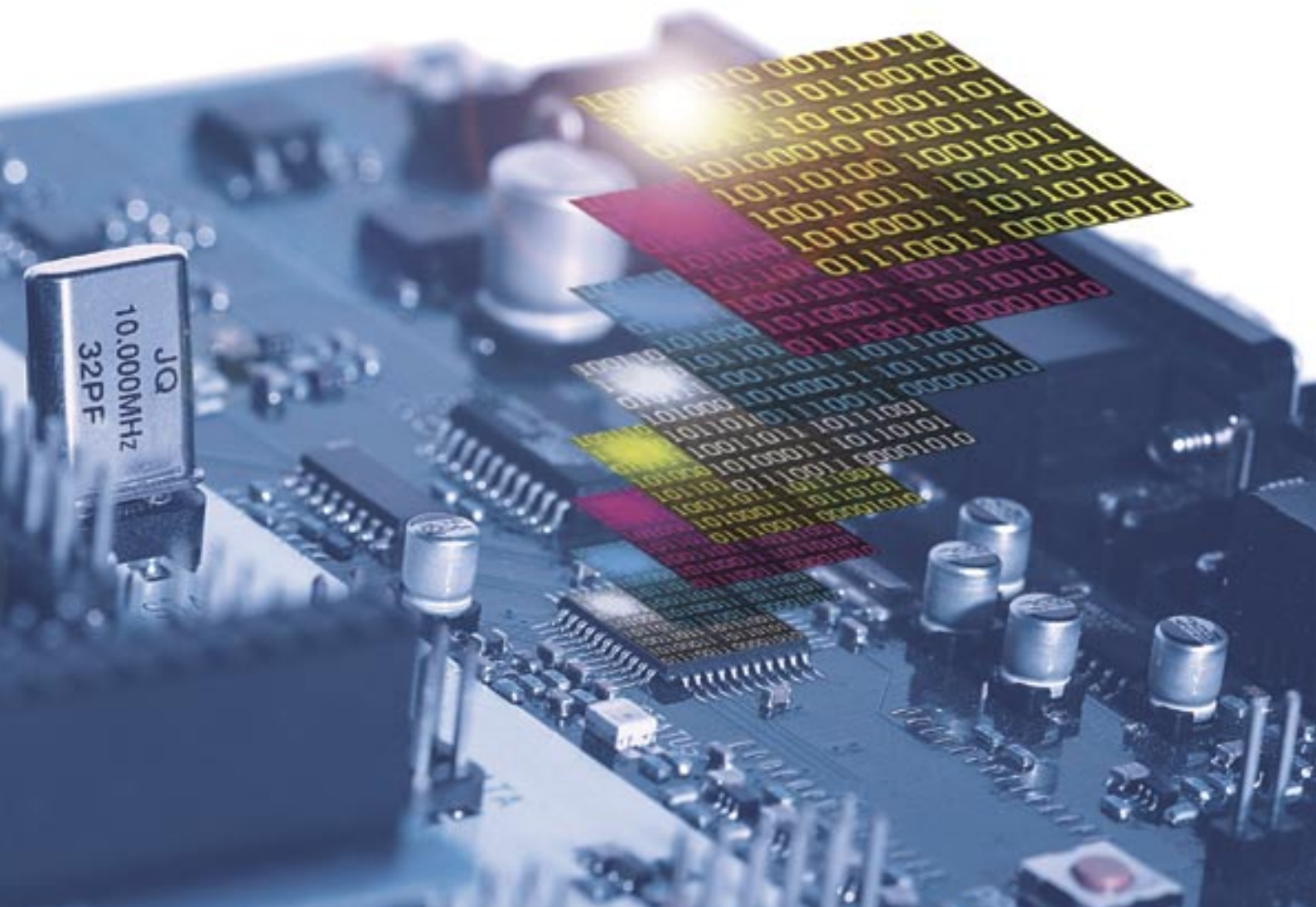
Our solutions allow flexible scaling. This makes us a competent technology partner for organizations of any size – from small companies to major corporations.

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

Fraunhofer IESE is one of 56 institutes of the Fraunhofer-Gesellschaft. Together we have a major impact on shaping applied research in Europe and contribute to Germany's competitiveness in international markets. The institute is officially a "Selected Landmark 2008" of the Germany-wide initiative "Germany – Land of Ideas".

## Annual Report 2007

Fraunhofer Institute for  
Experimental Software  
Engineering IESE



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**Fraunhofer**

## Editorial

### “Everyone wants to grow old ...

... but nobody wants to be old.” This statement contains more than the proverbial grain of truth. The facts confirm what popular wisdom says: We are getting older and older, and thanks to the advances made in medicine, our health is also better when we are older, at least statistically. And yet, many questions remain unanswered, questions that entail insecurity and fears. Will I still be able to take care of everything in the future? Will I become a burden to my relatives? Will I have to move to a senior citizens’ home? Will I be able to afford good-quality nursing care if I need it?

State-of-the-art information and communication technologies can help us obtain answers to these questions that affect all of us. This opinion was also adopted by German President Köhler when he came to visit our institute in the fall of last year. He was excited about the possibilities offered by ambient technology for all of us in our



everyday lives. At our institute, assisted living systems and intelligent living environment were presented to the head of state and to the interested public as technological implementation of the motto of his visit: “Partnership of the Generations”.

The “intelligence” of ambient applications rises and falls with the systems embedded in them, which require all the skills a software and systems engineer has in terms of functionality, safety, reliability, and usability. It is not without a reason that such systems have emerged as one focus of our research and development activities. For the numerous combinations of hardware and software, “embedded” has two different meanings: In an engineering sense, meaning embedded into everyday items, industrial plants, and means of transportation, and also in a figurative sense, in other words: embedded into everyone’s lives and thus into our society.

In light of this situation, it is easy to imagine that the importance of quality, safety, and cost efficiency in the design and production of software-based systems, while already pre-eminent today, will continue to increase even more in the future. We at Fraunhofer IESE are facing this challenge together with our partners in numerous academic and even more industrial collaborations, consortia, and development projects. Find out for yourself – just read on!

Wishing you stimulating and informative reading –

*Dieter Rombach*

Dieter Rombach,  
Executive Director  
Fraunhofer IESE

*P. Liggesmeyer*

Peter Liggesmeyer,  
Director, Fraunhofer IESE



Prof. Dr. Dieter Rombach



Prof. Dr. Peter Liggesmeyer

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## Highlights in 2007

### German President Köhler visits Fraunhofer IESE in Kaiserslautern More Quality of Life with High-Tech

“Partnership of the Generations” – this was the motto of the eighth visit by German President Horst Köhler in Rhineland-Palatinate on 7 November. In Kaiserslautern, the head of state got an impression of the high-tech competence of the Western Palatine region and paid a visit to the Assisted Living Laboratory at the Fraunhofer Institute for Experimental Software Engineering IESE. Clearly taken with the new possibilities offered by innovative information technology for more quality of life for senior citizens, Köhler used the chance to talk with the institute’s scientists.

The Assisted Living Laboratory has only been in operation officially since the year 2006, but has made rapid progress during that brief time. The engineers of Fraunhofer IESE use it to develop and test novel technologies for “intel-

ligent” living environments, which will offer optimal daily-life support to elderly people or people in need of assistance. In a presentation, President Köhler watched a realistic scenario and showed an open mind towards these systems, which provide unobtrusive assistance if needed and thus enable an independent life in people’s own homes even in older age.

The President was especially impressed by the fact that humans with their individual needs are the focus of state-of-the-art information technology research. Professor Dieter Rombach, Executive Director of Fraunhofer IESE, went even further and called this application of information and communication technology a “human science, which clearly and directly puts itself at the service of people needing help and support.” In doing so, “technical equipment is not intended at all to replace conventional care methods, but shall supplement these with additional possibilities”, stated the institute’s director.

#### Arrival in Kaiserslautern:

Institute director Prof. Dieter Rombach (in the front, far left), the Minister President of Rhineland-Palatinate, Kurt Beck, and German President Horst Köhler during the welcome speech at Fraunhofer IESE by Prof. Jürgen Nehmer (at microphone).





In the area of IT-supported assisted living systems, Fraunhofer IESE is collaborating closely with medical professionals and professional caregivers. These include the Westpfalz-Klinikum hospital and the Integrated Emergency Medical Dispatch Office Kaiserslautern. Furthermore, in the context of the research focus on Ambient Intelligence, the institute is tied into an international research consortium together with the University of Kaiserslautern, which results in optimal synergy effects for future work.

Currently, the main attention of the Fraunhofer IESE experts is focused on individualizing assisted living systems. In the future, these shall adapt even bet-

ter to different users. Intensive cooperation with patients and senior citizens at every step of the development ensures that the research and development work has the highest possible practical relevance.

A study performed by the federal government allows the conclusion that the consequences of demographic development might have a stronger impact in Germany than in other western countries. The special importance of developing functional and empirically proven systems for the care and support of elderly people, respectively people in need of assistance, was emphasized once again by the visit of President Köhler at Fraunhofer IESE.

**In case of an emergency:**

The medical director of the Westpfalz-Klinikum Kaiserslautern (right), Prof. Dr. Christian Madler, uses the context of a simulated fall to explain to the people present the possibilities of fast and systematic emergency intervention through intelligent living environments (from left to right: Prof. Dr.-Ing. Peter Liggesmeyer, Institute Director, Fraunhofer IESE; Dr. Klaus Weichel, Lord Mayor of the City of Kaiserslautern; Kurt Beck, Minister President of the state of Rhineland-Palatinate, Prof. Horst Köhler, President of the Federal Republic of Germany; Eva Luise Köhler; Doris Ahnen, Minister for Education, Science, Research, Youth and Culture of the state of Rhineland-Palatinate; Prof. Dr. Dieter Rombach, Executive Director, Fraunhofer IESE; Prof. Dr. Christian Madler, Medical Director, Westpfalz-Klinikum Kaiserslautern)



CeBIT 2007

### Fraunhofer IESE presents the Intelligent Apartment

Intelligent assisted living systems were the focus of the presentation of Fraunhofer IESE at CeBIT 2007 in Hanover. A miniature version of the institute's own Assisted Living Laboratory gave visitors interesting insights into state-of-the-art research in this highly practice-relevant area. The goal is to enable elderly persons or those requiring care to remain longer in their own homes, living a self-determined life with the support of ultra-modern information technology.

It happens when you least expect it: A sudden circulatory weakness makes an elderly person dizzy and results in a fall. But the intelligent apartment becomes

active immediately: In a realistic simulation across two fair booths, visitors were able to experience how the senior citizen's walking aid recognized the accident, how the home automation system attempted on its own to communicate with the patient, and how it finally alerted the "Emergency Medical Dispatch Office". Medical experts estimate that, in the regional environment of IESE, this technique could already be used every day to save accident victims from suffering the more serious consequences of an accident.

The Assisted Living Lab, which was introduced at the booths of the Fraunhofer-Gesellschaft and BMBF, is indeed a very special kind of laboratory environment. What appears to be hardly different from a normal living environment is equipped throughout with





In realistically detailed laboratory environments at Fraunhofer IESE, the software-based systems for the apartments of the future are developed and tested.

sophisticated sensors and electronic data processing. The objective of this effort: An apartment that proactively reacts in case of emergencies and that offers its resident the correct help at precisely the correct time, depending on the situation.

Equipment that captures data, such as RFID chips in the floor covering, motion sensors in the rooms, or everyday-type items equipped with sensors, are only parts of a much more complex overall system. The real core of the system is the software-supported networking and interpretation of the data provided by the sensors in accordance with current medical knowledge. Only this combination makes practical, context-sensitive support from the home automation system realistic.

The research performed at Fraunhofer IESE in the area of assisted living systems concentrates on the systems engineering of environments that indepen-

dently recognize and assess situations on their own, based on networked sensor data. In a very general sense, this means that people are relieved of routine tasks and thus have more time for creativity. Furthermore, dangers can be averted. This should lead to cost savings not only in the health sector. Elderly persons and those requiring care will benefit from this in a particular way through better care – an obligation for society, whose importance should increase due to the demographic changes in society.

Additional background and project reports on the topics of Ambient Intelligence and Intelligent Living Environments can be found in this annual report on the following pages, in the description of the project EMERGE starting on page 98, as well as in the foreign relations/activities section starting on page 121.

**Fraunhofer IESE presented its developments in the area of assisted living systems at CeBIT 2007.** At the booth of the Fraunhofer-Gesellschaft, the scientists had set up a miniature version of the institute's own Assisted Living Laboratory. German Federal Research Minister Annette Schavan had the possibilities of innovative living environments explained to her by the President of the Fraunhofer-Gesellschaft, Prof. Hans-Jörg Bullinger (l.), and the Chairman of the Fraunhofer Group for Information and Communication Technology, Prof. Dieter Rombach.

EADS and German Air Force get first V-Modell® XT certificate  
**Milestone for Eurofighter Software**

As the first organization worldwide, the **Systems Support Center Eurofighter (SSC)** in Manching, a collaborative institution of **EADS Deutschland GmbH** and the **German Air Force**, has become V-Modell®-XT-certified. Under the leadership of the Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern, the required conformity check was performed successfully in cooperation with the **chair of Software Systems Engineering at Clausthal University of Technology**. Stephan Miegel, manager of the SSC Eurofighter, saw the quality of the SSC's own, well-defined development processes confirmed by the result. The deputy director of SSC EF, Lieutenant Colonel Michael Prang, also affirmed that "the confirmation of conformity is an important milestone for performing military maintenance and modification measures on the Eurofighter software."

The certificate was issued in the context of a pilot project, where the organization-specific characteristics of the SSC were first determined on the basis of

document checks and workshops and then compared with the requirements according to the V-Modell® XT. In doing so, important lessons were learned for future conformity checks. The issued certificate is complete as far as the contents are concerned, but is still preliminary regarding the period of validity, since the official certification agency is currently still under construction.

Defined development processes are one requirement for engineering-style software production. For software developing organizations, success is determined by establishing and optimizing standard-conformant processes within a short period of time. Companies contracted by federal government agencies must therefore apply the V-Modell® XT in the future. To support these companies, they can get evidence of their conformity with the V-Modell® XT with the help of a certificate, respectively obtain this certification. Fraunhofer IESE and TU Clausthal are offering various services related to the V-Modell® XT, including support for the introduction and adaptation of the V-Modell® XT as well as conformity checks.

In government agencies and in many organizations, the V-Modell® XT is the guideline for the organization and performance of IT projects. Since 4 November 2004, the V-Modell® XT has been mandatory for public development projects. This is a recommendation of the Inter-Ministerial Coordination Committee to federal government agencies, which stipulates the application of the V-Modell® XT for new systems to be developed. Professor Manfred Broy from the Institute of Informatics of TU München and Professor Andreas Rausch from TU Clausthal designed this development standard together with partners such as Fraunhofer IESE in Kaiserslautern.

**Beaming faces at the presentation of the certificate:**  
 Dipl.-Ing. Michael Pirang, Lieutenant Colonel, Deputy Director, System Support Center Eurofighter;  
 Dipl.-Ing. Stephan A. Miegel, Director, System Support Center Eurofighter;  
 Prof. Dr. Andreas Rausch, Clausthal University of Technology;  
 Dr. Jürgen Münch, Division Manager Quality Management, Fraunhofer IESE;  
 Dipl.-Brmst. Andreas Schlichting, Fraunhofer IESE (from left to right).





Fraunhofer-Gesellschaft and Ministry of the Interior collaborate  
**E-Government 2.0 with Competent Support from Academia**

Reducing the burden of bureaucracy for companies, accelerating administrative processes, and performing the workflows between public administration and business fully electronically – these are important goals of the “E-Government 2.0” program, which was presented by the German Federal Government in September 2006. The **Fraunhofer eGovernment Center, an alliance of nine Fraunhofer institutes**, was given the task of providing scientific support for the program. A collaboration agreement was signed to this end in May 2007 by Federal Minister of the Interior, Dr. Wolfgang Schäuble, and Prof. Dr. Dieter Rombach, Executive Director of Fraunhofer IESE and Spokesman of the Fraunhofer eGovernment Center.

Dr. Wolfgang Schäuble, Federal Minister of the Interior, welcomed the collaboration: “E-Government is an important ingredient in the modernization of public administration and thus of great significance for Germany’s competitiveness. Here we need future-oriented development. I am glad that with the Fraunhofer-Gesellschaft, the Federal Ministry of the Interior is getting competent support from science in implementing E-Government 2.0.”

The renowned research institution will provide scientific support for the implementation of the government program with expert opinions and a workshop, and will evaluate the goals,



**Collaboration on eGovernment 2.0:** German Federal Minister of the Interior, Dr. Wolfgang Schäuble (r.) and the Spokesman of the Fraunhofer eGovernment Center, Prof. Dieter Rombach, signing the collaboration agreement.

methods, procedures, and results of E-Government 2.0. The focus shall be on addressing the target groups in accordance with their needs, since the government’s online services shall correspond to the needs of its users. In addition, the Fraunhofer eGovernment Center shall take into account developments in German, European, and worldwide eGovernment and create expert reports on selected topics from eGovernment research. The coordination at the Federal Ministry of the Interior will be done by the E-Government Competence Center, which, as the ministry’s think tank, co-designs the technological evolution of federal eGovernment.

The knowledge transfer will support the modernization of public administration, since current research results from computer science as well as from legal, economic, administrative, and social

sciences will be infused directly into the user-oriented evolution of the federal government’s eGovernment services. This will create a solid foundation for making modernized public administration viable for the future.

“We consider the collaboration agreement to be an important step towards supporting the modernization of federal public administration with the proven know-how of the Fraunhofer institutes”, was Prof. Dieter Rombach’s comment when the agreement was signed. “Our basis is the principle of user-oriented eGovernment, which makes the provable benefit for all stakeholders the criterion for technological innovation.”

Senior citizens test electronic household helpers

“ ... much easier than I thought!”

In view of the changes in demographics, age-appropriate living is a central challenge for our society. This was the motivation for the Fraunhofer Institute for Experimental Software Engineering IESE, in **collaboration with the Senior Citizens’ Office of Speyer**, to perform an extended series of tests aimed at optimizing home automation systems in the living environments of elderly people. The highly motivated participants ranging in age from 50 to 80 years turned out to be enthusiastic about the systems, which were easy to use despite their many functions. The results will become part of the current research done by Fraunhofer IESE in the area of assisted living systems; products are expected to be ready for introduction to the market in 7 – 10 years.

This was the first time that 67-year-old Helma Rieser sat in front of an interactive monitor. Her eyes concentrated on following the symbols that lit up. She knew exactly what she wanted. The tips of her fingers systematically moved

across the touch-sensitive surface; the shutters closed and the living room lights were turned off. Everything was as though Ms. Rieser was about to go to bed. An electronic service panel in combination with a sophisticated home automation system made it unnecessary for her to actually go to the switches and windows. She hardly even noticed the video camera that was watching her do all this.

The scenario was part of a scientific experiment devised by the researchers at the Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern. The issue was to optimize intelligent home automation systems for tomorrow’s senior citizens’ apartments for practical use. For this purpose, extensive tests were performed under usage conditions that were as realistic as possible. While performing different everyday tasks, the test subjects were monitored by video cameras. By analyzing the video recordings later on, the Fraunhofer IESE experts can detect possible weak points in the software control and will be able to design systems that are optimally tailored to the needs of the future users.



Ludwig Schultheis controls a virtual apartment with the interactive operating panel. Software expert Sebastian Adam from Fraunhofer IESE (left) is monitoring the experiment.





The multi-step series of tests included a total of three experiments, with the results of previous test phases becoming a part of subsequent tests as improvements. This engineering-style systematic procedure also appealed to the test subjects: "Finally, there is someone who listens and builds things that are actually useful", Helma Rieser said happily. "I have to admit that at the beginning, I was sceptical about whether I would be able to handle the technology. But then everything was much easier than I thought." The courage of these senior citizens aged 50 to 80 to get involved in these so-called "usability studies" has paid off. In 7 – 10 years already, the Fraunhofer IESE experts expect the tested equipment to be the standard for elderly people's living environments.

Despite the comparatively complex tests in the context of the study, the participants immediately recognized the benefits of the tested systems. Alfons Weindel, for example, is over 80 years old himself, and has been providing nursing care for his wife for many years. For the enthusiastic digital photographer, computers have been a part of his daily life for a long time already. This senior citizen is convinced that if only the new technology in the home were available soon, that would be "a great help in our daily lives". Until that time, more research and development work will be needed. "In practice, it is extremely important to exactly match the system to the individual and recognize the respective living situation as automatically as possible", says

Sebastian Adam of the "Assisted Living Systems" research team at Fraunhofer IESE. "This absolutely requires intensive conversations and tests with the future users of this technology, since the individual is the focus of our development," adds the computer scientist with a look at the test series already planned for the year 2008.



Prof. Dr. Dieter Rombach, Director of Fraunhofer IESE, during the opening ceremony.

Kaiserslautern chosen as site of **Fraunhofer Innovation Cluster “Digital Commercial Vehicle Technology”**

Trucks, trailers, farm machinery, tractors, construction machinery: The high-tech inner life of these motorized heavyweights is the focus of the new innovation cluster “Digital Commercial Vehicle Technology”, which was opened by the Fraunhofer-Gesellschaft, the state government of Rhineland-Palatinate, and the German Federal Ministry of Education and Research (BMBF) with a ceremony held at the Fraunhofer Center in Kaiserslautern.

The concept of innovation clusters has already proven itself well in other high-tech areas. Under the motto “Success Built on Cooperation – A faster route

from ideas to products”, the Fraunhofer-Gesellschaft has so far founded six innovation clusters in different technological areas. Just like the newly founded cluster in Kaiserslautern, they constitute a platform for cooperation among researchers and engineers from universities, research institutions, and industrial companies. They are a part of the pact for research and innovation made by the federal and state governments in 2005 with research institutions outside the universities intended at further expanding the competitiveness of German research.

“The scientific core of the innovation cluster “Digital Commercial Vehicle Technology” is formed by the Fraunhofer Institute for Experimental Software Engineering IESE and the **Fraunhofer Institute for Industrial**

**Mathematics ITWM.** On the part of industry, participants include **Daimler AG, the Volvo Group, John Deere, Robert Bosch GmbH, Haldex brake products GmbH, MB-technology GmbH** as well as **Schmitz Cargobull AG**", said the director of the cluster, Dr. Klaus Dreßler.

"Bundling the competencies of Fraunhofer ITWM and Fraunhofer IESE makes it possible to embark on new paths in virtual product development and quality assurance. In the innovation cluster, we will jointly develop new solutions for competition-relevant challenges encountered by the commercial vehicle industry", stated Dieter Rombach at the opening event.

For the state government of Rhineland-Palatinate, it was particularly significant to further expand the already existent economic potential in the area of commercial vehicles, to promote new product ideas, and, based on this, to secure

jobs in the long term, respectively create new jobs. Until 2010, the cooperation project will have a total budget of 10 million euros; in addition, it is made to last indefinitely. The Fraunhofer-Gesellschaft and the state of Rhineland-Palatinate will each contribute 3 million euros; industry will contribute 4 million euros. Furthermore, the German Federal Ministry of Education and Research has funded the preliminary phase in Kaiserslautern with 0.7 million euros.

Doris Ahnen, Minister for Education, Science, Youth, and Culture, pointed out that, with the innovation cluster "Digital Commercial Vehicle Technology", the two Fraunhofer Institutes for Experimental Software Engineering and for Industrial Mathematics will bundle the research and development competencies of science and industry in the Kaiserslautern region with the objective of achieving tighter integration of development and manufacturing processes with the usage and monitor-

ing of commercial vehicles "Such a platform for exchange and cooperation between researchers and developers from universities, research institutions, and companies provides an excellent option for further development of this region", said Ahnen.

With its tasks and objectives, the new cluster will perfectly integrate itself into the research landscape of Kaiserslautern as a center of technology and science. "The scientific development in Kaiserslautern is a one-of-a-kind success story and proves that investments into science and research are investments into the future", the minister declared.

Minister for Economics Hendrik Hering welcomed the fact that the competitiveness of the commercial vehicle industry, which is so important for Rhineland-Palatinate, will be further strengthened by the innovation cluster. "The initiative picks up on the activi-



**During the opening ceremony**  
(from left to right):

Ralf Kalmar, Fraunhofer IESE

Prof. Dr. Dieter Rombach, Executive Director, Fraunhofer IESE

Hendrik Hering, Minister for Economics, Transport, Agriculture and Viniculture of the state of Rhineland-Palatinate

Doris Ahnen, Minister for Education, Science, Youth and Culture of the state of Rhineland-Palatinate

Dr. Klaus Dreßler, Fraunhofer ITWM, Director of the Innovation Cluster DNT

Prof. Dr. Ulrich Buller, member of the Executive Board of the Fraunhofer-Gesellschaft

Bernhard Walter, VOLVO Construction Equipment

Prof. Dr. Dieter Prätzel-Wolters, Executive Director, Fraunhofer ITWM





**Commercial vehicle en miniature:**

Dr. Klaus Dreßler, Fraunhofer ITWM, Director of the Innovation Cluster DNT

Doris Ahnen, Minister for Education, Science, Youth and Culture of the state of Rhineland-Palatinate

Hendrik Hering, Minister for Economics, Transport, Agriculture and Viniculture of the state of Rhineland-Palatinate

Ralf Kalmar, Fraunhofer IESE, Project Manager (from left to right).

ties of the already existent commercial vehicle cluster and complements them.” Based on the initiative of the Ministry for Economics, the University of Kaiserslautern, and Daimler AG, the Commercial Vehicle Cluster Südwest, abbreviated CVC, was initiated in the fall of 2005. This cluster in southwest Germany aims at bridging the gap between science and industry. CVC and the new innovation cluster will be closely intertwined.

The proportion of IT systems and the use of computer science and simulation during vehicle development and production are constantly increasing. “Therefore, I expect that this research and development cluster will make a major contribution to increasing the competitiveness and competence of our industrial companies in this region along the entire value chain”, the minister continued. CVC and the new

innovation cluster would therefore receive support. Additional state instruments for promoting industry, such as technology promotion for individual companies, promotion of innovation assistants, or the founder’s support program FiTour would be employed as flanking measures.

The current project activities of the Fraunhofer institutes involved, together with companies from the commercial vehicle domain, constitute the basis for the completely practice-oriented work of the new innovation cluster. Fraunhofer ITWM will mainly concentrate on processes for virtual product development. Currently, projects are running at the institute with a series of well-known commercial vehicle manufacturers from the region, focusing on the topic of “Vehicle Simulation under Operating Stress”. This includes, for example, calculations on the lifespan



of a tractor-trailer axle; different axle connections are compared here to decide which variant will be built as a prototype. In the area of rail vehicles, ITWM has developed software for an undercarriage monitoring crosstie, which detects and reports overheated axle bearings and frozen brakes on passing trains.

Fraunhofer IESE is focusing on the realization of zero-defect software in the area of development and product planning. Since its founding in 1996, Fraunhofer IESE has maintained intensive collaboration with well-known manufacturers and suppliers in the commercial vehicle domain. Topics focus on supporting manufacturers in efficiently realizing software for various vehicle variants, improving the diagnosability of the vehicles, and efficiently detecting software defects in control units prior to production.

In the cluster, work on projects takes place on various time scales, which include the risky phase of pre-research as well as the development of concrete methods and their transfer into real projects of the industrial partners. In the context of workshops and events, stakeholders regularly exchange up-to-date research results and new challenges.

Other synergies are used in the interdisciplinary collaboration with the Center for Commercial Vehicle Technology at the University of Kaiserslautern as well as with the Commercial Vehicle Cluster and its working groups.

Further information:

[nutzfahrzeugcluster.fraunhofer.de](http://nutzfahrzeugcluster.fraunhofer.de)



**Kaiserslautern Racing Team e.V. moving into offices at the Fraunhofer Center  
Racing Fever Hits Engineering Students**

The Kaiserslautern Racing Team e.V. – in brief: KaRaT – is currently getting ready for taking part in the European Formula Student competitions next year by building its own race car. The Fraunhofer Institute for Experimental Software Engineering IESE as a founding member of the Science Alliance Kaiserslautern e.V. is providing the student racing team with office space at the Fraunhofer Center for use as a central planning office. Construction work has been going on at full speed since July; the self-designed vehicle is expected to be finished at the beginning of 2008. The enthusiastic future engineers are looking at May 2008 for their first official race.

The new KaRaT office is bustling with activity. Between construction drawings, computers, and models, Andreas Rieser, chairman of KaRaT e.V., has reason to be happy: “The offer made by Fraunhofer IESE, to provide us with an office here at the Fraunhofer Center, arrived just at the right time.” The optimal working conditions with computer, printer, and telephone give the project the necessary kick: “My student office was indeed a little small for more than a dozen people”, adds Rieser and grins. After the project was presented to the chancellor of the University of Kaiserslautern, Stefan Lorenz, things went very fast: “He was enthusiastic about our idea and got in touch with Professor Rombach from Fraunhofer IESE. Now we can plan and design efficiently”, says Andreas Rieser, sketching what will come next.

**Young design engineers with great plans:**  
The self-designed race car is expected to be operational by January 2008.



In terms of size and performance, the vehicles roughly correspond to those of the Formula 3; they are no toys: "This has nothing to do with model kit building", explains the chairman of KaRaT e.V. "We are designing a fully functional race car to be built in light-weight construction mode and powered by a motorcycle engine with about 90 HP. In order for us to move as fast as possible, we decided from the start to use a chassis made from carbon fiber composite material." Among experts, such a "monocoque" is considered a special challenge, since it is hard to calculate and does not forgive any mistakes made during construction.

"One has to consider that such a project with an overall volume of about 70,000 euros cannot be handled alone", says Jochen Friedrich, financial manager and marketing boss of KaRaT e.V. 53 students, including 5 women, are working in six groups on engine, chassis, electronic control, transmission and clutch as well as on project budgeting and marketing. The University of Kaiserslautern provides support for their work with know-how and workshop facilities.

KaRaT e.V. cooperates with the Institute for Construction in Mechanical and Device Engineering regarding the assembly of the vehicle; the carbon fiber chassis is being built together with the Institute for Composite Materials IVW following a CAD design created in cooperation with the Institute for Virtual Product Development. The Institute for Manufacturing Engineering and Production Management will provide competent support for the necessary mold construction; the Contact Office for Information and Technology (KIT) at the University of Kaiserslautern provides assistance in the form of industrial and press contacts. "We are constantly



**Design study:**  
So far, the steering wheel only exists as a clay model – the control and display elements are already in place.

looking for more companies that want to commit themselves", states Jochen Friedrich, "so that we can participate in our first race in May 2008, as planned".

The Formula Student is the German equivalent of the Formula SAE, which was founded in 1981 by the American Society of Automotive Engineers SAE with the objective of improving the university education of engineers. The competition aims at building and operating a fully functional race car. Last year, it took place in Germany for the first time.

Further information:

[www.fs-kl.de](http://www.fs-kl.de)



EUROCAT GmbH and Fraunhofer IESE offering continuing education with certificate

**Series of Seminars on “Development of Medical Device Software” has Started**

On 29 October, the first seminar entitled “Basics of Standard-Conformant Software Development” took place in Stuttgart as part of a new series of seminars on “Development of Medical Device Software”. **EUROCAT Institute for Certification and Testing GmbH**, which is accredited as an inspection and certification institute, and the Fraunhofer Institute for Experimental Software Engineering IESE have collaborated on developing a continuing education program designed specifically for engineers and managers who want to work as software developers or quality managers in the medical systems domain, or who are already work-

ing in that domain and want to expand their software engineering skills in a regulated environment.

With their different topics, the six on-site events of this series of seminars cover all core areas of medical device software and systems development beyond the actual implementation. Focus areas include modeling of highly efficient development processes, architecture designs of medical systems software, as well as configuration and risk management during the development of critical systems. The curriculum takes into account the applicable international regulatory requirements and contains numerous practical examples and exercises. Participants who attend all of the events offered in this series of seminars will get a qualified certificate upon passing an examination. Since the topic areas are self-contained, it is also possible to attend single seminars from the series.





The successful combination of concentrated competence in best-practices software development and far-reaching experience regarding the inspection and certification of software in terms of international regulatory requirements on medical devices makes these seminars stand out from the multitude of continuing education and training events on the market. The lecturers do not merely teach theoretical knowledge. Thanks to numerous collaborations and projects with companies from the medical systems and IT domain, they have solid knowledge regarding regulations and standards, and the experience base of the application-oriented practitioner.

In the first seminars, developers and quality managers from eight different companies have already used the opportunity to receive continuing education.

The seminars are being held between October 2007 and October 2008 at modern conference venues, with each seminar being offered once in Stuttgart and once in Frankfurt/Main. The series, including the certificate examination, can be booked at an attractive package price. The selected partner hotels are offering participants special conditions for overnight stays. Registration can be made at any time at [www.medizinprodukte-software.de](http://www.medizinprodukte-software.de).



**Unimaginable without software:** Medical products must work reliably under any circumstances. Therefore, system development in this area is subject to many regulations that the software experts must know.

Prof. Jürgen Nehmer retires  
**First Senior Professor Appointed in  
Rhineland-Palatinate**

He can look back upon a long and fulfilled career: Prof. Dr. Jürgen Nehmer, professor at the University of Kaiserslautern for many years and scientific advisor to the Fraunhofer Institute for Experimental Software Engineering IESE, was honored with a festive retirement ceremony held at the Fraunhofer Center in Kaiserslautern on 13 July 2007.

The event saw VIPs from politics and academia take a retrospective look at the life of the jubilarian. The state of Rhineland-Palatinate was represented by the Minister for Education, Science, Youth and Culture, Doris Ahnen. Speaking for the University of Kaiserslautern, where Professor Nehmer had worked and taught since 1979, were the President of the University, Professor Helmut Schmidt, and the Dean of the Department of Computer Science, Professor Reinhard Gotzhein. Then, as the first holder of a university chair

ever, Professor Nehmer received the senior professorship of the state of Rhineland-Palatinate from the hands of Minister Doris Ahnen and Professor Helmut Schmidt.

After a musical intermezzo, Professor Dorothea Wagner, incumbent Vice-President of the German Research Association DFG, praised her predecessor for his numerous meritorious services. Colleagues of Professor Nehmer during his scientific career, such as Professor Friedemann Mattern from ETH Zurich or Dr. Anastase Kimonyo from the Kigala Institute of Science Technology and Management (KIST) in Rwanda, gave interesting talks to enrich the event, which was held under the motto "Perspective".

The scientific talk was given by the renowned software expert Professor Manfred Broy from the Technical University of Munich. The group Chantal from Alzey provided the appropriate artistic atmosphere for the event with its "concertante music from nine centuries".



Prof. Jürgen Nehmer was honored with a festive retirement ceremony.



In honor of Prof. Nehmer, a room at the Fraunhofer Center was named after the jubilarian. Minister Doris Ahnen and university president Helmut Schmitt attended the ceremony together with other guests in the atrium in front of the future "Jürgen Nehmer Room".





The group Chantal provided an appropriate artistic setting for the event held in the auditorium of the Fraunhofer Center.

Jürgen Nehmer, born in 1942, studied electrical engineering in Karlsruhe, where he also earned his Ph.D., and then gained far-reaching practical experience in industry. He became a world-leading expert for the development of software-based systems with the highest safety requirements. The most important stations in Professor Nehmer's career include his membership in the German Scientific Advisory Board, his Vice-Presidency of the German Research Association, and his function as Technology Ambassador for the city of Kaiserslautern.

In 2004, Professor Jürgen Nehmer was honored for his services to research and teaching by being awarded the Service Medal of the state of Rhineland-Palatinate. He will continue to be closely connected to science, evidenced among other things by his activities as an advisor for Fraunhofer IESE. At the Fraunhofer Center in Kaiserslautern, a room was named for him in order to commemorate this outstanding scientist.



Minister Doris Ahnen and university president Prof. Helmut Schmitt awarded the first senior professorship of the state of Rhineland-Palatinate.



**A trip to the third dimension:**  
The participants of Girls' Day 2007 with their tutors Timo Klein (l.) and Dr. Dirk Zeckzer (r.) from the visualization research area after an experiment in virtual 3D worlds.

**Girls' Day at Fraunhofer IESE  
Make Way for Future Female  
Scientists!**

Once again, Fraunhofer IESE opened its doors in the context of Girls' Day, which is held Germany-wide every year. After a brief introduction to Fraunhofer IESE given by the institute's equal rights representative, Ms. Justine Weidenbach, the day started with exciting information provided first-hand.

Female apprentices and scientists presented themselves and their areas of work at the institute. The participants learned which type of apprenticeship leads to which type of work profile at a scientific institution like Fraunhofer IESE. There was plenty of opportunity to get answers to questions right on the spot, in an open and relaxed atmosphere.

After a brief tour of the building and the exhibition areas, a visit to the Assisted Living Laboratory provided an outlook on how innovative information technology will fundamentally change people's everyday lives in the future. Practical encounters with science and technology followed: Functioning personal computers were assembled, and entire cars were disassembled virtually.

During a joint lunch, the participants had a chance to let the certainly eventful morning pass in review. Fraunhofer IESE is already looking forward to welcoming many young and interested female researchers in the future!



**Eager and fully concentrated:**  
Despina Stefanidou (l.) and Milena Negrinotti are working on system integration.

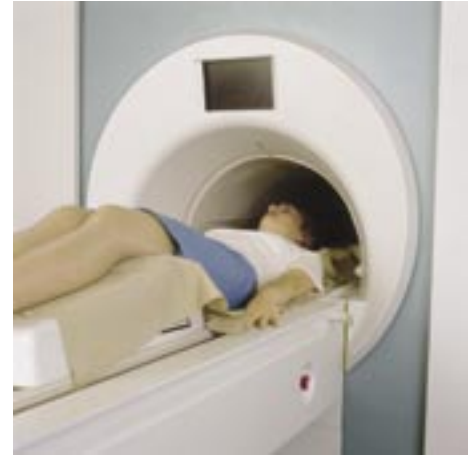
## Focus on Health Care and Medical Systems

The relatively new business area "Health Care and Medical Systems" at Fraunhofer IESE has presented itself to a wide professional audience in the context of various conferences and trade fairs. On 5 and 6 September, the institute presented its extensive offerings on Software and Systems Engineering in the area of medical systems at the "IT Trends in Medicine 2007" trade fair in Essen. One focus of the event was on electronic health records and the increasing amount of networking in medical systems. Seen against this background, the research areas of Fraunhofer IESE, such as reliable and flexible system and software architectures as well as the usability of software-based systems, are of particular relevance. By applying the institute's own technologies in a systematic and goal-oriented manner, these systems can be developed with provable functional and application-oriented quality, and very efficiently at the same time. New processes and approaches developed by the institute were discussed

with experts and industry representatives, resulting in very promising ideas for a combination of services offered by electronic health records with applications of the research area Ambient Assisted Living of Fraunhofer IESE.

On 26 and 27 September, the business area presented itself at the annual conference of the German Association of Biomedical Engineering in Aachen. Matched to the interests of the professional audience from the area of electromedicine, Fraunhofer IESE presented processes and approaches for developing embedded software that meets the strictest requirements on safety, reliably excluding any risk for patients, users, or the environment. Using the institute's innovative approaches, safety analyses for software can be systematized and partially automated. Manufacturers of medical systems can thus obtain the required safety evidence for their software in a much more efficient way.

Current dates of trade fairs and conferences in which the business area Health Care and Medical Systems will take part can be found on the website of Fraunhofer IESE [www.iese.fraunhofer.de](http://www.iese.fraunhofer.de).







**Ambient Intelligence in Rhineland-Palatinate was the motto of the Technology Day 2007.**

The opening speech was held by the Minister for Education, Science, Youth and Culture of the state of Rhineland-Palatinate, Doris Ahnen.

“Technology Day 2007” at Fraunhofer Center in Kaiserslautern

**Ambient Intelligence in Practical Use**

Supporting people with the help of intelligent technical systems is the goal of “Ambient Intelligence”. Reason enough to take a closer look at this important research topic spanning several disciplines. The time to do this was during the Rhineland-Palatinate “Technology Day 2007” at the Fraunhofer Center in Kaiserslautern.

“Researchers, students and entrepreneurs have come to Kaiserslautern because the issue is highly relevant and important for academia, industry, and society”, said Doris Ahnen, Minister for Education, Science, Youth and Culture, at the opening of the one-day event.

Ambient Intelligence technology provides intelligent, networked, and computing environments. New kinds of user interfaces adapt to the situation at hand and support users in different living environments.

“By now, Ambient Intelligence has produced a multitude of products that assume important roles in our lives, such as vehicle assistance systems that take over more and more safety functions from the driver”, explained Ahnen.

Since 2003 – “when hardly anyone knew what this term means” –, the state of Rhineland-Palatinate has acknowledged the importance of Ambient Intelligence by establishing a research focus in Kaiserslautern. Other universities, research institutions, and companies in the state are also working on this topic of the future.



“The multitude of work areas involved reflects the complexity of this research project. Although Kaiserslautern occupies the leading role as far as the scientific part is concerned, a lot of development work is also being done at the universities of Koblenz-Landau and Trier, and at the University of Applied Sciences Trier. The work done in these different locations is complementary in an ideal way”, the minister stated.

Neither any single site nor individual universities can be competitive across all research areas simultaneously. Therefore, the topic “Ambient Intelligence” with the research focus in Kaiserslautern and the complementary supplement provided by the initiatives in Koblenz und Trier is a very good example of cross-site collaboration in Rhineland-Palatinate regarding an important issue of the future.

“The challenges will consist of further concentrating and sharpening the research competencies existing at the universities and research institutions while balancing mutual competition

and joint collaboration. Our research and technology policy emphasizes further evolution of these existing strengths and, at the same time, networking these central research areas with an interdisciplinary environment that supports and promotes them”, the minister added.

The “Technology Day 2007”, which, after its successful premiere in Mainz at the end of the previous year, was held for the second time, served to make the Ambient Intelligence activities and competencies in Rhineland-Palatinate visible and to contribute to creating a tighter network among the stakeholders in academia and business.

An exhibit held concurrently showed the great variety of projects and products “Made in Rhineland-Palatinate”. A total of 38 exhibitors from industry, collaboration projects between academia and industry, as well as poster presentations provided an impressive reflection of the quality and extent of the activities in this area.



The accompanying technical exhibition in the atrium gave small and medium-sized companies a chance to present their products in context.



Exhibits by the University of Kaiserslautern included IT-supported training systems for athletes and new approaches in mobile robotics.

**On the podium of the Fraunhofer Center’s auditorium:**

Prof. Wolfgang Wahlster (l.) from the German Center for Artificial Intelligence, Prof. Dieter Rombach from Fraunhofer IESE, and Prof. Lothar Litz from the University of Kaiserslautern.



Strategy presented for business-oriented eGovernment  
**Business Sector Meets Public Sector – in the Rhine-Neckar Metropolitan Region**

In October 2007, the Rhine-Neckar metropolitan region presented its strategy of business-oriented eGovernment in the context of the regional conference “Business Sector Meets Public Sector”. The strategy’s empirical basis is a study of regional business performed by Metropolregion Rhein-Neckar GmbH together with Fraunhofer IESE.

In the three German states that make up this metropolitan region – Baden-Württemberg, Hesse, Rhineland-Palatinate – manufacturing companies were surveyed and those administrative processes were identified whose IT implementation promises to yield a high benefit potential for business and the public sector. The screening method developed by Fraunhofer IESE, which had already been used successfully in projects on the state level, was applied to determine the eGovernment suitability and worthiness of business processes at the interface with the public sector.

After the method had been adapted to the specific needs of the metropolitan region, processes with a high potential for eGovernment could be identified during the course of just a few months. Four of those affect mostly large manufacturing companies. They include construction approval processes, approvals in accordance with the Federal Immission Control Act, water rights approvals, as well as reporting duties of companies towards public agencies. 20 of the processes identified primarily affect small and medium-sized companies, and include not only construction approval processes, but also traffic control processes, processes for awarding public contracts, or information from public geo registries and property registries.

After business has now given a clear signal for regional eGovernment, the concrete implementation of the eGovernment strategy is being prepared in dialog with the municipalities.

**Picturesque landscapes and urban city life with efficient public administration:**

In the Rhine-Neckar metropolitan region, business-oriented eGovernment shall rationalize approval processes and information requests from registries, among others.



MetriKon 2007 at Fraunhofer Center in Kaiserslautern

### Software Measurement for Software Professionals

An important date for all software developers, decision-makers, and engineers in the IT domain: On 15 and 16 November 2007, the Software Metrics Conference MetriKon 2007 took place at the Fraunhofer Center in Kaiserslautern for the second time already. The professional conference organized by the German-Speaking User Association for Software Metrics and Effort Estimation (DASMA e. V.) offered a program of international presentations featuring contributions from state-of-the-art research and experience reports from industrial application in practice. The co-located professional exhibit provided an opportunity for discussion with specialized service and tool providers.

International professional presentations by experts in their field, hailing from institutions such as the Fraunhofer Institute for Experimental Software Engineering IESE or the universities of Berlin and Heidelberg, were given, and reports were delivered by experienced practitioners from renowned companies such as Daimler, Robert Bosch, or IBM – to name but a few. Furthermore, the opportunity was provided to participate in tutorials on software measurement processes and cost estimation. Prior to the conference, there was a chance to take certification examinations for the COSMIC Full Function Point Method as well as for the IFPUG Function Point Analysis.

This trend-setting professional conference is the only one of its kind in Germany that focuses on measurement, and is therefore the place to meet for international specialists from industry and research. The number of participants, which continues to increase year after year, is proof of the great significance of these issues for the entire information and communication industry. In a dense program, practitioners and decision-makers can obtain information about the state of the art of scientific research and get valuable ideas for their own organizational practice from the intensive exchange with application professionals from industry.

Traditionally, contributions at MetriKon conferences have comprised aspects such as comparison, introduction, and evaluation of goal-oriented software metrics as well as practical experiences with industrially used methods for estimating the development effort in software projects. Special focus is given to quantitative project management and controlling issues as well as to ways of

providing tool support for selected processes. Work done by ambitious next-generation scientists is not overlooked – which is reflected by the award given to the best diploma thesis in the area of software metrics and effort estimation. The award, endowed with 1000 euros, was presented for the fifth time already in the context of an evening event held at the end of the first conference day.

If you were unable to make it to Kaiserslautern to attend MetriKon, you should mark your calendar for ESEM 2008: As a co-founder of the “International Software Engineering Research Network” (ISERN), Fraunhofer IESE will organize the largest international conference on “Empirical Software Engineering and Measurement” in Kaiserslautern on 9 and 10 October 2008. This will be another event where all renowned international experts dealing with software measurement will gather.

Further information:

<http://metrikon.de>



Software and systems engineering for experts  
**IESE Academy starting in 2008 with Top-Quality Seminar Program**

Under the motto "We Make Technology Transfer a Reality", the Fraunhofer IESE Academy will offer seminars on the newest trends and developments in Software and Systems Engineering starting in 2008.

The seminars are geared towards decision makers, project managers, and interested employees from the IT domain. The series of seminars during the first half of the year will start with the topics "Quantitative Management for Software-based Organizations" and "Software Quality through Model-based Testing".

In the seminars and workshops, renowned experts from industry and academia will teach up-to-date content representing innovation and new paradigms. The focus of the seminars will be oriented towards the business areas and competence areas of Fraunhofer IESE. Participants will learn first-hand which sustainable improvements organizations developing software and systems can achieve through the practical application of state-of-the-art research results.

Software and systems technologies are evolving continually. The methods for their design, implementation, and quality assurance are also subject to continual changes. The IESE Academy builds a bridge between theory and practice by making use of the extensive know-how and the multitude of experiences of Fraunhofer IESE, one of the world-leading research institutes in this area.

Further information and registration:

[iese-akademie.fraunhofer.de](http://iese-akademie.fraunhofer.de)

**IESE-Akademie**

Fraunhofer-Zentrum  
Kaiserslautern

**Seminare für  
IT-Professionals**

Seminarprogramm  
1. Halbjahr 2008

**Fraunhofer** Institut  
Experimentelles  
Software Engineering





Learntec 2007

### Modern Content Engineering

From 13 to 15 February 2007, Fraunhofer IESE presented itself at the joint booth of the Fraunhofer-Gesellschaft at the Learntec educational fair in Karlsruhe with a wide range of services and tools to support professional documentation- and training projects. The focus was especially on single-source publishing approaches for the efficient development of process descriptions, manuals, and training media.

Everyone knows this problem: Independent of the medium used for a publication, the actual information contained in handbooks, aids, process descriptions, guidelines, operating instructions, or warnings remains practically identical. Yet, in practice, these are often developed multiple times, and a lot of effort is spent on maintaining them.

The solution offered by Fraunhofer IESE: Content Engineering! Here, content is engineered according to systematic and team-oriented processes. This can be planned and repeated, and mostly follows the principle of „Divide-and-Conquer“. The focus is on the single-source publishing approach: Information is captured only once and can be published in random combinations and media formats. This supports teamwork, saves effort for development and maintenance, and increases the consistency of the documents.

At the dm-Arena in Karlsruhe, Fraunhofer IESE also presented its entire range of methodological support in the development of high-quality training media, which is based on many years of experience in the engineering-style conception, realization, and evaluation of qualification solutions.

Further information:

[www.learntec.de](http://www.learntec.de)



Institute Director Prof. Peter Liggesmeyer delivering his keynote on the occasion of the 10th anniversary meeting of STI e.V.

STI Annual Assembly in Kaiserslautern  
**10-Year Anniversary of Software  
 Technologie Initiative e. V.**

Under the motto “10 Years of STI e. V. – Software Engineering in the Course of Time”, the STI Annual Assembly took place in Kaiserslautern. The meeting held in the prestigious setting of the Fraunhofer Center once again offered numerous ideas, a lot of information, and many discussions on current challenges in the IT domain.

The Software Technologie Initiative e. V. has been in existence for ten years. During this decade, which was characterized by mutual exchange as well as by the transfer of know-how and technology, there have been many trend-setting developments in the area of software and systems engineering. Central standards such as the UML were first adopted ten years ago; the paradigm of object orientation started its triumphant success. The evolution of technologies, method, and tools is

making continual strides. If you want to be at the forefront of modern developments, you can hardly pass up the most recent trends such as model-driven development, service-oriented architectures, and Web 2.0. The STI e. V. Annual Assembly offered an opportunity for everyone interested to obtain comprehensive information and exchange ideas with users and experts.

“10 years of Software Technologie Initiative e. V. are a reason to celebrate, to look back at what we have achieved, and to formulate new exciting goals”, summarized Prof. Dieter Rombach, member of the Board of Officers of STI e. V. and Executive Director of the Fraunhofer Institute for Experimental Software Engineering IESE. “During the past 10 years, we have managed to establish a strong local network in the area of information and communication technologies. In the future, the challenge will be to increasingly turn this bundled know-how into a motor for driving other domains as well”, added Prof. Rombach.



Further information:

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

## Automotive Software Engineering by Fraunhofer IESE

Numerous Fraunhofer projects accelerate and simplify engineering processes in automotive development and offer interesting new perspectives for the construction of vehicle parts and the development of software systems.

In the year 2007, Fraunhofer IESE presented its competencies in the area of Automotive Software Engineering at the 62nd International Motor Show IAA in Frankfurt and at Embedded World 2007 in Nuremberg, among others.

Software systems, in particular, are increasingly assuming control over important vehicle functions that impact the safety of both passengers and motorists, cyclists, and pedestrians. Therefore, the level of quality and safety requirements placed on these systems must be particularly high. Fraunhofer IESE is developing innovative and future-proof concepts for safe software systems in automobiles and exhibited a concept



car on the scale of 1:5 to demonstrate how complex systems can be realized safely, yet cost-efficiently.

During her tour of the future trends conference Tomorrow+ at the newly opened BMW World in Munich, Bavaria's Minister of Economic Affairs Emilia Müller lets software expert Thorsten Keuler explain the software in the BMW Concept Car (scale 1:5) (from left to right: Thomas Keuler (IESE), Minister Emilia Müller, Dr. Manfred Danglmaier (IAO), Prof. Dr. Josef Nassauer (Bayern Innovativ)).



## Fraunhofer IESE and its Network Partners

### International Research Networks

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

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

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



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



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](http://www.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 für Experimentale Software Engineering IESE, Kaiserslautern
- Fraunhofer-Institut für Informations- und Datenverarbeitung IITB ("Fraunhofer Institute for Information and Data Processing"), Karlsruhe
- Fraunhofer-Institut für Software und Systemtechnik ISST ("Fraunhofer Institute for Software and Systems Engineering"), Berlin
- 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-style principles. Its primary goals are the establishment of a community of software engineering experts and professional users as well as the creation of an Internet portal that makes the 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.

Further information:

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



## Industrially-funded Collaborations

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

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

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

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

and practice, STI e. V. is the regional platform for direct, unfiltered exchange of knowledge, experience, and information in the area of software development.

Objectives:

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

### Contact at Fraunhofer IESE

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# The Fraunhofer-Gesellschaft

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 Kuala Lumpur, Malaysia  
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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 future-oriented research projects with the aim of finding innovative solutions to issues concerning the industrial economy and society in general.

Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, 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.



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**

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



The man behind the name:  
**Joseph von Fraunhofer**

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

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

## Fraunhofer IESE Groups and 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 sixteen institutes, 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](http://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
- Transport and Mobility
- Culture and Entertainment
- E-Business
- E-Government
- Production
- Digital Media
- Software
- Security
- Communication Systems
- Finances

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#### Fraunhofer eGovernment Center





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

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

Each institute in the eGovernment Center has many years of experience

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

performed in cooperation with other institutes of the Fraunhofer eGovernment Center when appropriate.

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#### Fraunhofer Traffic and

## Transportation Alliance

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



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

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**Fraunhofer** Verbund  
Verkehr





## Fraunhofer Ambient Assisted Living Alliance

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

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



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

### Business areas

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

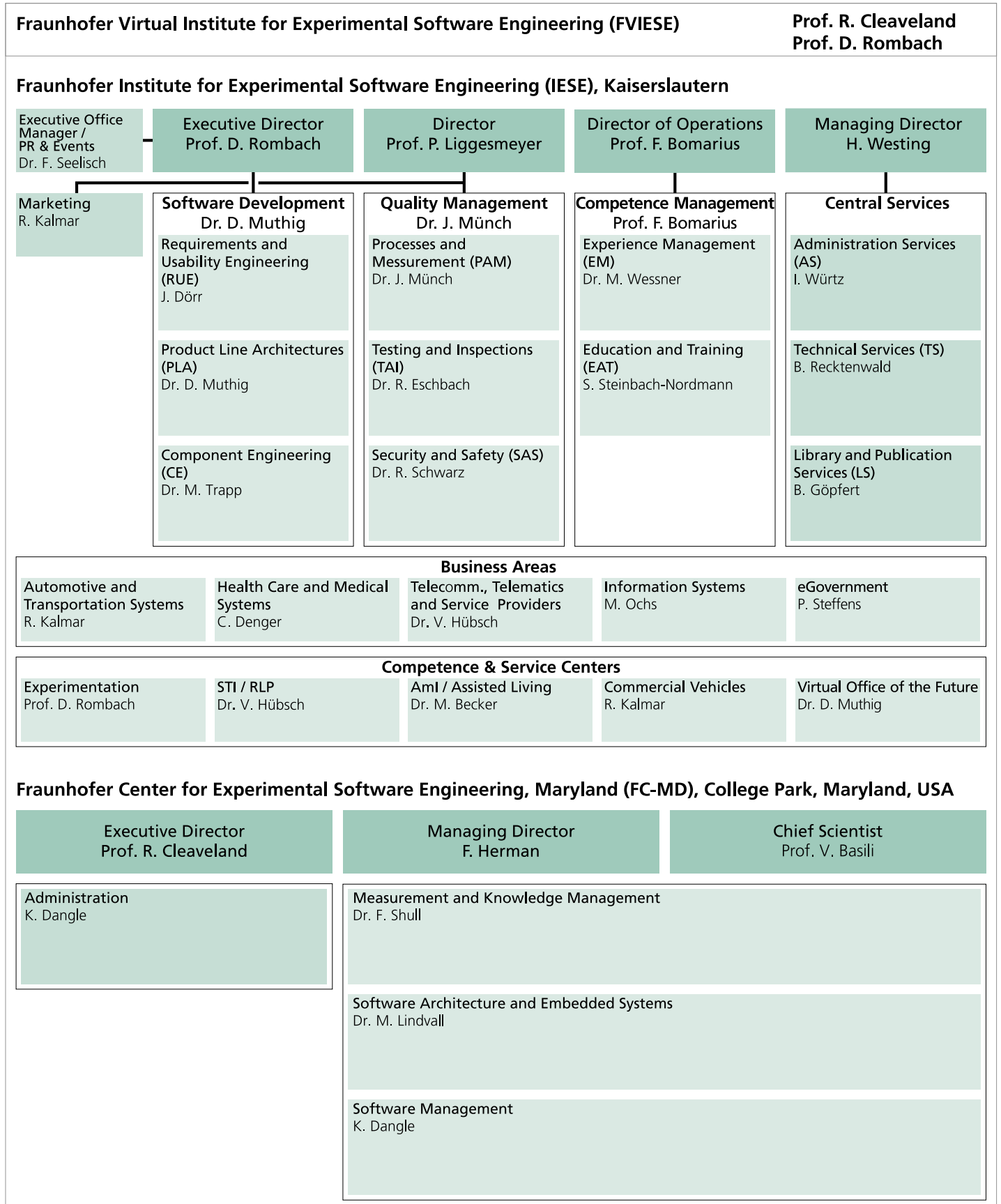
The contribution of Fraunhofer IESE is mostly in the area of systematic development of software-intensive systems. For the context of AAL, this includes approaches to the systematic development of integrated AAL solutions with predictable quality, development approaches for adaptable and adaptive systems,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

In this context, Fraunhofer IESE is active, for instance, in the projects BelAml (Bilateral German-Hungarian Collaboration on Ambient Intelligence Systems) and EMERGE (Emergency Monitoring and Prevention), which are presented in detail in this annual report.

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# Organizational Structure



## 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
- Telecommunication, Telematics and Service Providers
- Health Care and Medical Systems
- Information Systems
- eGovernment

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

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

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

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

# The 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

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University of Kaiserslautern  
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Director Software Technology  
Daimler AG  
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Head of Development  
Research and Advance Engineering  
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T-Systems NOVA  
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vwd group Technology  
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Head of the Advisory Board  
Former Executive Vice President  
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Directing Ministerial Councilor, Rhineland-Palatinate State Chancellery  
Mainz

### Brigitte Klempt

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

### Klaus Lütkefedder

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

### Dr. Hans-Ulrich Wiese

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

## Fraunhofer-Gesellschaft

### Dr. Hans-Otto Feldhütter

Research  
Fraunhofer-Gesellschaft e. V.  
München

### Dr. Gunnar Brink

Research Planning  
Fraunhofer-Gesellschaft e. V.  
München



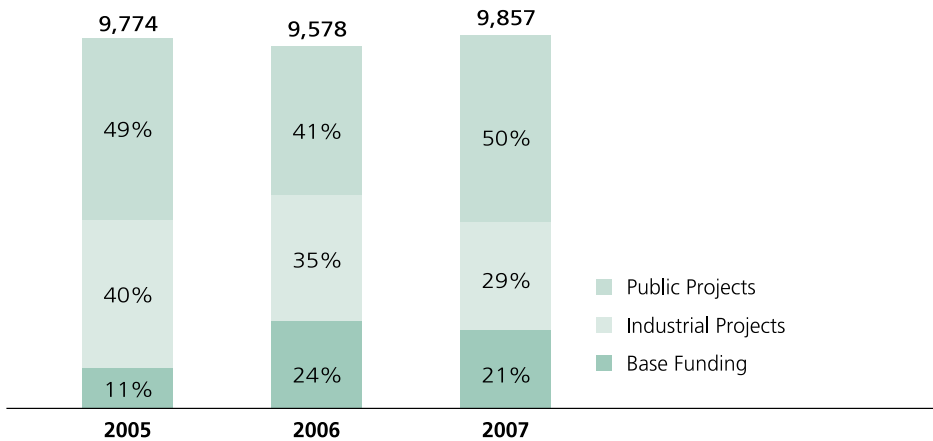


## Development of Personnel and Budget

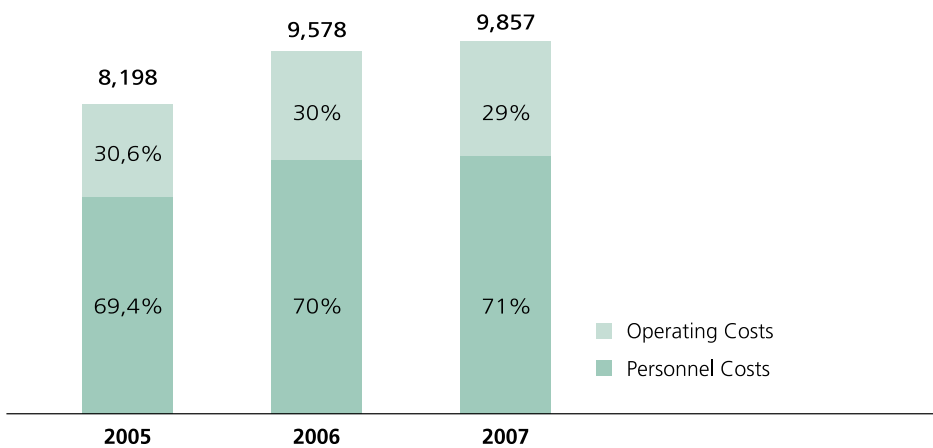
### Development of Personnel and Budget

Fraunhofer IESE continued its planned growth in 2007, with the search for qualified personnel gaining increasing importance. The cost structure is stable; the proportion of women among the employees was 23%.

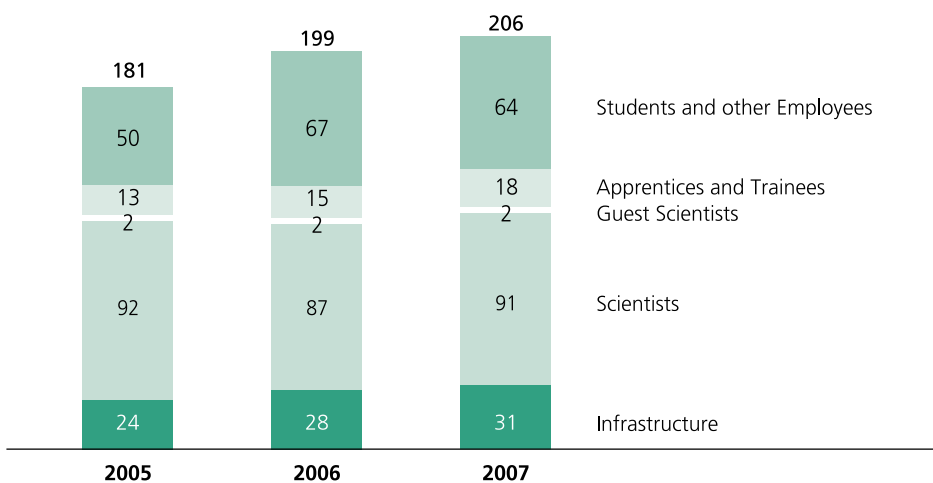
In 2008, the institute plans to further increase its scientific staff.



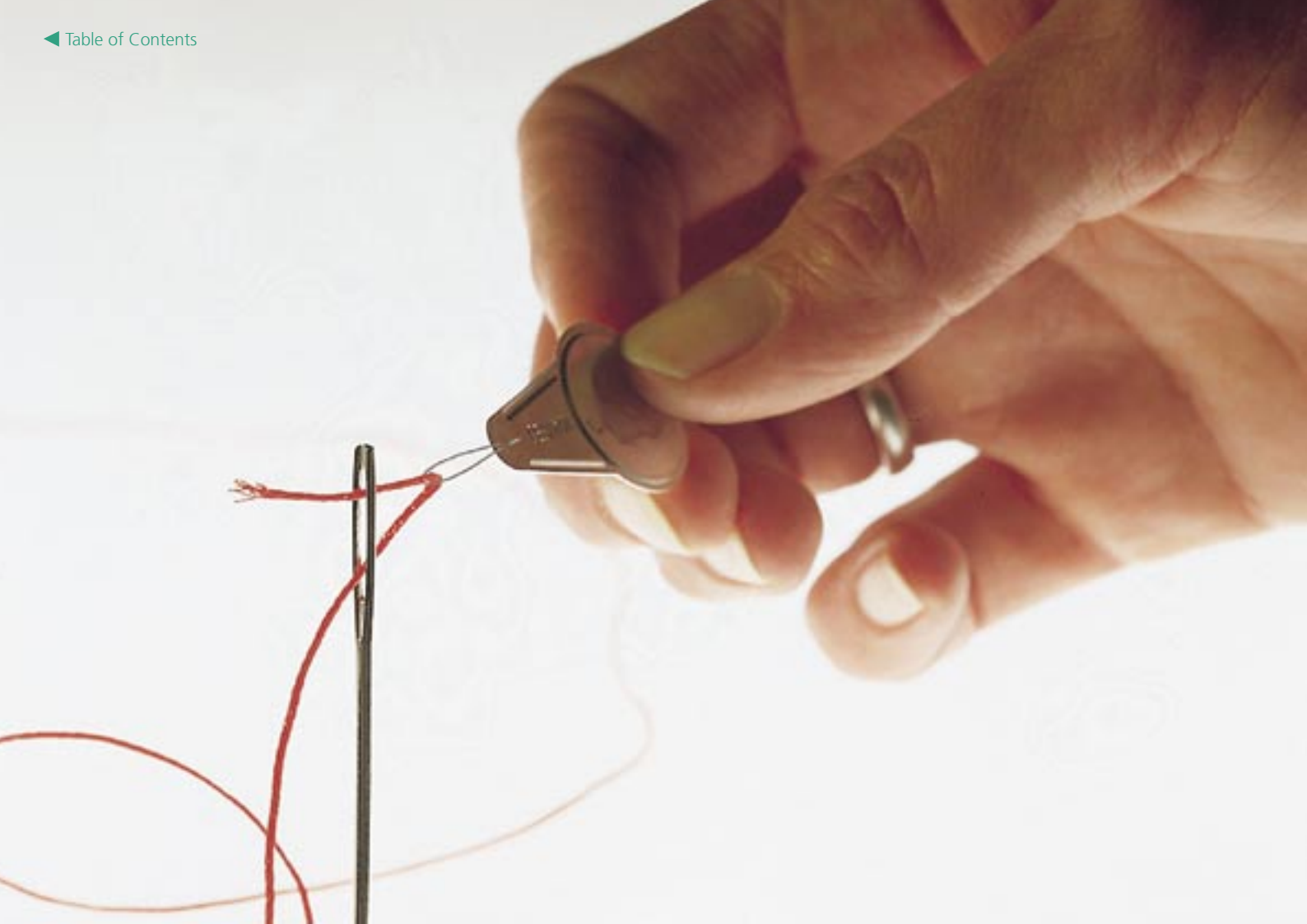
Development of Budget (in T euro).



Development of Costs (in T euro).



Development of IESE Personnel.



# Departments

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## Requirements and Usability Engineering (RUE)

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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 lead to software that fulfills the demands of the user, including usability aspects.



- **Software Product Lines as the basic concept:** Scoping and modeling of variants of a software family in the context of Requirements Engineering result in the rational and consistent design of a product line.
- **Custom-tailored methods as the recipe for success:** Requirements Engineering that is to be suitable in practice is no product to be bought off the rack. An organization's culture as well as the internal structures of a software developing company are two of many factors that must be taken into account when designing the "ideal" requirements process.

**Products and Services**

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

- **Definition and adaptation to the requirements processes and documents:** The Requirements Engineering processes must live up to the respective situation in the company in order to support and not obstruct the development process. Company- and project-specific adaptation of requirements processes and documents is therefore one of the most important services we offer in this area.

- **NFR identification and specifications that can be validated:** Non-Functional Requirements (NFR) are just as important for the quality of a software system as its functionality. Fraunhofer IESE identifies these requirements early on and anchors them in the development process.
- **Usability checks:** The most modern usability analysis and evaluation processes permit solid evaluation of a system's usability. Tests performed by Fraunhofer IESE throughout the entire process reveal defects early on and allow their cost-efficient elimination.
- **Usability by construction:** Fraunhofer IESE offers an integrated procedure that already takes usability aspects into account during requirements definition. Through consistent task orientation and the use of usability patterns, usable systems are developed in a particularly cost-efficient way.

- **Scoping of Product Lines:** Product lines allow efficient software development – provided that the requirements process reliably identifies the functional areas that are relevant for the entire software family. Fraunhofer IESE stands for highly profitable product line technology from the requirements to the finished system.
- **Training sessions, coachings, and more:** The spectrum of services offered by Fraunhofer IESE ranges from training sessions in the area of requirements and usability via stakeholder workshops held prior to the development and creativity workshops for finding ideas to coaching during requirements definition in concrete projects and introduction of innovative technologies.



## 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 accurately adapted to the product line approach that is being used. Suitable evaluation processes and prediction models capture all characteristics of the system.

### Competence in Software and Systems Engineering

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

- **Definition of product line approaches:** Successful product line engineering is always fundamentally anchored in the respective development organization. Factors such as established practices in an organization, existing organizational structures, or the specific characteristics of the intended product line must be taken into account when creating a custom-tailored solution.
- **Definition and documentation of product line architectures:** Systematic considerations regarding the architecture of a software system on the basis of product lines and their complete documentation cover a major industrial demand for functionality, adaptability, and maintainability.

- **Production-integrated migration support:** By performing integrated, step-wise migration to product line development, advance projects such as feasibility or profitability analyses, or the design of processes for component reuse, take place successively during the course of the development while new products are being developed continuously.
- **Architecture evaluation:** The evaluation of the architectures of existing software-based systems of all kinds under requirements aspects and with regard to customer wishes contributes to a large extent to generating systematic improvement measures.

### Products and Services

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

- **Advance analyses and goal definition:** The prerequisite for the successful introduction of a product line are various kinds of preparations that can be integrated directly into the production operation with the help of PuLSE® and thus already benefit the ongoing system development. Fraunhofer IESE accompanies system developers in such matters as determination of the usage sce-

nario, 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)

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Dr. Mario Trapp

## Motivation

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

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

## Vision

No two embedded systems are alike – therefore, we do not strive for a universal approach to development, but rather develop customized concepts.

In doing so, we take into account all domain-specific requirements on the future products as well development methods and tools that already exist in an organization’s environment. Together with model-based development approaches, this makes it possible to efficiently develop complex overall systems with special consideration of non-functional characteristics.

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

## Competencies

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

- **Domain-specific component systems:** By adapting component systems and modeling languages to the respective application domain,



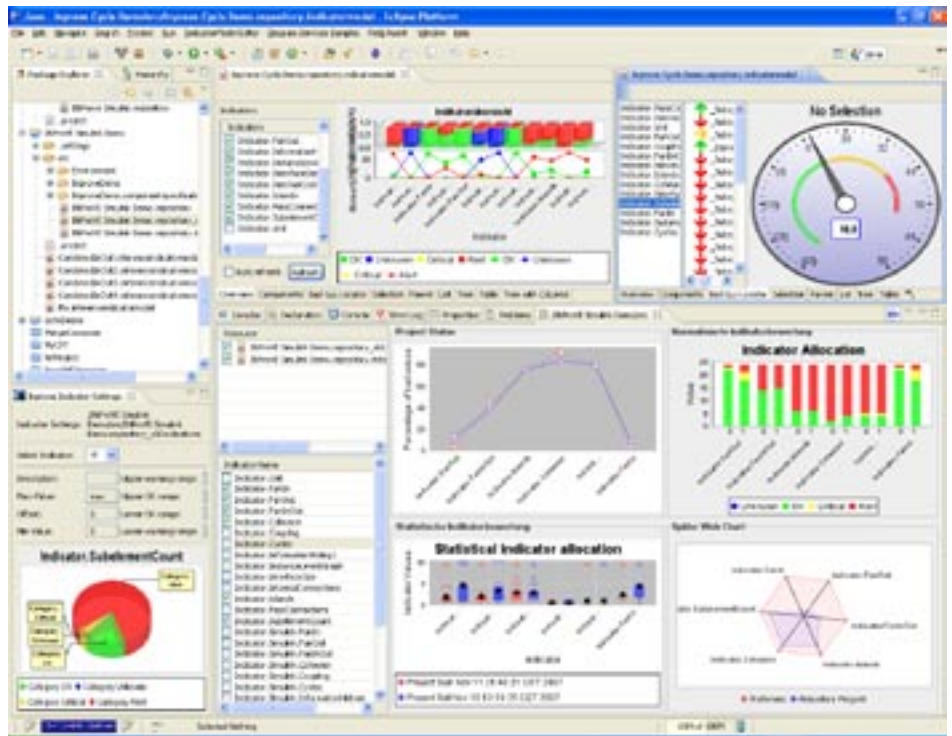


individual building block systems are created that can be integrated seamlessly with existing methods and tools. In practice, the overall result is higher system quality, reduced development times, and lower development costs.

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

**References**

In the future, automobiles will interact with their environment much more than they do today. At the same time, diagnosing defects in the ever more complex systems is becoming a challenge: Heterogeneous technologies and short development cycles make their demands on development engineers. For the development of diagnosis



systems for car repair shops, Fraunhofer IESE has designed a component-based diagnosis framework based on the ComPOSE technology (“Component Oriented System Engineering”) in a collaborative project with **BMW Forschung und Technik GmbH**. It can be used to model new diagnosis tests with particular efficiency while simply reusing already existing diagnosis procedures. Compared to traditional approaches, heterogeneous testing systems can thus be mastered without much effort and new testing equipment can be easily integrated into the diagnosis environment.

In the automotive sector, model-based approaches are a quasi-standard; however, they are usually limited to functional characteristics. In collaboration with an **automotive supplier**, however, the quality of a dataflow-oriented model was to be evaluated in terms of non-functional requirements such as maintainability. During the course of the successful collaboration, it could be demonstrated that INProVE, Fraunhofer

IESE’s inspection tool that is optimized for embedded systems, detects about 90% of all weaknesses that could be found during manual inspections – in much less time and at a fraction of the costs.

Despite major cost pressure, the automotive industry must guarantee that safety-critical, software-intensive systems in a vehicle are indeed safe. Standards such as ISO 26262 play an important role in this context. In collaboration with **Daimler Research**, Fraunhofer IESE has developed a Safety Engineer Guideline, which ensures that products and development processes are standard-conformant while taking into account company-specific requirements at the same time. On the basis of this guideline, existing processes were assessed and improvement potentials were identified. Methods, templates, and background information provided by Fraunhofer IESE support the developers in the practical implementation of ISO 26262.

## 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 minimized.
- **Process management and process evolution** are the basis for the definition, introduction, and continuous optimization of development processes.
- **Process and product assessments** analyze development processes and products with regard to their strengths and improvement potential, or with regard to their conformity to standards. Thus, they provide the basis for solid decisions in software and system development.

### Competence in Software and Systems Engineering

The strength of Fraunhofer IESE's software engineering research lies especially in the engineering-style combination of new software engineering methods, respectively such methods that were further developed or adapted upon a customer's request. Thus, the synergies created by the different processes can be 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

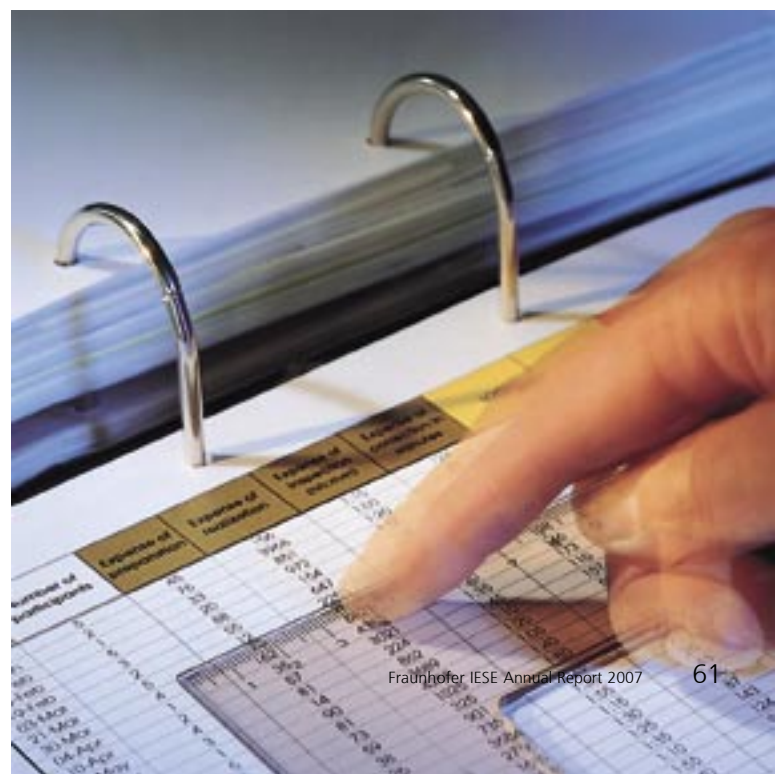
Software and Systems Engineering is one key to gaining a competitive edge in a hard-fought market. Fraunhofer IESE develops and evaluates custom-tailored solutions for optimal software and system development processes that fulfill the highest requirements regarding efficiency, documentability, and conformity 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 and supports the achievement of conformance to standards,

for instance in accordance with ISO/IEC 15504 (SPICE) or V-Modell® XT. Customer-specific software product assessments and support in implementing CMMI® and Six Sigma are also possible. Systematic product analyses can be performed with the flexible M-System, for instance.

- **Training sessions, workshops and seminars:** The courses offered by Fraunhofer IESE enable decision-makers and practitioners from the area of software and system development to apply measurement processes and process technology on their own. The institute offers one-day or multiple-day events, which can be held either at Fraunhofer IESE or directly at the company site. Topics include introductory courses for the V-Modell® XT as well as courses on issues such as product metrics, empirical studies, or cost estimation.



## Testing and Inspections (TAI)

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Dr. Robert Eschbach

### 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.
- **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.

## 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.



## Security and Safety (SAS)

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Dr. Reinhard Schwarz

### 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 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 possibility for certification.

- **Secure IT network structures and network monitoring:** Design and analysis of secure infrastructures with tool-supported detection of vulnerabilities.

### 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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Dr. Martin Wessner

### Successful by Experience

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

- **Reuse of experience** helps to avoid the situation that processes that have already been proven in operation are not used due to ignorance - in other words, that the wheel keeps getting re-invented over and over again. Additionally, this prevents the repetition of known errors.
- **Validation of experience** captures the application context of an experience together with information on how this experience has proven itself in practice. This facilitates its application in a new case.

- **Cataloging and archiving** help to maintain an overview of the multitude of smaller experience packages, thus preventing the “treasure trove of experiences” from becoming a useless heap of information in the end.
- **Business management considerations** ensure that experience management in a company is a worthwhile investment into the future, for instance, by focusing on the most relevant core issues and by reducing the costs of capturing experience.

### Competence in Software and Systems Engineering

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

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



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

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

- **Experience-based Information Systems (EbIS):** Beyond its purely methodological competence, Fraunhofer IESE realizes entire experience-based information systems on behalf of its customers. To establish them, the institute's own product line INTERESTS is used, which combines complete scalability with the advantage of individually adaptable user interfaces.
- **EM products for SMEs:** Small and medium-sized enterprises benefit from experience captured and delivered at the right time. With Fraunhofer IESE's EM solution MI-MIR, 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 – to evaluating and maintaining the implemented solution.



## Education and Training (EAT)

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Silke Steinbach-Nordmann

### Competitive through Competence Development

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

- **Planning, design, and implementation of qualification processes:** Systematic needs analyses, skill profiling, and the analysis of an organization's existing continuing education culture form the basis for the customer-specific design and development of training courses, learning materials, and eContent for network-based learning and education.
- **Evaluation and optimization of qualification processes, programs, and media:** Efficient qualification must be integrated into the respective application context with regard to organizational, individual, and technological issues. Parallel evaluation, technology acceptance studies, and cost-benefit analyses contribute to establishing these firmly in an organization and lead to continuous improvement of the selected programs.

- **Design and development of user documentation:** Software documentation is developed and designed in such a way that, with the help of Single Source Publishing, various types of help systems and learning media for introducing the user to the software described can be efficiently developed.

### Competence in Software and Systems Engineering

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

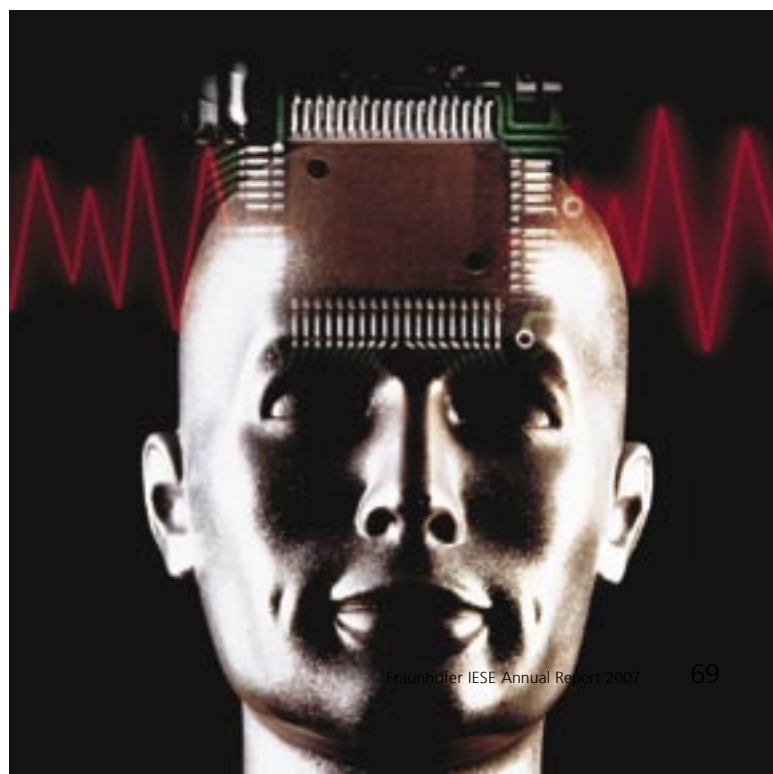
- **Development of courseware and process engineering:** Starting with the requirements analysis and the scoping of the educational needs, qualification programs, (mainly electronic) learning materials, and documentations are designed, implemented, and evaluated in an engineering-style manner. This procedure also makes it possible to analyze and optimize the existing development processes of educational programs, learning software, and documentations.
- **Rapid development:** Systematic reuse of existing materials and media enable the short-term production of high-quality learning systems and user guides without any loss of quality.

- **User support and help systems:** On the basis of structured technologies, multimedial and classical materials for user support and guidance are developed. Help systems and software instructions can be developed via DocBook, DITA or other comparable procedures and settings.
- **Goal-oriented evaluation:** Proven empirical software engineering processes (such as the Goal Question Metric, GQM) are adapted to concrete measurement tasks and provide a quantitative view on the performance of learning systems or help systems, resp. enable systematic improvements regarding the design and execution of qualification processes.
- **Process development and improvement:** Some companies develop their own learning software and documentations. For them, Fraunhofer IESE offers to analyze and improve their development processes via IntView, the integrated development methodology for simultaneous consideration of all dimensions of courseware and documentation development.
- **Support in product selection:** In many cases, sophisticated solutions are already available for specific training or education problems, making expensive new development unnecessary. Fraunhofer IESE systematically compares products available on the market and finds the best learning system for specific task definitions.
- **Software documentation and software training:** Fraunhofer IESE designs, evaluates, and develops all types of software documentation as well as user guidance and training materials, including the configuration of documentation development environments, content development, product testing, and shipping.

## 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.







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# 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.

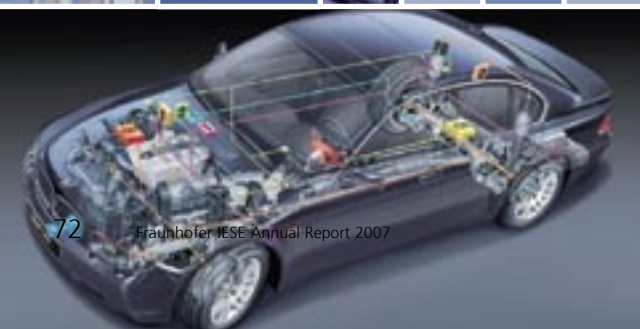
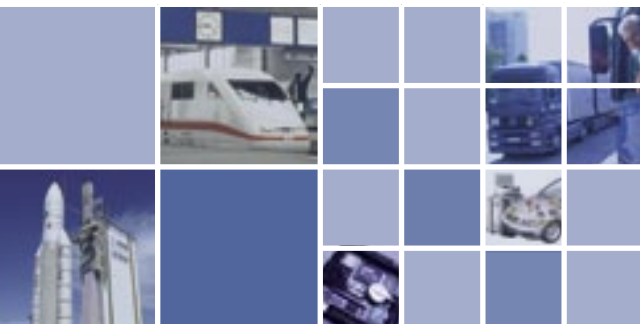
Automotive Software Engineering defines a holistic approach that includes all development activities, starting from automobile-specific process models on the basis of established standards (ISO/IEC 12207, IEC 61508) and the use of maturity level models (ISO/IEC 15504, Automotive SPICE, CMMi). Product

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 Competencies in Software and Systems Engineering

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



### 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 standard-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 such as model-based testing or SIL/MIL/HIL tests.

#### Testing of Distributed Systems

The testing and diagnosis of distributed systems constitute a special challenge 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 26262 for you, or we provide support.

# Telecommunication, Telematics and Service Providers

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Dr. Volker Hübsch

## Confidence in Critical Systems

Fraunhofer IESE currently has five 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 scalable, available, maintainable, and flexible, but also particularly secure and reliable.

If minor malfunctions can already have major effects, and if the systems to be designed are very complex, then only an engineering-style, systematic development method will do. The risk of major financial losses is too great if, for

example, telephone or energy networks suddenly break down, or if service providers cannot offer their services temporarily due to a data network failure.

## Competence in Software and Systems Engineering

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

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

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





- **Security audits and tools for vulnerability analyses** uncover potential security problems in software and software-based systems during the development process already. The concept of “Security by Construction” offers more protection with lower costs than the later safeguarding of existing systems.
- **Process assessments and measurement-based improvement programs** enable optimization steps in development processes on the basis of empirical findings. Thus, even such aspects as the efficiency and acceptance of methods - which is normally hard to quantify - can be captured and evaluated objectively.
- **Software Product Lines** help to increase product variety while saving resources through consistent reuse at the same time, and rationalize development processes while maintaining constant quality.
- **Requirements and Usability Engineering** ensures that a system demonstrably fulfills a predetermined performance claim of all non-functional properties and is easy to use.
- **Systematic experience management** makes proven and tested knowledge - an indispensable tool – available for the daily work of software and system developers.
- **Continuous testing procedures and systematic inspections** integrate the mandatory quality assurance into the running development process. There are significant cost benefits compared to performing quality assurance at the end of system development, due to early elimination of defects and optimized processes.

### Products and Services

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

- In modern production environments, security audits for active network components such as web-servers, routers, firewalls, and operating system configurations must fulfill high requirements especially with regard to security against manipulations. Fraunhofer IESE’s tool-supported processes, for example **CROCODILE®**, the **Cisco Router Configuration Diligent Evaluator**, detect even hidden security leaks, which would not be found with a purely manual process, despite high effort.

- Systematic checks during the course of assessments have a solid engineering-style basis with **FAME®**, the **Fraunhofer Assessment Method**. These checks exactly show an organization’s improvement potential based on empirical data obtained from its running operation.
- With **PuLSE® – Product Line Software Engineering**, our customers get brand quality when it comes to designing product lines. Lower costs per unit through greatly reduced development effort quickly pay off when compared to single system development, and time-to-market is shorter for new product variants.
- Requirements Engineering made simple with **Usable Software Products Based on Innovative Requirements Engineering**. This process integrates the demands and organizational goals of industrial customers with the lowest possible effort. The user-focused procedure results in high usability and wide acceptance of the developed systems and thus guarantees highest customer satisfaction.

## Health Care and Medical Systems

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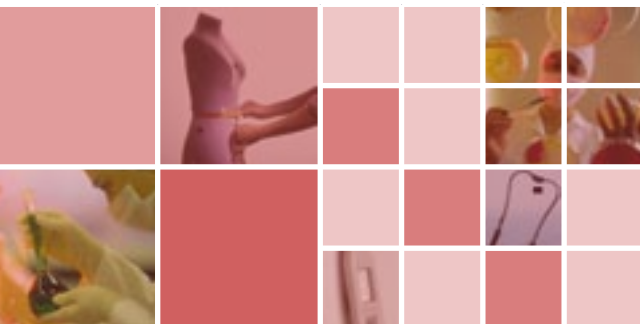
### Software-based Systems for Health and Quality of Life

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

Our software and systems engineering approach supports you all the way from the elicitation of requirements on the medical product to validation. Together with our customers, we develop innovative solutions for software development that efficiently fulfill the requirements of IEC 62304, DIN EN 60601-1-4, and ISO 12207, and pro-

vide assistance in systematically implementing them in daily practice. We integrate future-oriented methods and techniques that ensure quality requirements (e.g., in accordance with ISO/IEC9126) efficiently and economically. Safety is the top priority in this respect. We use new methods to support you in performing risk management according to ISO 14971 for software, and to use techniques such as Failure Mode and Effects Analyses (FMEA) and Fault Tree Analyses (FTA) for analyzing software safety. Custom-tailored quality management approaches (e.g., similar to ISO 13485) are defined as supporting processes. Your benefits:

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



## Competence in Software and Systems Engineering

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



### Software Development

#### Requirements Management

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

#### Usability Engineering

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

#### System- and Software Architectures

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

#### Software Product Lines and Reuse

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

### Software Quality Management

#### Risk Management

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

#### Safety Analyses

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

#### Development Processes

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

#### Static Quality Checking Techniques

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

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Michael Ochs

## Software in the Age of Information

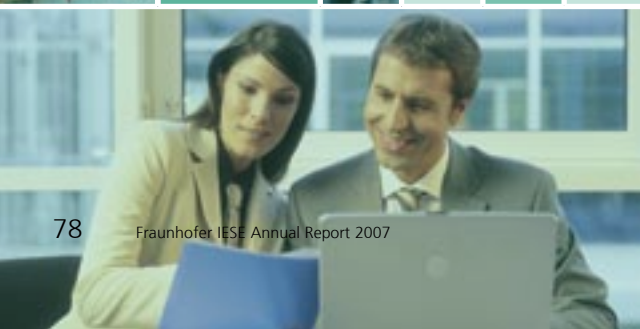
Information systems permeate our daily lives in various ways. Especially in the area of eCommerce and eBusiness, online shops, auction platforms, and banking resp. stock exchange systems, as well as company-internal information systems such as ERP and CRM, perform millions of transactions every day. 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, if electronically processed tax forms end up in the wrong hands, or if highly critical operational information does not arrive on time at the required location during military missions.

## Competence in Software and Systems Engineering

Fraunhofer IESE supports organizations that develop, maintain, and use company information systems during 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.





Our special emphasis is on fulfilling the high demands on quality, regarding, for example, safety and security, usability, reliability, maintainability, availability, and extendability, 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 are 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 procurement**, which can be provided either via development through subcontractors or through Commercial-off-the-Shelf products. Both ways entail risks – we minimize these risks inherent in purchasing and subcontracting along the respective process chain.

### 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.

- **Architecture Evaluation:** The evaluation of the architectures of all kinds of existing software-based systems under requirements aspects and with regard to customer wishes is a major contribution towards generating systematic improvement measures.
- Requirements Engineering made simple with **Usable Software Products Based on Innovative Requirements Engineering**. This user-focused process integrates the demands and organizational goals of industrial customers with the lowest possible effort.
- **Blended Learning** teaches software and system development decision-makers and practitioners everything about topics such as the *Unified Modeling Language* in 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.

## eGovernment

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Petra Steffens

### eGovernment Solutions for Public Sector and Business

The public sector with its more than 4 million employees represents one of the largest “business sectors” in Germany. It has to balance regulatory constraints, economic feasibility, and quality of service for its customers. Whether new IT solutions meet with success depends most of all on how well the public sector, business, government, and IT collaborate.

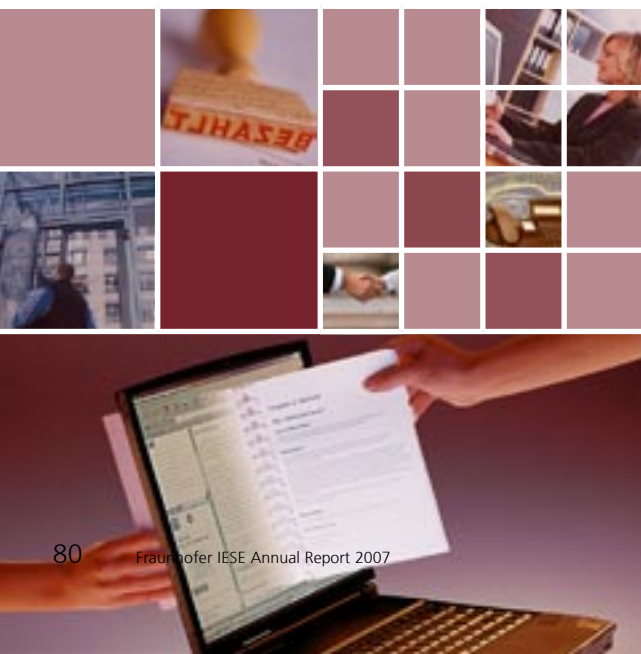
Whereas during the early years of e-Government, the citizen as a customer of the public sector was the main focus of developments, recent years have seen a growing shift of this focus towards the interface between the public sector and business. This is where the highest gains in efficiency are expected.

ROI analyses performed prior to implementation projects ensure a project’s

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

Your benefits:

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



## Competencies in Systems Engineering

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



### ROI Analyses

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

### Needs Analyses and Subcontractor Support

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

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

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

### System and Software Architectures

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

### Security

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

### Usability

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

### Qualification

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





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## Listening to the users – measuring usability and considering it early during product development

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A product is successful if its users are satisfied with it – this applies to hardware, software, and software-based systems to an equal degree. Functionality, services offered by the manufacturer, or the so-called “fun-of-use” factor significantly contribute to making customers like a product. In 2006, the AMUSE – Appraisal and Measurement of User Satisfaction approach was developed in the context of the collaboration project “Quality in Use” together with Siemens AG Corporate Research & Technology. The central goal was to elicit and monitor the abstract measurement of user satisfaction and to take it into account as early as possible during a product’s life cycle.

In our current work, we have now been able to test AMUSE in the context of an extended collaboration with Siemens Audiologische Technik (Siemens MED SAT) in Erlangen. The core of AMUSE is a questionnaire that can be used to analyze user satisfaction early in a product’s (version) life cycle and monitor it throughout its entire life cycle. With the help of the AMUSE questionnaire, the product characteristics perceived by the user for the current test object, such as a computer software, were measured first. In order to improve features perceived as unsatisfactory in a future release, the product characteristics were then assessed in terms of their contribution to the product features. This was done by using already

existing documents or prototypes and employing the AMUSE assessment and counting method. This resulted in a list of priorities that helped to select exactly those features that contribute the most to the desired product improvement.

The following statements could be made following the practical testing of AMUSE in real life:

- The results of the counting and the assessment enable a more solid (more objective) decision when prioritizing features.
- AMUSE enables systematic optimization of the benefit to the user.
- The assessment of the product features in terms of their contribution to product quality constitutes a formal checking criterion in the sense of a “quality gate” for the underlying requirements documents.
- By measuring satisfaction with a questionnaire, immediate, transparent conclusions can be drawn regarding the product quality perceived by the user (White-Box test).
- Strategic considerations and road-mapping are supported well by AMUSE, but this process cannot be automated.
- Communication with a company’s management is facilitated by the AMUSE profile.

- Fewer changes in product features are to be expected during development.
- Additional product feature information captured can be used by developers in terms of goals such as increasing performance, fun at work, or similar properties.

After a successful pilot phase, AMUSE is currently being used in other projects, the intent being to gain more experience and obtain more data from using this method. At the same time, the supporting tools are being improved continually.



**Perfectly adjusted hearing aids through digital 3D scans:**

The iScan by Siemens Audiologische Technik scans an imprint of the ear canal in just a few moments. The 3D model thus captured can be used to manufacture an in-ear hearing aid that fits perfectly and is comfortable to wear. AMUSE was used successfully in the context of this project.

*Satisfied users –  
successful products!*

## Assessed and certified: The certification concept for the V-Modell® XT

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Well-defined development processes are the prerequisite for engineering-style software production. For software developing companies, sometimes the decisive factor in competition is being able to establish and optimize standard-conformant processes within a short period of time. Following a 2004 recommendation issued by the Inter-Ministerial Coordination Committee, companies contracted by the federal government must apply the methodology and procedure of the V-Modell® XT for all software and systems development projects. In the context of further evolving the V-Modell® XT, one of the tasks of Fraunhofer IESE was the definition of certification rules and assessment procedures.

The certification of the System Support Center Eurofighter in Manching (SUZ EF), a collaborative project between EADS Military Air Systems and the German Air Force, was used to test the basic concept (developed by Fraunhofer IESE) for process model conformity assessments in accordance with the V-Modell® XT.

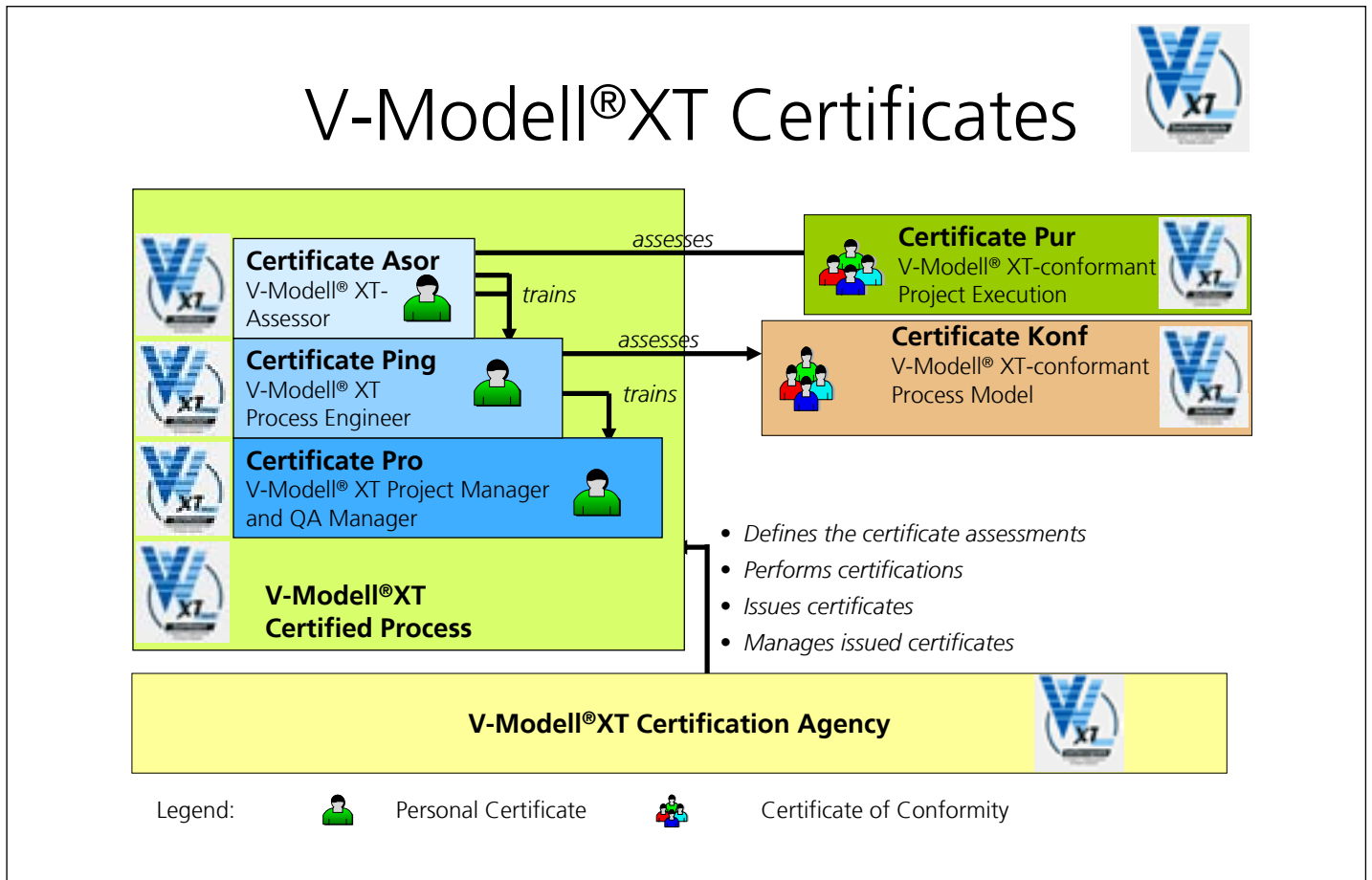
The item to be assessed was the process documentation used, which was to be checked in terms of adherence to the provisions of the "V-Modell XT® Konf" ("V-Modell® XT conformant process model"). The assessment was

performed by Fraunhofer IESE and the Software Systems Engineering research group of Clausthal University of Technology.

In the context of this first certification assessment worldwide of the V-Modell® XT, the processes designed proved to be suitable in every respect. In the context of the pilot project, valuable hints for improving the V-Modell® XT could be gained. In the conformity assessment, the process documentation of the System Support Center Eurofighter turned out to be so resilient that it only needed minor adjustments to be used directly in the context of the V-Modell® XT.

The lessons learned will become input for the ongoing development of additional levels of conformity. With the certificate "V-Modell® XT Pur", for example, it will be possible to not only assess the product instantiations used, but also the actual process instantiations. Fraunhofer IESE will also define the major procedures for the development of these assessment processes. Furthermore, the institute will provide services related to the V-Modell® XT in the near future – in addition to the actual conformity analyses, the service portfolio will also include training programs and project coaching.





Certification concept of the V-Modell® XT (schema)

*Highest system quality  
developed engineering-  
style with V-Modell® XT!*

## Most probably defect-free – quality check with statistics

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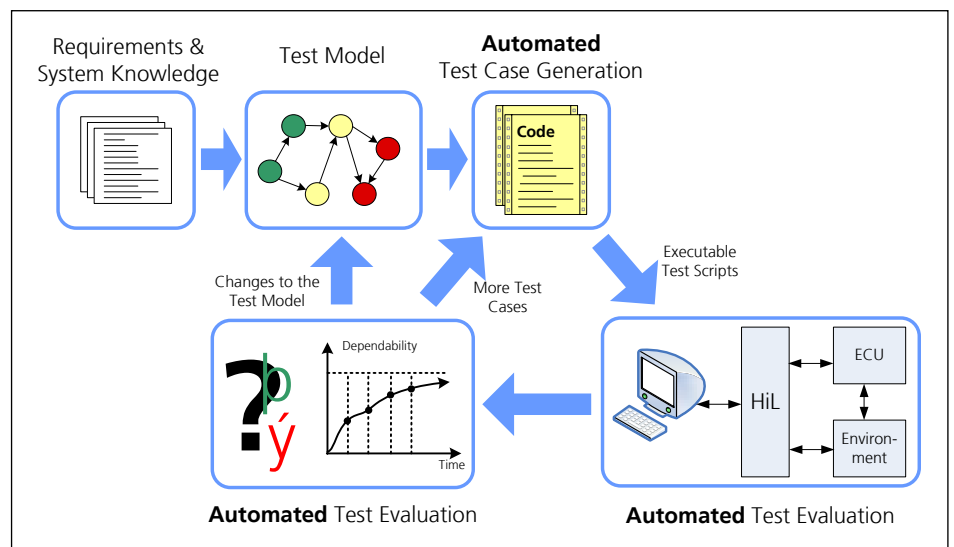
### Collaboration Partners

System developers and suppliers from the automotive, automation, and rail industry

The most important innovations in the automotive sector in recent years have been characterized by software-based assistance systems. Such systems are used, for example, to keep a vehicle aligned, to control tire pressure, adjust the speed depending on the situation at hand, or reliably navigate us to wherever we want to go. Software-intensive functions increase driving comfort and safety – while offering ever new arguments for buying a car equipped with numerous features. Regardless of whether we look at them from an individual, safety-related, or economic perspective: These systems must work perfectly.

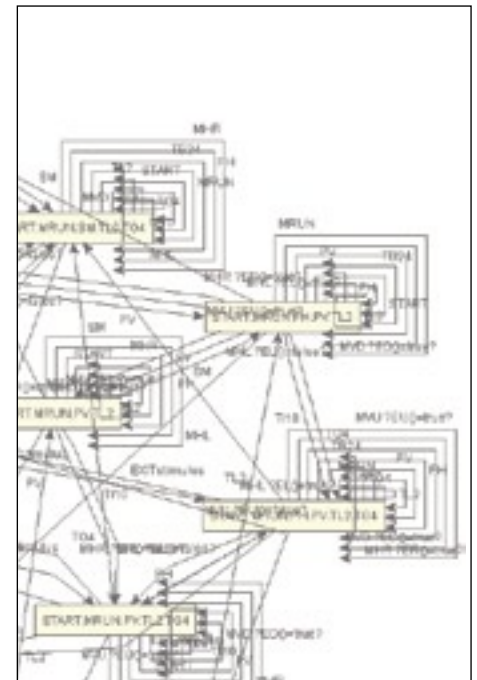
High quality requirements together with increasing complexity and a multitude of variants therefore demand ever more comprehensive checks. On average, the necessary tests account for more than half of the entire development effort. Yet, one very rarely obtains reliable and meaningful, quantitative assessments of a system’s reliability.

This is where the innovative technique of “statistical testing” comes in. The starting point is a computing model that captures the way the software is used. It is called usage model or test model. Those systems or subsystems that are used most often or that behave in a critical way can then be checked more thoroughly. According to the experiences made by Fraunhofer IESE, already the planning of these tests can be used for discovering many weak points in the specification. This helps to avoid frequent implementation mistakes right from the start. The model can be derived directly and systematically from the functional requirements in the requirements specification; relations and dependencies are studied and documented. Each path through such a resulting usage model describes one possible application scenario of the system. These scenarios can be generated automatically in accordance with desired criteria and in an executable form on the basis of the usage model – including the expected system reactions.

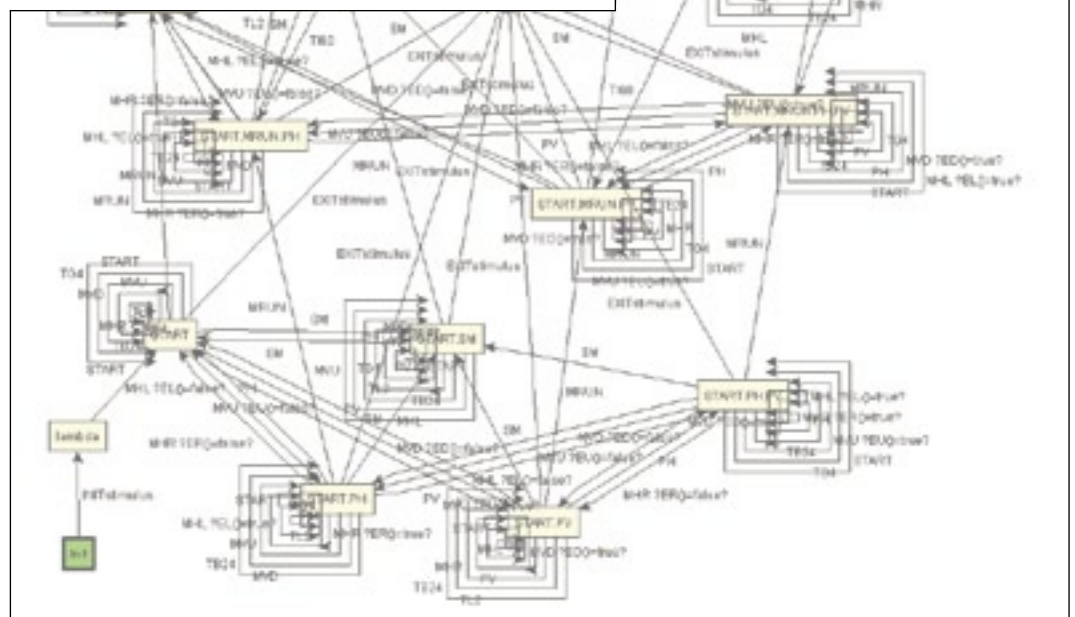


#### Testing with statistical procedures:

At the beginning, there are the requirements on a software, such as those recorded in the specification. With the test model derived from those, the relevant test cases can be generated automatically and the tests can be executed using appropriate scripts.



The usage or test model is a complex network of mutual dependencies, even in relatively simple systems such as the case of a car door shown here. It can be derived from the requirements and serves as a basis for statistical testing, which can be performed in an automated way on a hardware-in-the-loop (HiL) testbed, for example. The software engineer Prof. Jesse Poore from the University of Tennessee, who has received many awards as a widely recognized expert in the area of statistical testing, accompanied numerous industrial projects in collaboration with the Department of Testing and Inspections at Fraunhofer IESE during his one-year research stay.



By covering the paths through the model in an appropriate number of runs, a statistical statement can be made regarding the degree of coverage. Finally, by running functional tests in parallel, a statement can be made about the reliability. Statistical tests are suited especially for control devices on higher levels of formalization, since the

usage of a mirror or window control device, for example, changes little over the course of time.

Variant-rich product lines and real-time aspects, in particular, constitute the central challenges of future research work on this novel testing technique.

*Automated testing procedures save time and money!*

## Quality assurance in balance: Achieve defined quality with acceptable effort

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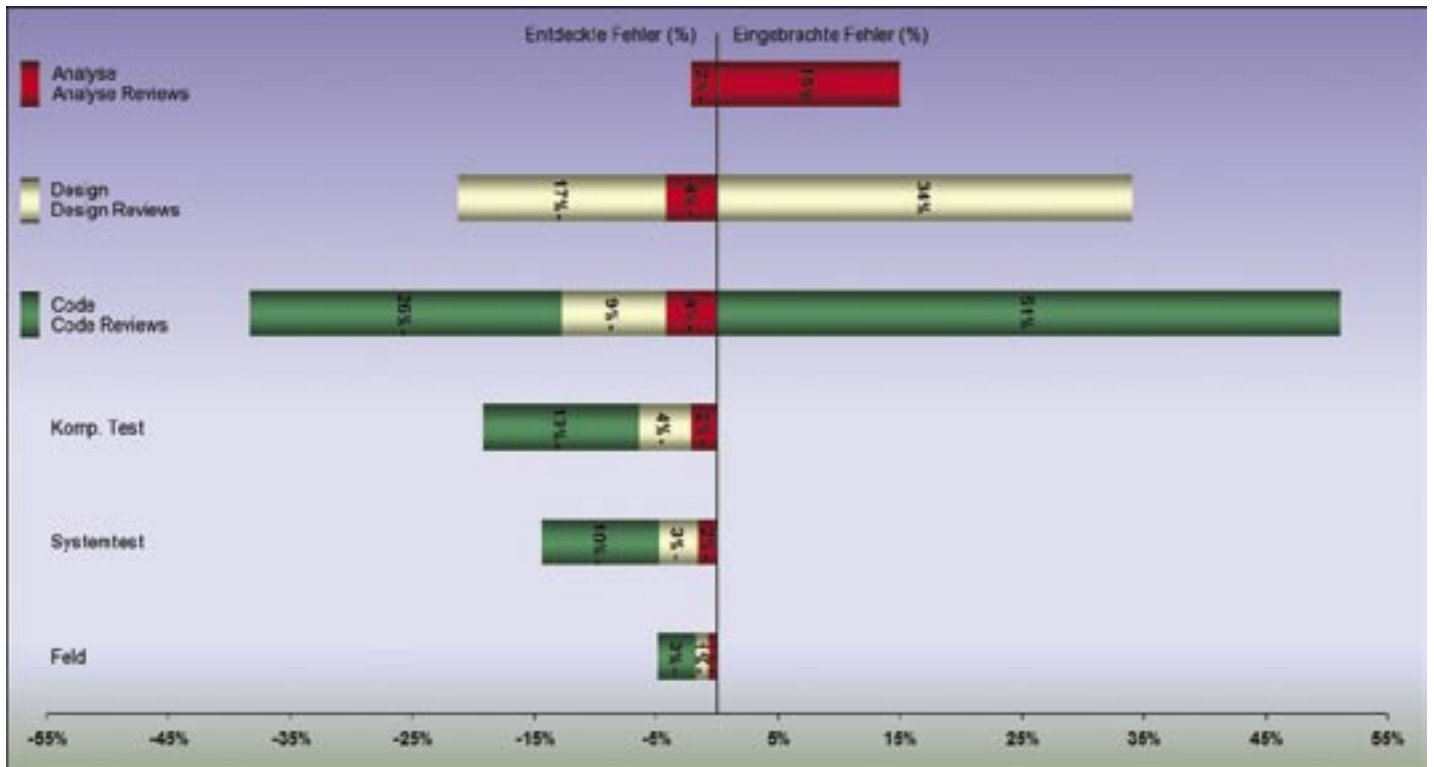
Product quality is a decisive competition factor for software developing companies. But qualified personnel are rare and expensive, and quality assurance (QA), in particular, must often make do with scarce resources. In light of this situation, it becomes more and more difficult to detect and correct defects that have cropped up during a development process, and to do so in time, before the product is delivered. However, these risks do not only occur in new developments – even the reuse of components in customer-specific solutions may lead to spectacular quality defects later on in the software product if adequate quality assurance is missing.

So how can existing development capacities be optimally distributed to the necessary quality assurance activities? This is the issue covered by the projects TestBalance and LifeCycleQM at Fraunhofer IESE. The objective of TestBalance is a software product that is optimal from a business perspective, whereas in the project LifeCycleQM, the focus is on efficient quality management and systematic quality strategies for reusable components.

Both projects are based on specially developed process and cost models. These support QA and project managers in optimally planning quality assurance measures and thus in striving for a pre-defined product quality. The models systematically evaluate quality during the development cycle and then determine the necessary resources and the adequate methods for realizing the desired quality.

In collaboration with industrial partners as well as with the Fraunhofer Institute for Industrial Mathematics ITWM, work is currently under way for the development of a systematic quality management approach. Whereas LifeCycleQM focuses on reusable software components, TestBalance looks at the problem under cost aspects, with the goal being the achievement of a defined quality using a checking intensity that is optimal for business under given constraints. Tool support for both projects is under development.





**Graphical clue for software developers:**

The number of defects detected, respectively corrected, during the individual development phases of a software project is visualized using a defect flow model.

At IBS AG, Höhr-Grenzhausen, an initial QA strategy has already been implemented in the context of LifeCycleQM. Future optimization of the applied strategy is planned by continually measuring defects and eliciting relevant factors that impact QA measures. In the project TestBalance, first applications of

the models developed as well as empirical evaluations have taken place at the research partners' sites. In the further course of the project, the existent, context-specific models shall be adapted, generalized, and evolved into an integrated, comprehensive solution.

*Use development resources optimally, ensure the best possible product quality!*

## Grab the evil by its root: Detect security vulnerabilities already during software development

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SHE AG  
[www.she.net](http://www.she.net)

An Internet browser that executes dangerous code hidden on visited websites without further questions? A server application that can be misused for undesirable purposes using cleverly selected input data? These are two of the uncountable examples of IT security vulnerabilities that are reported almost daily and are most often caused by careless programming.

When we investigate the reasons for such vulnerabilities, we see that a large number of them can be traced back to defects in the programming of the underlying software. Common security measures such as firewalls or virus scanners are more or less effective in making it difficult to exploit an existing vulnerability. However, such defensive measures do not deal with the root of the problem: the security-critical defects in the program. Therefore, as a matter of principle, it is better to develop software as secure as possible right from the start and thus deprive possible attack strategies of their basis. However, until now, the manual vulnerability analysis by experts that needs to be performed first had been tied to high costs and efforts in the case of complex software.

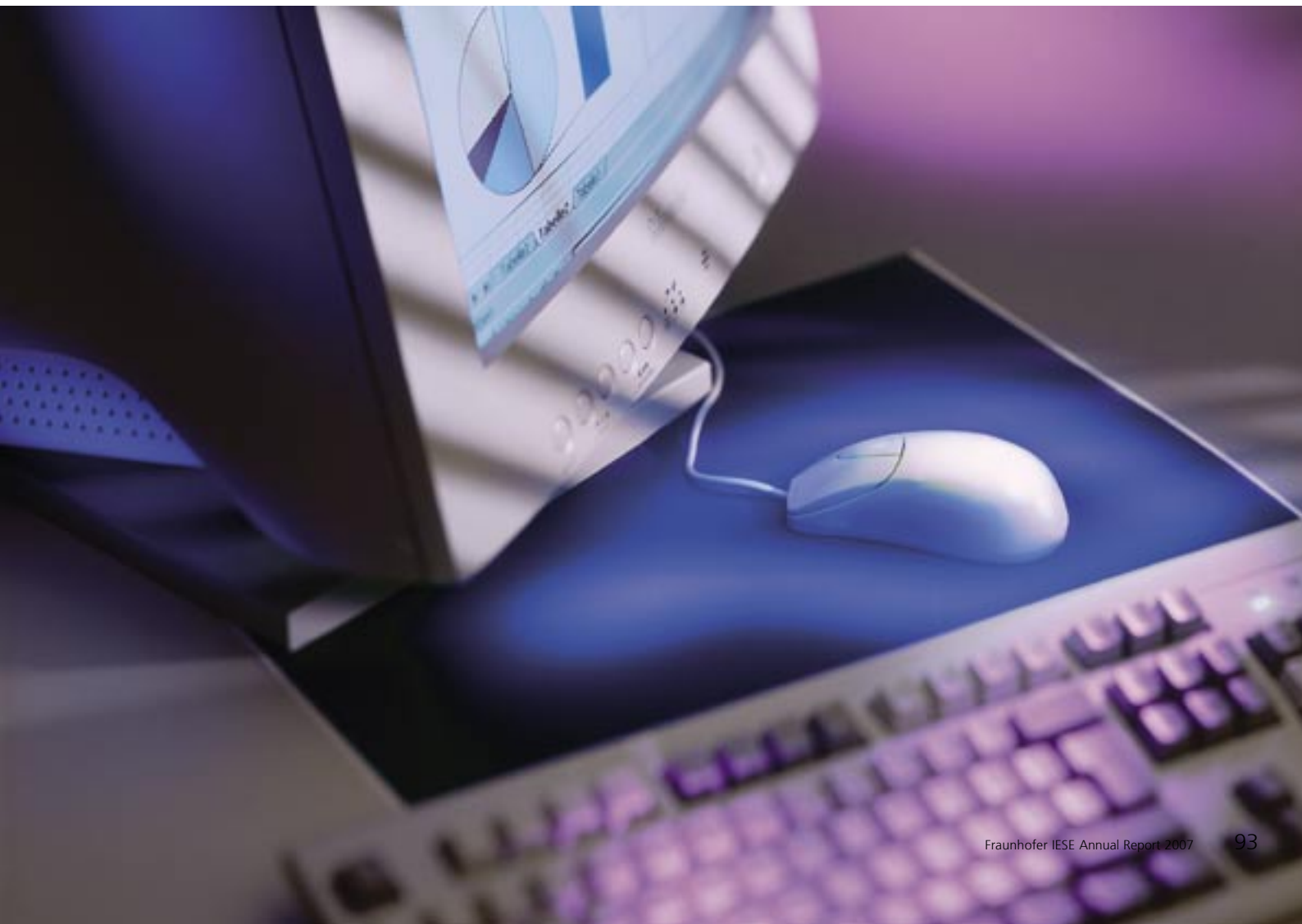
Fraunhofer IESE and three software and IT security companies have joined forces in the project SecFlow in order to jointly develop a tool that can automatically detect one of the most important kinds of vulnerabilities in the source code of a software: vulnerability regarding manipulated input data. The first target are typical security vulnerabilities in web applications such as SQL injection or cross-site scripting. However, the analysis capabilities of the tool can also be extended to other programming environments and types of vulnerabilities, depending on what the customer wants.

Fraunhofer IESE contributes know-how on complex program analysis methods and on software security; CC GmbH (Wiesbaden) contributes its competence in developing program analysis tools tested in practice. ICT AG (Trier) adds its experience with Internet applications, and SHE AG (Ludwigshafen) will test the Secflow tool in security analyses performed for its customers. Jürgen Spieß, Sales Application Security at SHE AG, hopes that "with the Secflow tool, we will be able to significantly increase the quality of the results and the efficiency of our software security analyses." At least those defects that cause a program to be tricked into undesirable behavior through cleverly manipulated input data should then be a thing of the past.

#### **Dangerous life on the Internet:**

Carelessly programmed web applications quickly lead to problematic security vulnerabilities - for example, if applications can be outwitted by manipulated input data.

*Better to develop safely  
from the start than to  
close the gaps later on!*



## Extended program: Technology-supported learning complements classroom seminars

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### Collaboration Partner

Berufsgenossenschaft für Gesundheitsdienst und  
Wohlfahrtspflege (BGW)  
[www.bgw-online.de](http://www.bgw-online.de)

The Employers' Liability Insurance Association for Medical Services and Welfare Work (BGW) as a statutory accident insurance company offers a comprehensive range of continuing education and training programs to its six million insurance beneficiaries in more than 500,000 organizations from different domains (e.g., health care and veterinary service, social welfare work, hairdressing, or children's day care centers). The focus is on classroom seminars dealing with issues such as occupational health and safety.

The association wants to expand its future educational program and plans to increasingly use technology-supported learning programs (eLearning). In addition, BGW considers tight interconnection of its future eLearning activities with the issues of experience and knowledge management a desirable goal.

Thus, Fraunhofer IESE was contracted to design appropriate usage scenarios in close cooperation with BGW and to describe a suitable platform architecture. Furthermore, suggestions for

a suitable methodology as well as for the technical and organizational implementation of the platform were to be elaborated.

In order to consistently align architecture and functionality of the platform with the wishes of the customer, Fraunhofer IESE performed detailed elicitations regarding the possible usage scenarios. In addition to the Central Prevention Services department responsible for the seminar program of BGW, these elicitations also included other BGW departments that either deal with product development or with customer support. In supplemental surveys, technical and data privacy constraints were analyzed, which must be taken into account when setting up and operating an electronic knowledge and communication platform.

On the basis of the results of the surveys, Fraunhofer IESE developed future usage scenarios in a design study and designed a possible technical architecture for the platform. Based on these recommendations, BGW has now started to design the platform.





*If you use the right methodology, eLearning is efficient!*



## A new dimension of networking in agriculture: agroConnect.rlp

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State of Rhineland-Palatinate  
[www.rlp.de](http://www.rlp.de)

The reform of the EU agricultural policy in 2003 and the dynamic developments on the world's agricultural markets have fundamentally changed conditions for the various sectors of agricultural production. The goal of improved consumer protection and the demand for cross-company quality assurance call for more efficient value-adding processes in the agricultural sector. For the state of Rhineland-Palatinate, this is to be achieved by means of an information and communication infrastructure for the support of agricultural business processes.

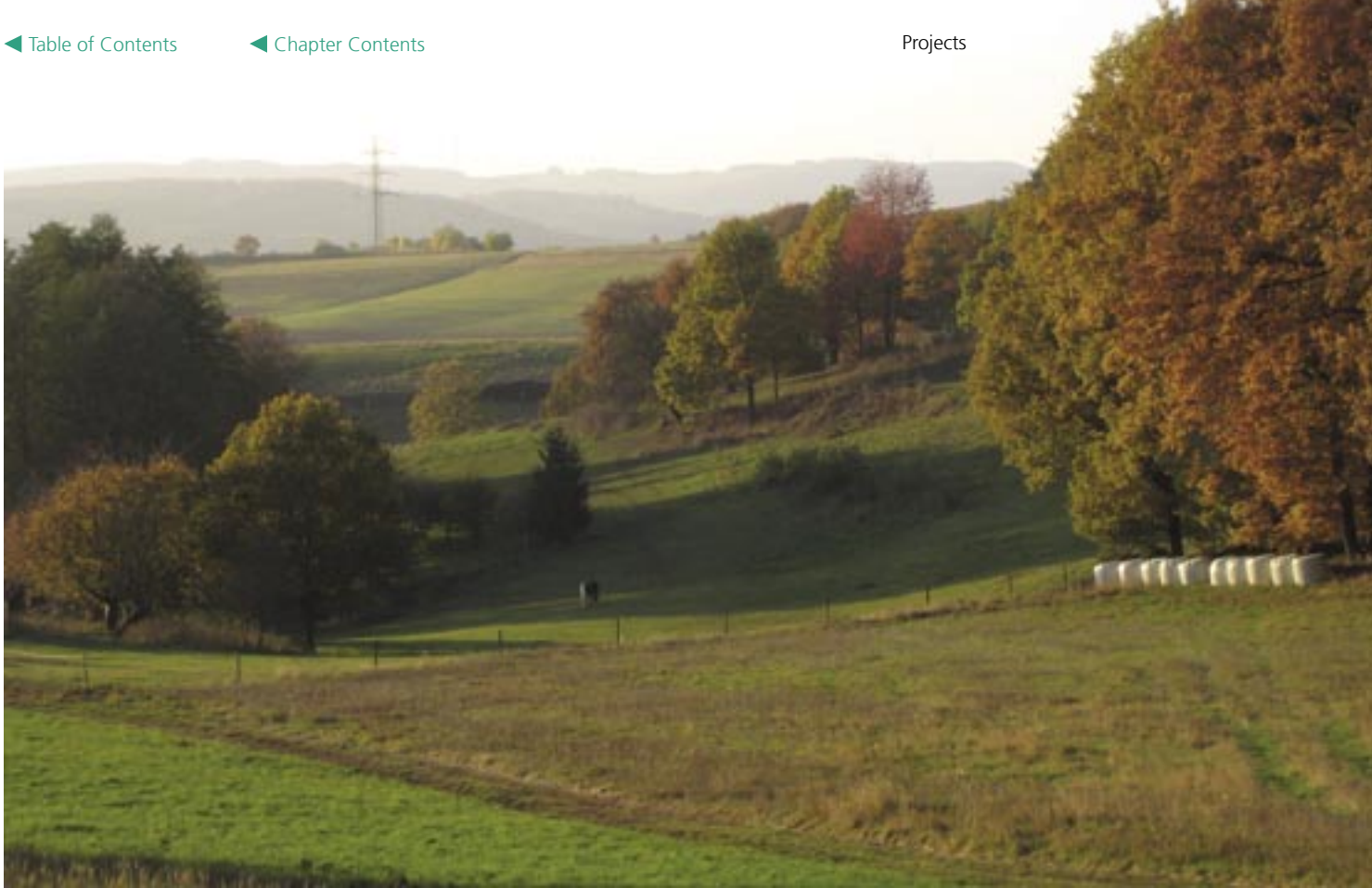
The task of agroConnect.rlp consists of supporting documentation-, administration-, and business workflows in agricultural production and consulting by public agencies. It shall be possible to include territorial data (aerial photographs, location and borders of cultivated areas) into these processes and exchange them. Very important aspects are the flexible use of the data captured once and the avoidance of unnecessary multiple entries. Technical requirements for this include standardized documents that allow exchanging alphanumerical data together with geodata between the stakeholders involved. The infrastructure is to be built up, and a prototype shall be developed and piloted on the basis of a service-oriented architecture (SOA).

The project agroConnect.rlp takes place in cooperation with the Competence Center for Innovative Information Systems of the University of Applied Sciences Bingen and the Service Center Rural Region Rhein-Nahe-Hunsrück. It is funded by the Ministry for Economics, Transport, Agriculture and Viniculture of the state of Rhineland-Palatinate (MWVLW).

Fraunhofer IESE makes numerous contributions to agroConnect.rlp:

- Overall project management of the consortium
- Coordination of the project work with activities of related projects by the state of Rhineland-Palatinate
- Analysis of representative agricultural production processes
- Elicitation and analyses of needs existent among the stakeholders involved (farmers, farmers' associations, contractors, outreach centers, etc.)
- Analysis and evaluation of project-relevant software components as well as important standards and formats for data exchange
- Selection and monitoring of pilot applications



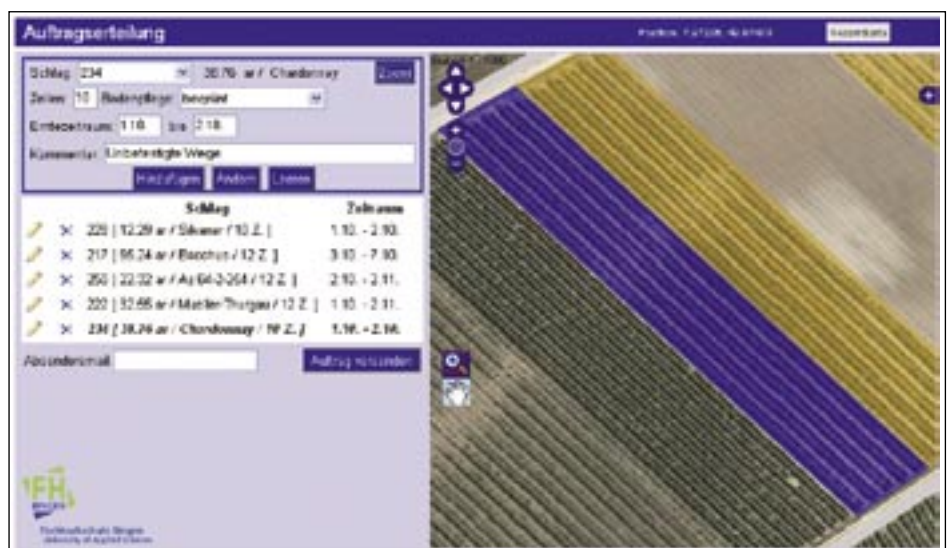


The first pilot applications of the project were performed and evaluated in the context of the 2007 grape harvest. Selected grape growers in Rhineland-Palatinate were able to use agroConnect.rlp to electronically conclude contracts with contractors whose fully automatic harvesting machines were equipped with GPS devices made by CORBITCONNECT AG. The data transfer also included data on the

grape growers' areas, which were used, for example, for optimizing the machines' routes and for determining their positions in real time.

For CeBIT2008, a presentation of agroConnect.rlp is under preparation. It shall demonstrate the system's potential and performance ability and prove that it is also suitable for other states.

*eGovernment strengthens the agricultural sector!*



**Service-oriented and web-based:**

The idea is that communication between the farmer, public agencies, and business partners should happen primarily online. Business process transactions take place over the Internet.



## EMERGE: Smart and proactive living environments

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**Collaboration Partners**

Siemens Corporate Technology  
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Westpfalz-Klinikum Kaiserslautern  
[www.westpfalz-klinikum.de](http://www.westpfalz-klinikum.de)

e-ISOTIS  
[www.e-isotis.org/](http://www.e-isotis.org/)

Bay Zoltan Foundation for Applied Research  
[www.bzlogi.hu](http://www.bzlogi.hu)

Art of Technology  
[www.art-of-technology.ch](http://www.art-of-technology.ch)

European Microsoft Innovation Center (EMIC)  
[www.microsoft.com/emic/](http://www.microsoft.com/emic/)

National Center of Scientific Research  
 »Demokritos«  
[www.demokritos.gr](http://www.demokritos.gr)

Medical University of Graz  
[www.meduni-graz.at/](http://www.meduni-graz.at/)

**Further information**

The EMERGE Project  
[www.emerge-project.eu](http://www.emerge-project.eu)

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



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

The aim of the EU project EMERGE – Emergency Monitoring and Prevention is to develop a modern and automated environment for elderly people using Ambient Intelligence technologies. The sensors that are needed for unobtrusively monitoring elderly people in their daily lives are primarily integrated into the home environment. Sensors mounted on people's bodies are only used for monitoring vital parameters

such as pulse. The data captured on the environment and the residents are fed into a so-called "Human Capability Model" (HCM), which combines the functional assessment of movements, activities, and vital data and derives Activities of Daily Life (ADL). The HCM is divided into a series of sub-models for sensors, environment, the functional health condition of an individual, and descriptions of normal, resp. irregular, activities from an emergency medicine perspective. These sub-models adapt to the respective "abilities" of the individual in question and to his or her very specific environment in order to detect potential, respectively acute, emergencies as accurately as possible. The system-generated assistance in case of an emergency is performed incrementally and involves other stakeholders such as family members, neighbors, caregivers, and emergency rescue dispatch centers. Emergency-specific information is transmitted using modern communication technologies in order to enable optimal reaction to the respective situation while improving resource disposition at the same time.



The benefits and disadvantages of the models, technologies, and solutions developed in EMERGE are studied under realistic conditions in two field trials as well as under laboratory conditions (including studies performed at the Assisted Living Laboratory of Fraunhofer IESE). These studies employ engineering-style quality models. They

are performed from the perspective of the people affected and from that of professional caregivers, as well as under technological aspects. In the medium term, positive results may lead to new medical and technical guidelines and standard operating procedures for emergency medicine and dispatch offices.

*Technology that thinks ahead!*



## Flying by instruments instead of flying blindly: Effective project control through “Software Cockpits”

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### Collaboration Partners Soft-Pit

Federal Ministry of Education and Research (BMBF)  
[www.bmbf.de](http://www.bmbf.de)

T-Systems Multimedia Solutions GmbH  
[www.t-systems-mms.com/](http://www.t-systems-mms.com/)

LogControl GmbH  
[www.logcontrol.de](http://www.logcontrol.de)

OrgaTech GmbH  
[www.orgatech.org](http://www.orgatech.org)

SQS Software Quality Systems AG  
[www.sqs.de](http://www.sqs.de)

FUJITSU Enabling Software Technology GmbH  
[www.est.fujitsu.com](http://www.est.fujitsu.com)

Brandenburg Technical University Cottbus  
Software Systems Engineering Research Group  
[www-sst.informatik.tu-cottbus.de/LS-SST](http://www-sst.informatik.tu-cottbus.de/LS-SST)

### Further information

Soft-Pit  
[www.soft-pit.de](http://www.soft-pit.de)

Even today, much still depends on a project manager's experience when it comes to controlling software development projects. Project managers often must make a “gut” decision about the current condition of the project and about the correct measures to take at any given time. Software project control centers, also called “Software Cockpits”, provide support for project management: They make control decisions transparent, make it possible to recognize risks early on, and enable project managers to take adequate and systematic countermeasures, if necessary.

Software Cockpits cannot be set up in a general manner, but rather only in a systematic way. Usually, procedures and characteristics differ so much between individual development projects, respectively application domains, that the planned project control center must be adapted to the specific context on the level of the organization and the project. Development projects are characterized by a large degree of creative, manual activities. The fully automatic capturing of information is thus not sufficient for getting a holistic picture.

In the context of the Soft-Pit project, which is funded by the German Federal Ministry of Education and Research BMBF, a framework is being developed for the systematic introduction

of Software Cockpits, with Fraunhofer IESE being in charge of the consortium of project partners. The primary goal of this project is to derive measurements based on project and organizational goals and strategies, and to select and adapt suitable interpretation and visualization mechanisms.

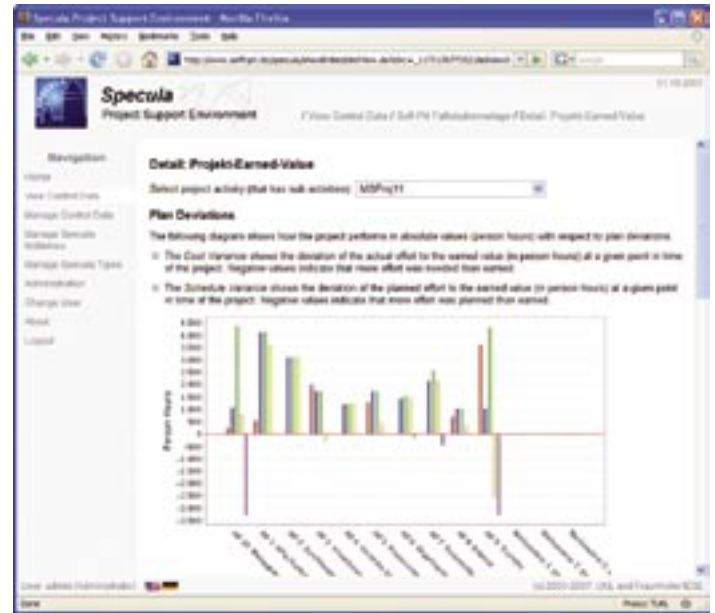
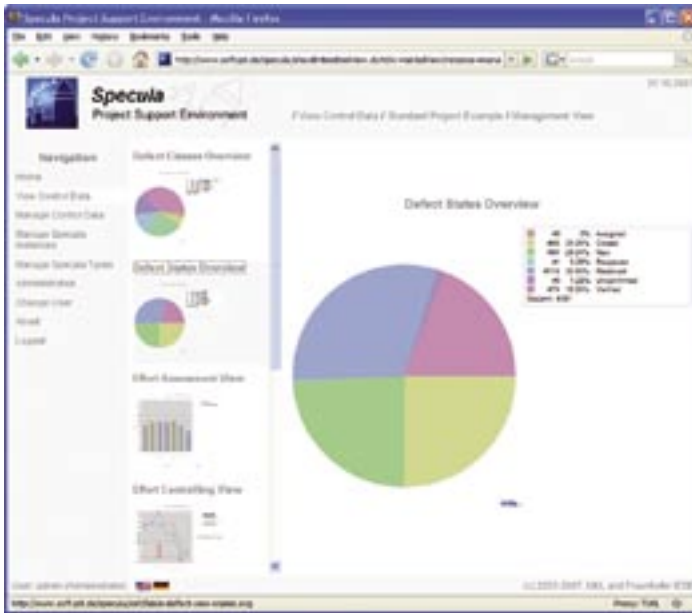
A controlling tool designed by Fraunhofer IESE implements and evaluates the mechanisms that have been developed. It efficiently combines different data collection, interpretation, and visualization components, which can be tailored to the intended application area. The approach was developed in collaboration with the consortium partners SQS Software Quality (Cologne) and the Software Systems Engineering chair of BTU Cottbus and is currently being validated empirically in industrial case studies by the partners T-Systems Multimedia Solutions GmbH (Dresden), LogControl GmbH (Pforzheim), and OrgaTech GmbH (Lünen) in the context of real development projects. In the future, experiences collected across an entire organization and explicitly documented knowledge shall also be integrated into the project control centers. This will make it faster and more effective to initiate suitable countermeasures in case of faulty development. Software Cockpits will thus eventually integrate themselves into a learning, continually improving organization.



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Forewarned is forearmed:

High-performance analysis tools look at a software project from different perspectives. Pertinent visualizations alert project managers to critical project states and risks.

*Keeping track with software project control centers!*

## Gaining a competitive edge through abstraction

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### Collaboration Partners

Deutsche Gesellschaft für Luft- und Raumfahrt (DLR) (Project sponsor)

Testo AG  
[www.testo.de](http://www.testo.de)

WIKON Kommunikationstechnik GmbH  
[www.wikon.de](http://www.wikon.de)

Büren & Partner Software Design GbR  
[www.spin.noris.de](http://www.spin.noris.de)

University of Bremen, Software Engineering Group (Faculty 3)  
[www.informatik.uni-bremen.de/st/](http://www.informatik.uni-bremen.de/st/)

Tynos IT Services

Alcatel-Lucent Deutschland AG  
[www.alcatel-lucent.com](http://www.alcatel-lucent.com)

### Further information

The ArQuE Project  
[www.iese.fraunhofer.de/projects/arque/de/](http://www.iese.fraunhofer.de/projects/arque/de/)

Successful companies develop products that are in demand by promptly reacting to customer wishes. However, getting a product to market fast must not result in lower product quality. In the project Architecture-centric Quality Engineering (ArQuE), funded by the German Federal Ministry of Education and Research (BMBF), these aspects are studied together with (currently) five industrial partners from the domain of product-integrated software (embedded systems).

Together with WIKON Kommunikationstechnik GmbH located in Kaiserslautern, Fraunhofer IESE has developed a new reference architecture for measurement devices for the remote monitoring and control of technical plants. The tool Software Architecture Evaluation and Visualization (SAVE), which was developed at Fraunhofer IESE and received the Rhineland-Palatinate innovation award, supported the definition and implementation of the newly designed architecture. Using SAVE, the implementations of the existing end devices were analyzed first and the lessons learned were then used for defining the new architecture. During

the subsequent transfer of the implementations into the new reference architecture, SAVE continually monitored the status by comparing nominal and actual values. This process-integrated success monitoring finally enabled fine-tuning and optimization of the reference architecture.

In the meantime, Wikon Kommunikationstechnik GmbH has developed the first generation of telecontrol devices in four variants based on the new architecture. Compared to previous generations of products, approx. ten months of working time could be saved in development so far, and about three months in testing. Considering that in this case, only three engineers were involved in developing the end devices, these figures show the enormous savings potential of architecture-centric development – especially in combination with consistent reuse of already existing components. By using this novel software architecture at the center of the entire development process, Wikon Kommunikationstechnik GmbH will now be able to bring its products to market significantly faster, while maintaining assured quality.

During the further course of the ArQuE project until April 2009, the lessons learned with Wikon and the other partners for the application domain of product-integrated software systems will be consolidated into an integrated approach. This ArQuE approach shall firmly establish processes such as reverse engineering and product metrics on the level of the architecture in order to achieve efficient quality assurance. The industrial case studies performed at all partner sites will contribute to the empirical validation of the resulting lessons learned.



**Faster time to market with software architectures:**

WiKon Kommunikationstechnik GmbH in Kaiserslautern is developing a wide range of different tele-control devices and telemetry devices – like the tank monitoring device pictured here. With the help of novel software architectures, the development cycles of the innovative products get significantly shorter, while quality remains the same.



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*Engineering-style planning  
– efficient development!*



## More FUN at work – business software with integrated motivational trainer

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(until September 2007)  
[www.est.fujitsu.com](http://www.est.fujitsu.com)

DCON Software & Service AG  
[www.dcon.de](http://www.dcon.de)

a3 systems GmbH  
[www.a3systems.com](http://www.a3systems.com)

### Further information

The Fun-of-Use Project  
[www.fun-of-use.de](http://www.fun-of-use.de)

Monotonous, uninteresting work with computer programs is not only a burden on employees, but due to the low productivity resulting from the lack of motivation, it is also a burden on a company's business success. The project FUN, which is funded by the German Federal Ministry of Education and Research (BMBF), has spent the past two years studying those features of business software that, in addition to pure functionality, have a positive impact on user experience in daily use.

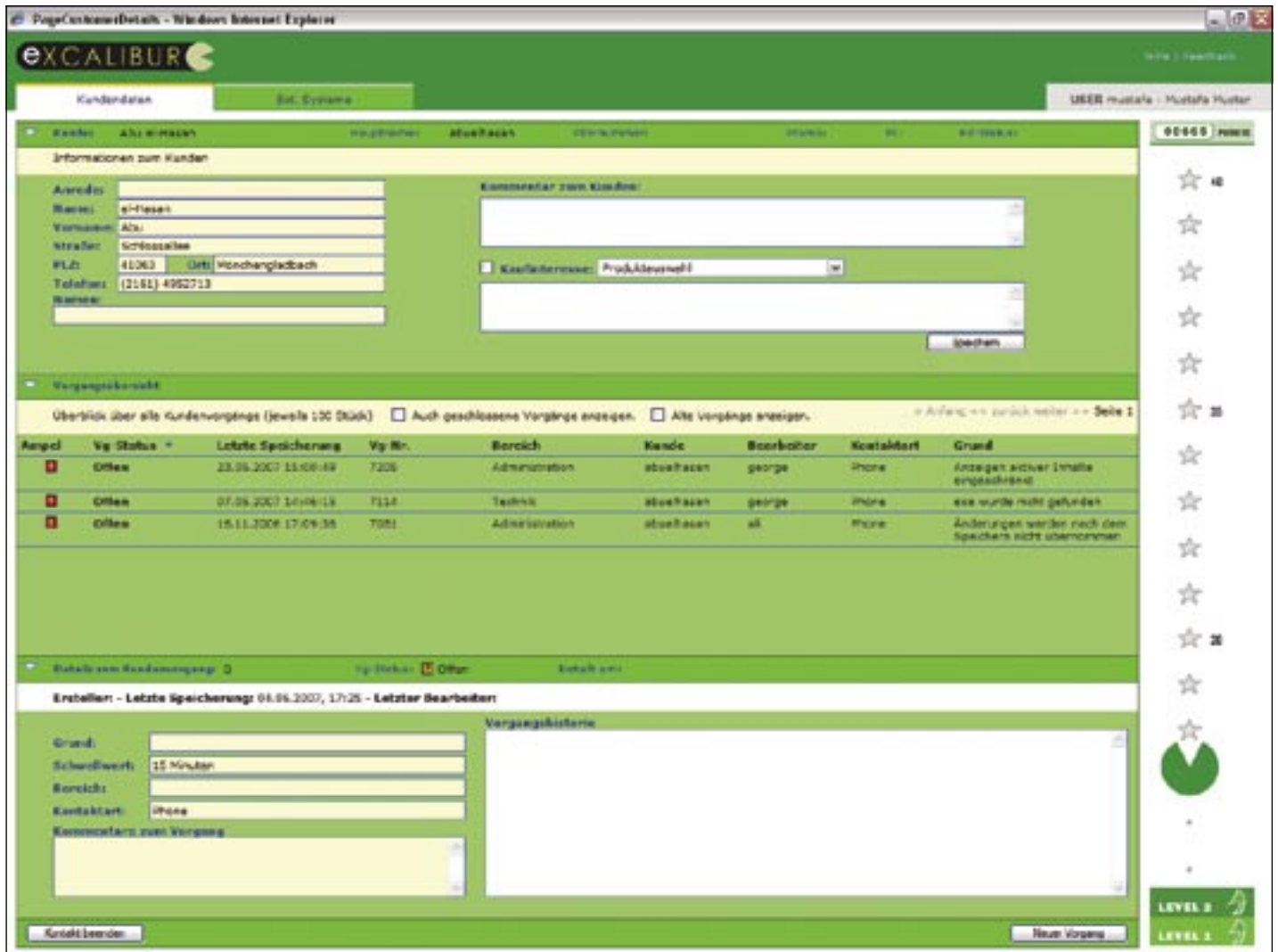
During the course of the project, the understanding of the term "Usability" was extended for the context of work. In addition to the idea of efficiency, aspects such as motivation and creativity during task fulfillment were also looked at, the objective being to increase employees' work output. In line with these ideas, highly motivating concepts were developed for designing user interaction with the business application, concepts that particularly animate users to continue a rather "boring" task or make it more interesting by offering alternative ways of doing such a task.

One of the collaboration partners for the practical implementation and the subsequent empirical studies in a controlled lab environment was the software manufacturer a3 systems GmbH located in Saarbrücken. The underlying application was a web-based helpdesk application for telephone customer ser-

vice. It mapped the support processes to be performed in a technically and organizationally perfect way in accordance with the IT Infrastructure Library (ITIL), the current de-facto standard in IT service management.

Out of the numerous alternative interaction concepts elaborated in advance, the so-called level concept was finally implemented for subsequent studies. When customer service employees do their daily routine tasks one after the other, they reach higher and higher levels – similar to a video game with several levels. The call center application thus "enriched" was studied at the usability lab of Fraunhofer IESE in terms of its motivating effect by comparing it against an unchanged application as a blind test.

The result was amazing: It was shown that the mere goal of achieving a higher level plus continuous comparison of one's own progress with that of colleagues resulted in significantly more customer requests being handled than with the unchanged software. The employees had more fun during work and were not distracted so easily. Therefore, it can be empirically proven that even those features of a software that have no direct impact on its functionality may thus increase the efficiency of work. Motivational interaction concepts in business applications pay off – in any regard.



**Small cause, great effect:**

In the context of the project FUN, motivational elements visualizing the progress of one's personal work were integrated into a call center application. The result of the relatively minor extension: significantly more fun in doing routine work and measurably higher performance.

*People who enjoy working work harder!*



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**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.



## Ultimate system quality with less manual work: INProVE automates the analysis of non-functional weaknesses

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Dr. Mario Trapp

### Collaboration Partners

System developers and suppliers  
from the automotive industry

Any change made to the technical equipment of a vehicle model must pass a safety and function control by the manufacturer. In the case of mechanical parts, more and more often, computer models are already tested in advance, long before the construction part arrives at the traditional testing site. In case of software parts, the situation is different: Although today, already more than 80 percent of new functionalities in the automotive area are at least partially the result of software, early testing of models on the software level is not yet sufficiently established. Tests do ensure that the software “works”. However, in general, there is no testing of the non-functional requirements, such as clear structuring, resource efficiency, or sustainability, which is just as important. The reason is quite obvious: Until now, detecting such weaknesses was only possible manually, with a lot of effort required to do so.

With the analysis platform INProVE – Indicator-based, Non-functional Property-oriented Evaluation and Evolution of Software Design Models developed by Fraunhofer IESE, there is now an “electronic test bed” for dataflow-oriented design models, so that in the future, it will also be possible to automatically look for those weaknesses that do not have an immediate effect on the functioning of the software. In order

to serve different application domains, INProVE is first tailored and calibrated for one domain. Then INProVE systematically and independently looks at design models in search of potential problem areas. For each indicator checked, the defects found are marked and each component is assessed according to its strength on a scale from “tolerable” to “critical”.

In order to achieve a success rate of over 90 percent when using INProVE, the engineers at Fraunhofer IESE have taken a close look at the industrial partners involved. The result is that INProVE already conserves and formalizes implicit, domain-specific expert knowledge today and evaluates the quality of the models based on this. Currently, typical elements and properties are being studied in static analyses that an expert can use to detect defects; preparation is under way for dynamic analyses. By using an automatically generated list of defects, the developers save a lot of time, which, in turn, can be usefully reinvested into increasing quality. In the future, this aspect will be actively supported by INProVE through automatic defect corrections and model improvement suggestions. Regular automatic control checks also continually show developers their progress towards higher efficiency and more software quality.

Embedded systems in the automotive area can be produced more cost-efficiently and with higher quality if automated weakness analyses are used. These systems, which may be critical, require not only functional checks, but also testing for non-functional problem issues.



**InProVE Command Center:**

With a single glance, the software developer detects possible weaknesses in the design model on the basis of the queried indicators. Expressive diagrams and color coding make it easy to distinguish critical defects from tolerable ones.



*Automatic analysis platforms increase quality and decrease time to market!*





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## 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)

The Fraunhofer Center for Experimental Software Engineering, 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 engages in research and technology transfer 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 organizations' software issues.

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

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 or acquire software as part of their business.

Project customers include government agencies such as the Department of Defense and NASA and companies like Boeing, Motorola, Daimler, 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.

In its work, FC-MD adheres to the following list of fundamental principles:

- 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,

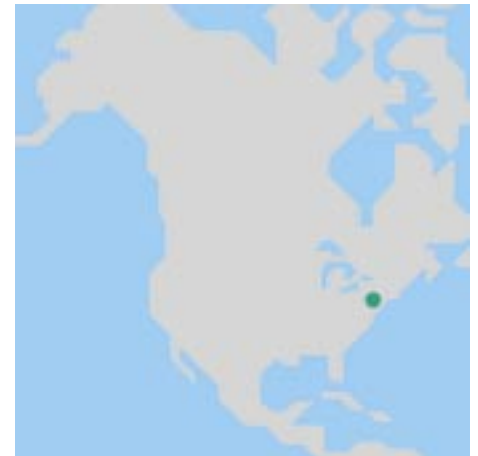
- Utilizing experience to guide technical and management choices,
- Tailoring solutions to meet specific customer contexts,
- Transferring proven technologies into practice.

### Competencies

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

### Business Areas

- Aerospace / NASA  
Contact: Frank Herman
- Defense  
Contact: Kathleen Dangle, Frank Herman
- Small & Medium-Sized Business Process Improvement  
Contact: Kathleen Dangle
- Automotive  
Contact: Prof. Rance Cleaveland
- Medical  
Contact: Prof. Rance Cleaveland



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



## Projects in Progress

### Software Architecture Tools and Methodologies

During 2007, FC-MD continued its long-standing collaboration with IESE on the software-architecture analysis and evaluation (SAVE) technology. The SAVE tool has been applied by both FC-MD and IESE to software architectures of partners and customers, and FC-MD has in the past used the tool as part of the NASA technology infusion program that transitions promising laboratory tools into practice within NASA. One noteworthy development in 2007 with respect to this technology was the preparation by FC-MD personnel, with input from IESE researchers, of a patent application for the core algorithms used by SAVE to infer software architecture from source-code files. The application is being filed in the USA and other countries, with the eventual view toward commercialization of the underlying technology.

FC-MD also received a Software Assurance Research Program (SARP) grant from NASA to study new additions to the SAVE paradigm. Traditionally, SAVE has relied on the static analysis of source code to compute architectural information. While computationally efficient, such methods are known to suffer from deficiencies in analyzing certain types of software systems, including those that use networks for intra-system communication. FC-MD is using its new award to study the addition of run-time information into software architecture analysis. The new techniques rely on the collection of information obtained while an applica-

tion is running and comparing this information with specifications regarding expected behavior given by developers. The project involves close cooperation with the Johns Hopkins University Applied Physics Laboratory, which provides development assistance to NASA on its space exploration, satellite, and missions-operations programs. In particular, a group responsible for the development of new ground-communications software is serving as a testbed for the new SAVE developments. This effort is a follow-on to a very successful experience with earlier SAVE technology in the context of a NASA Technology Infusion effort undertaken by FC-MD with APL, which resulted in the publication of technical papers and dramatically raised the profile of SAVE within NASA.

### Software Defect Experience Base

With the help of a newly acquired research grant from NASA, also through the Software Assurance Research Program, FC-MD has begun development of tools for organizing information about software defects and turning it into actionable assets with organizations. While software defects are widely discussed both inside and outside the software industry, precise classifications of the sources of, consequences of, and approaches to preventing or correcting them remain underexplored. FC-MD has special expertise in the construction of so-called experience bases for software; such experience bases organize information about different aspects of software development so that it can be reused and disseminated throughout an

organization. The purpose of this project is to develop an experience base for software defects that can be used as a basis for iteratively improving the development practices of an organization.

Work so far has focused on the development of a NASA-oriented taxonomy of software defects, using defect data collected by different NASA centers. Information on the sources of these defects, and the remedial actions (fixes, workarounds, etc.) employed by the different NASA projects, is also being studied. The eventual goal is a lessons-learned database, coupled with strategies for rating information quality and usefulness, that can be used to determine best practices for preventing software defects and coping with them when they arise.

### Best Practices Clearinghouse

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

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

practice selection. The BPCCh 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. BPCCh 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 BPCCh 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 BPCCh 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). The project has been underway for several years; efforts in 2007 focused on the acquisition of information about software best practices and the population of BPCCh databases with it. Efforts were also undertaken, using an internal project, to develop a generic BPCCh that can be targeted at organizations other than DAU. This genericization, called EMPEROR, is intended to be the source of future project work for FC-MD.

## 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 to 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, 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.

## 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 CESE launched a public training program initiative to help practitioners learn about specific topics and interact on a course-by-course basis. CESE initial offerings include:

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

In 2007, these offerings accounted for contacts with over 100 software engineers in area organizations.

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

In extending GQM, the GQM+Strategies™ approach first makes the business goals, strategies, and corresponding software goals explicit in the form of a model. Multifaceted links are established 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 IESE are developing support tools that take advantage of actual experiences and specific expertise in GQM+Strategies™ by storing common business goals, strategies, scenarios, etc., and their linkages. Using these tools, organizations will be better able to choose and navigate through the space of options and will be able to identify their own measurement program and track the organization's performance over time.

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

- Set-up and installation of a measurement program



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

FC-MD and IESE also provide training and workshops in the following areas:

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

### 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, the 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 that 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 from the analyses and studies so far 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 series of pilot studies on automated techniques for checking functional requirements on models of embedded control applications, and exploring how these techniques might be combined with Bosch tools and methods for checking non-functional requirements. The project is intended to assess the utility of Bosch's controller-design and instrumentation-based

validation processes for formally checking functional requirements against models of embedded controllers. The key features of the technique include:

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

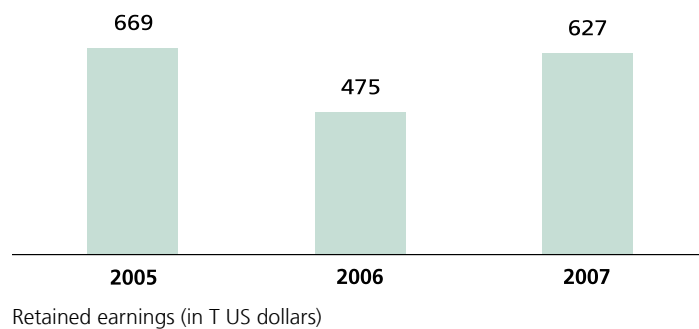
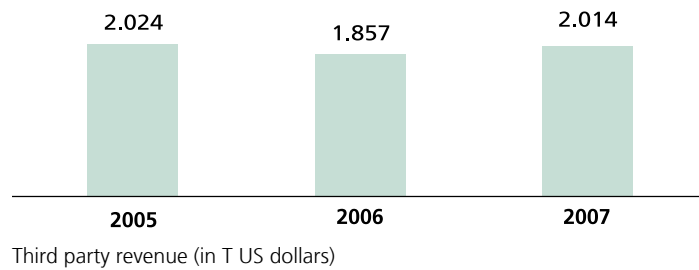
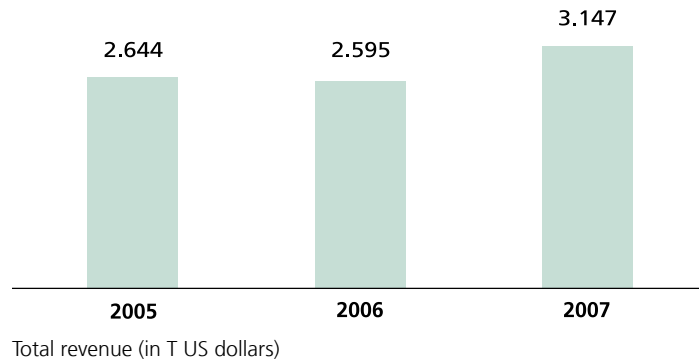
The technical work in the project has involved taking a Bosch controller model and the associated requirements specification, converting the model to Simulink® / Stateflow®, formalizing functional requirements as monitor models, also in Simulink® / Stateflow®, and using a Commercial Off-the-Shelf (COTS)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

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

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

### FC-MD in Figures

FC-MD experienced a sharp rebound in its revenues in 2007 vis à vis 2006. This was due to important new project wins in NASA’s Software Assurance Research Program, to new industrial projects in the automotive industry, and to renewals and increases in ongoing projects, specifically the Best Practices Clearinghouse. At the time of this report, final year-end figures for FC-MD were not available, but projections based on data through October 2007 suggest that 3rd-party revenues will slightly edge those of 2005, becoming the best to-date since FC-MD was founded. Retained earnings are also expected to show a significant increase. The net effect is a large jump over 2006 in both of these figures, and in total Center revenues. In 2007, 3rd-party revenues accounted for approximately 67% of total revenues. This represents a decrease from 2006, in which 72% of revenues were due to 3rd-party projects. This small decline was due to a greater sum of discretionary money coming from Fraunhofer USA to FC-MD, compared with 2006, in support of FC-MD 3rd-party governmental research projects that required matching funding from Fraunhofer.



### University Partners

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

### Other Partners

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

## Multinational EU 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:** Development of an open framework consisting of a requirements-driven software development method, a repository for systematic reuse, 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 sistemas, 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 is increasingly taking over a key position in our everyday lives. Yet, an unacceptably high number of software projects fail, caused, among other things, by the enormous complexity of the requirements. Interdependencies, dependencies, and great variability easily result in project managers losing the overview.

Software developers often have significant problems with managing this complexity. Regardless of whether the issue is to keep track of changes or reuse knowledge from previous projects: The main barrier in overcoming these problems is frequently a lack of mechanisms for describing and reusing coherent solutions to problems.

The main objective of the project "ReDSeeDS" is to develop an open framework consisting of a requirements-driven development method (including a precise specification language and corresponding processes), a repository for systematic reuse, and tool support throughout.

Traditionally, reuse in software development has been associated first of all with higher initial effort. Contrary to prior approaches, ReDSeeDS therefore minimizes exactly this effort. The basic reuse approach is case-based, with a reusable case comprising a complete set of software development documents (models and code) that belong together, from the user's needs to the resulting executable application. The ReDSeeDS framework appropriately packages these cases for reuse.

The actual reuse then happens like this: A new problem description in the form of a requirements model is compared to already existing models. The solution information (models and code) of the most similar problem is then suggested for reuse. Of course, adaptations to the concrete problem are still necessary.

To develop the ReDSeeDS framework, the project will combine and enhance the state of the art in the areas of requirements engineering, meta-modeling, model transformation, as well as querying and inference techniques.

This combination, while innovative by itself, will enable a completely new approach to software development based on case-based reuse. With the availability of open case bases and solution databases, this concept shall become the starting point for a community of software developers oriented towards systematic reuse.

Fraunhofer IESE supports the ReDSeeDS consortium with its competencies in the areas of software development methods, requirements management, systematic reuse, and empirical validation.



## QualOSS – Quality of Open Source Software

**Project Topic:** Quality offensive and quality seal for open-source software

**Keywords:** open-source software, software quality, quality management, license management, cost optimization

**Cooperation Partners:** Centre d'Excellence en Technologies de l'Information et de la Communication, Charleroi (Belgium); Facultés universitaires Notre-Dame de la Paix, Namur (Belgium); Universidad Rey Juan Carlos, Madrid (Spain); Zea Partners, Louvain-la-Neuve (Belgium); United Nations University - Maastricht Economic and Social Research and Training Centre on Innovation and Technology MERIT, Maastricht (The Netherlands); PEPITE, Liège (Belgium) AdaCore, Paris (France)

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**Grant Number:** 033547, IST-2005-2.5.5

As one of eight consortium partners, Fraunhofer IESE provides support for the European project QualOSS – Quality of Open Source Software. Its subject is a quality evaluation system for Open Source software. It includes a methodology that has been exhaustively validated empirically, as well as appropriate tools for automated quality evaluation. The project has an overall volume of almost 3 million euros and is initially scheduled to run until 31 March 2009.

The project QualOSS - Quality of Open Source Software, which is funded in the context of the European Union's 6th Framework Program (grant number: 033547, IST-2005-2.5.5), aims at developing a kind of "quality seal" for Open Source software. Based on the evaluation via QualOSS, users of software systems shall be enabled to easily determine to which degree a certain Open Source solution fulfills selected requirements. Especially non-functional quality requirements such as robustness and maintainability are targeted. Thus, QualOSS also analyzes factors such as the activity of the developer community of an Open Source solution, since this has direct consequences for the long-term usability of the software being developed. The first phase of the project has already been concluded; important decision-making criteria from industry and appropriate assessment tools are thus available.

QualOSS combines a total of eight European research and industrial partners from Belgium, Germany, France, the Netherlands, and Spain in one network. Fraunhofer IESE as an independent expert on professional software quality management and software testing contributes its proven competence regarding the measurement-based evaluation of software and systems to the project. "The strategic importance of Open Source software is increasing in many companies and administrations. Based on lessons learned in the context of our collaboration in QualOSS, we can provide companies with even more systematic support in the selection of Open Source software", says Dr. Jürgen Münch, division manager for quality management at Fraunhofer IESE.

More and more often, the use of Open Source software is seen as an alternative to proprietary software. The advantages are obvious: On the one hand, Open Source software is available in a modifiable form and can be adapted to the needs of the user organization. On the other hand, Open Source software offers plenty of functionality at relatively moderate purchasing costs, functionality that otherwise would have to be developed by the company itself or would have to be bought at a high price from proprietary sources. However, the use of Open Source software entails specific risks. This is especially true regarding deployment maturity issues and future sustainability, but also legal aspects such as warranty or licensing issues. Thus, such criteria should be evaluated with regard to concrete company goals in order to deploy Open Source software with as much profit and as little risk as possible.

Further information:

[www.qualoss.eu](http://www.qualoss.eu)

## EMERGE – Emergency Monitoring and Prevention

**Project Topic:** European consortium for Emergency Prevention and Assisted Living under the leadership of Fraunhofer IESE

**Keywords:** emergency prevention, assisted living, intelligent living environments

**Cooperation Partners:** Westpfalz-Klinikum, Kaiserslautern (Germany); Siemens AG, Munich (Germany); European Microsoft Innovation Center, Aachen (Germany); Art of Technology AG, Zurich (Switzerland); Medical University of Graz (Austria); National Center of Scientific Research "Demokritos", Athens (Greece); e-ISOTIS, Athens (Greece); Bay Zoltan Foundation for Applied Research, Szeged (Hungary)

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**Grant Number:**  
IST-2005-045056

In the context of the project Emergency Monitoring and Prevention (EMERGE) funded by the European Union, the Fraunhofer Institute for Experimental Software Engineering IESE together with other European partners is developing approaches and solutions to extend the time that elderly people can live a self-determined life in their own homes.

Fraunhofer IESE is the main coordinator of EMERGE. As an applied research institute, it contributes its competencies in the area of assisted living for elderly people from other software and systems development projects. The institute's Assisted Living Lab as a realistic test environment will play an important role in testing and integrating prototype solutions. In addition, field tests are planned in nursing homes and assisted living institutions in Germany and Greece in order to collect practical experiences.

As partners of Fraunhofer IESE, eight other research institutions and industrial companies from Germany (Westpfalz-Klinikum GmbH, Kaiserslautern; Siemens AG; European Microsoft Innovation Center), Switzerland (Art of Technology), Austria (Medical University of Graz), Greece (NCSR "Demokritos", e-ISOTIS), and Hungary (Bay Zoltan Foundation) are participating

in EMERGE. Their contributions will include technical developments as well as holistic approaches for health assistance for the elderly.

The goal of the project is to recognize emergency situations at home with the help of ambient and unobtrusive technology, and to provide adequate assistance, if needed. In addition to technical solutions, models for complete systems will be developed, which include the personal environment as well as recorded sensor data, and which can be custom-tailored to the needs of an individual.

The project will be funded with 2.45 million euros for close to three years in the context of the Sixth Research Framework Program of the European Union (grant number IST-2005-2.6.2 045056). The project partners will contribute a total of 1.5 million euros.





## Upskilling to UML

**Project Topic:** Development and localization of offline and online training materials for the UML modeling language. "Upskilling to UML" was co-funded by the European Union's vocational training program "LEONARDO DA VINCI".

**Results/Goals:** Innovative training materials and efficient training methods for the Unified Modeling Language (UML 2.0)

**Keywords:** UML, qualification building kit

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

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**Grant Number:** PP 146 369

The Unified Modeling Language (UML) is a standardized graphical language for describing object-oriented models. Without it, the world of object-oriented development would be hard to imagine nowadays. The UML offers a uniform notation for many areas of application and serves to describe database appli-



cations, graphics programs, workflow applications, real-time systems, etc. Furthermore, the use of UML has great strategic significance for an organization, since its influences become noticeable on many levels and UML diagrams in a project quickly become the “lingua franca”, the central medium for exchange between all stakeholders.

Today, the most important question for most organizations is no longer whether they will use UML, but rather: How can their employees working in development learn the modeling language UML as efficiently as possible and apply it productively in everyday use?

In light of these issues, blended-learning programs with their mixture of traditional classroom teaching and phases of independent learning, alone or in groups, become an attractive option. In the context of the Leonardo da Vinci project Up2UML, a building kit for training has been developed that supports trainers, course suppliers, and organizations with contents and methods for designing and executing qualification measures for UML 2.0. These can be used in a multitude of ways:

- Flexible usage of learning media in individually defined teaching/learning scenarios
- Simple adaptation in terms of content and design to the needs of the respective course
- Automated production of proprietary learning products
  - in different output formats and combinations (e.g., as online course, as printed reference book), as well as
  - in several languages (English, German, French, Bulgarian)
- Simple integration into learning or content management systems such as Moodle, Ilias, etc. via SCORM interface
- Integration into target-group-specific blended-learning scenarios supported by practice-oriented and adaptable guidebooks

Further information:

[www.up2uml.org](http://www.up2uml.org)





## Fraunhofer IESE in Worldwide Projects



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 Aml, development methods for adaptive systems with strict requirements on service quality, safety and security engineering, architectures & platforms for Aml 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); University of Kaiserslautern (Germany)

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

Professor Nehmer and Professor Rombach (Department of Computer Science of the University of Kaiserslautern) 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, various technologies for improving energy efficiency, communications adaptive systems, safety and security engineering, architectures & platforms as well as innovative human-machine interfaces were selected as 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 BelAml pilot project – under the leadership of the Fraunhofer Institute for Experimental Software Engineering (IESE) in Germany and the Inter-Uni-

versity 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 former 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 are 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. On the Hungarian side, funding

is provided by the National Office for Research and Technology (NKTH) under the supervision of the Ministry of Economic Affairs and Transportation. 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 workshop on joint scientific model topics and projects took place in Budapest. Since then, there has been regular exchange between the project participants. 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-)



**A visitor from Japan:**

For several years, Fraunhofer IESE has been collaborating intensively and successfully with the international electronic corporation Ricoh Co., Ltd., including cooperation in joint research labs. In October 2007, the Director of the German Research Center for Artificial Intelligence (DFKI), Prof. Andreas Dengel (l.), the Director of Fraunhofer IESE, Prof. Peter Liggesmeyer, the CEO of Ricoh Co., Ltd., Shiro Kondo, and the managing Director of DFKI, Dr. Walter Olthoff met in Kaiserslautern to discuss future activities.

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)

**Contact:** Dr. Jürgen Münch  
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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 Engineer-

ing 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 perform research into software development methods and further develop these methods; technology transfer into Japanese companies is also supported. 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. The topics of "Project Effort Estimation" and "Quantitative Project

Management" have been packaged for transfer in a multitude of projects. This included, among other things, the use of 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. Currently, the analysis and adaptation of continuing process improvement procedures for 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

### 2nd German-Korea Workshop on Software Product Lines

#### Background

As one of the collaboration programs of German-Korean research partnership, which is funded by the German Ministry of Education and Research (BMBF), the 2nd Workshop on Software Product Lines was held in Korea. This year, the workshop was hosted by Pohang University of Science and Technology (POSTECH), which organized the workshop in conjunction with Fraunhofer IESE.

#### Workshop Program

The workshop program included several Korean and German presentations. They covered various aspects of product line engineering from research issues and technologies to industrial applications in each country. The talk given by Fraunhofer scientist Dr. Dirk Muthig presented the challenges in the area of software and systems engineering in Europe with a special focus on organizational and economic aspects. Joochwan Kim, the representative of the Fraunhofer-Gesellschaft in Korea, gave an overview of the activities of the Fraunhofer-Gesellschaft in Korea. The remainder of the program concentrated on various technical issues and solutions for the efficient development and maintenance of software products, such as the service-oriented paradigm, aspect-oriented product line asset development, CASE tool support, and business process modeling.

#### Participants

A total of twenty people from different organizations took part in the workshop, both from academia and industry. The participating industrial organizations again included Samsung Electronics, but also Pohang Steel Company (POSCO). With POSCO, a collaboration project was subsequently initiated that

evaluates the applicability of the Fraunhofer PuLSE® method as a controlling software for steel plants.

#### Achievements and Outlook

The greatest challenges to establishing international collaboration are finding the right persons to contact and establishing a human network. From this perspective, the workshop was a successful continuation of prior activities. 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 collaboration projects have already been generated is evidence of this success.

There was a consensus on the necessity of continuing this workshop with a broader agenda and more participating organizations, as the demand for product line engineering practitioners is growing rapidly, not only in software-oriented industries but also in manufacturing industries such as automobiles, steel products, and cellular phones. As a visible sign of this commitment, the organizing committee decided to plan the 3rd workshop in Germany with an enhanced program and increased attractiveness for participants from industry.

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## 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.

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### COMPAS: What comes after capability level 5?

(Cooperation on Measurement-based quantified Processes for Activities in Software 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)

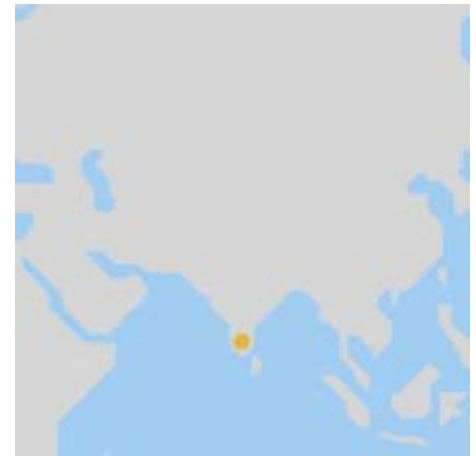
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One characteristic feature of mature software development processes is the enrichment of the process steps, which are initially merely defined qualitatively, with quantitative data (metrics) and, eventually, the control and optimization of the development 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 predic-



tion 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 samples of running or recently concluded projects in Europe.

### Collaboration Agreement on Maritime Software Engineering

**Project Topic:** Collaboration on software engineering for maritime applications

**Keywords:** embedded systems, process modeling, empirical analyses, cargo and passenger shipping, construction of maritime vessels, shipbuilding

**Cooperation Partners:** University of Kaiserslautern (Germany), University of Malta (Malta)

**Contact:**

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The beaming faces of the delegation members were proof that an agreement had been concluded successfully: The collaboration agreement between the Universities of Malta and Kaiserslautern in the area of Software Engineering for Maritime Applications was a done deal. The Fraunhofer Institute for Experimental Software Engineering IESE as a research and collaboration partner will contribute to the project with its competencies in embedded systems, in designing development processes, and in empirical analyses.







The high-ranking Maltese delegation led by the president of the University of Malta, Prof. Juanito Camilleri, had come to Kaiserslautern for a three-day visit during the second half of September. The stopovers of the representatives from academia and industry included a reception by the Lord Mayor of the city of Kaiserslautern, Dr. Klaus Weichel, and a meeting at Fraunhofer IESE, where the first steps of the collaboration were discussed. The highlight was the signing of the official memorandum of understanding at the University of Kaiserslautern, which stipulates the comprehensive collaboration between the two research institutions for one year initially.

In order to provide a solid scientific basis for the collaboration, the first step planned in cooperation with Fraunhofer IESE will be to take stock of the systems and software currently in use in maritime navigation. In a way analogous to known technologies from similar application areas such as commercial vehicles, future system architectures to be used in maritime vessels shall be derived from the knowledge and requirements obtained in this way.

Prof. Dieter Rombach, Executive Director of Fraunhofer IESE and one of the initiators of the visit, was satisfied:

“I am sure that this collaboration will result in important impulses, which will reach far beyond improvements in the development of complex software systems in maritime navigation.” The fact that two universities are concluding such an agreement has good reasons: By providing engineers with qualified training in future-oriented IT areas early on, one can counteract the lack of a professional workforce way before it leads to technological and economic drawbacks.

Jointly organized courses of study teaching both nautical and software engineering skills are envisioned as the first projects of the collaboration. The University of Kaiserslautern will contribute its practical experience in the area of IT qualification for graduates from other departments to the collaboration project. The Distance and International Studies Center, which is associated with the University, already offers post-graduate courses of study in the area of Software Engineering for Embedded Systems.

Information and communication technology has become a part of modern maritime navigation long ago. From motor yachts to container freighters – hardly any maritime vessel can do without computer-supported and software-based systems today. However, potential problems, which might even be safety-relevant in this area, do not only include missing standards, incomplete system integration, and non-harmonizing interfaces. The personnel side should not be underestimated, either: Whereas the seaman with a classical education is often barely familiar with modern computer systems, the engineer tasked with developing maritime systems often lacks important mari-

time navigation knowledge. Just like a combine or an excavator, “maritime commercial vehicles” are also built in relatively low numbers, while having to fulfill the highest requirements in terms of safety and reliability – even under the harshest conditions.

Against this background, a vast field of activity exists for collaboration projects from various disciplines, which is very promising from both a scientific perspective and an economic perspective. The ground-breaking agreement between the Universities of Malta and Kaiserslautern is a first step in this direction.

**Beaming faces**

after signing of the collaboration agreement between the Universities of Malta and Kaiserslautern.

- From left to right:
- Ph.D. Anton Bartolo, EuroMedITI Ltd.
- Geir Fagerhus, Steps Ahead
- Oscar Borg, Malta Maritime Authority
- Krystyna Wojnarowicz, Steps Ahead
- Prof. Helmut Schmidt, President of the University of Kaiserslautern
- Prof. Juanito Camilleri, Rector of the University of Malta
- Chris Falzon, Malta Enterprise
- Prof. Dieter Rombach, Fraunhofer IESE
- Ph.D. John Attard, CEO of EuroMedITI Ltd.



## German-French Research Partnership in Computer Science

**Project Topic:** Intensification of bilateral computer science research

**Keywords:** European research, computer science

### Cooperation Partners:

German Partners: German Research Center for Artificial Intelligence (DFKI GmbH), Fraunhofer Institute for Experimental Software Engineering (IESE), Max Planck Institute for Informatics, Max Planck Institute for Software Systems, University of Kaiserslautern, Saarland University.

French Partners: Centre National de la Recherche Scientifique; Institut National de Recherche en Informatique et en Automatique, Institut National Polytechnique de Lorraine, Université Henri Poincaré Nancy 1, Université Nancy 2, Université Paul Verlaine de Metz.

### Contact:

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The joint computer science research between Germany and France is being intensified. Bilateral research has existed for years between six German and six French research institutions. Now, the German-French cooperation agreement recently signed in Nancy will help to improve coordination and lead to an expansion of the topics covered.

As soon as the agreement came into effect, the first step for the 12 partner institutes was to form a steering committee. As one of the German institutes involved, the Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern is represented by its director Prof. Dr. Dieter Rombach. The first meeting of the steering committee took place at Fraunhofer IESE in Kaiserslautern in March 2007.

In the future, researchers of the involved institutions will increase their scientific collaboration in joint information and communications research projects, and will thereby also be able to improve the coordination of joint applications to European calls for proposals.



Thus, the transnational region of Wallonia, Luxembourg, Saarland, and Lorraine has the potential of becoming a center of excellence in the area of computer science. For example, researchers of the involved institutes are already working on algorithms for the automatic recognition of handwriting and speech, as well as on multi-language and multi-modal systems.



### Intensification of research in computer science:

The German-French delegation after signing of the collaboration agreement. On the far right: Prof. Frank Bomarius, Deputy Director of Fraunhofer IESE.

## Fraunhofer IESE in International Networks



Fraunhofer IESE is active in various international research networks. In addition to the need for being included in international networks from a research perspective, this commitment is also motivated by the experimental approach, which says that 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. These statements help to consolidate the respective methods in the sense of applied research. 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; an intensive mutual exchange of experience takes place



especially with the following partners: 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), Prof. Dr. Natalia Juristo (Politecnico 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. Dag Sjøberg (SIMULA, Norway), Prof. Reidar Conradi (NTNU, Norway), Prof. Dr. Markku Oivo (University of Oulu, Finland), Prof. Dr. Barry Boehm (University of Southern California, USA), Prof. Guilherme Travassos (Universidade Federal do Rio de Janeiro/COPPE, Brazil), Dr. Tore Dybå (SINTEF, Norway).

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 the Software Engineering Institute SEI in the USA, as well as with partners in India, Korea, and China. Within these collaborations, there is also a lively exchange of scientists and students.

### 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:

- Avaya Labs, USA  
<http://www.research.avayalabs.com/>
- Blekinge Institute of Technology (BTH), Sweden  
<http://www.bth.se/eng/>
- Computer Science and Systems Engineering Program COPPE, Federal University of Rio de Janeiro, Brazil  
<http://www.cos.ufrj.br/english/>
- Fraunhofer Center Maryland, USA  
<http://fc-md.umd.edu/>
- Fraunhofer Institute for Experimental Software Engineering, Germany  
<http://www.iese.fraunhofer.de/>
- Helsinki University of Technology, Finland  
<http://www.hut.fi/English/>
- Japan Manned Space Systems Corporation (JAMSS), Japan  
[http://www.jaxa.jp/index\\_e.html](http://www.jaxa.jp/index_e.html)
- Japan Aerospace Exploration Agency (JAXA), Japan  
[http://www.jaxa.jp/index\\_e.html](http://www.jaxa.jp/index_e.html)
- Lund University, Sweden  
<http://www.tts.lth.se/>
- Microsoft Research, USA  
<http://research.microsoft.com>
- Mississippi State University, USA  
<http://cse.msstate.edu>
- MIT Lean Aerospace Initiative, USA  
<http://web.mit.edu/>
- Nara Institute of Science and Technology, Japan  
[http://www.naist.jp/index\\_en.html](http://www.naist.jp/index_en.html)
- North Carolina State University, USA  
<http://www.ncsu.edu/>
- Northrop Grumman, USA  
<http://www.northropgrumman.com>



- NRC Institute for Information Technology, Canada  
[http://it-iti.nrc-cnrc.gc.ca/index\\_e.html](http://it-iti.nrc-cnrc.gc.ca/index_e.html)
- Norwegian University of Technology & Science, Norway  
<http://www.idi.ntnu.no/english/>
- NTT Data Corporation, Japan  
<http://www.nttdata.co.jp/en/index.html>
- Osaka University, Japan  
<http://www.osaka-u.ac.jp/eng/>
- SIMULA Research Laboratory, Norway  
<http://www.simula.no/>
- SINTEF, Norway  
<http://www.sintef.no/>
- SUN Microsystems, USA  
<http://www.sun.com>
- University of Kaiserslautern, Germany  
<http://www.uni-kl.de/>
- University of Vienna, Austria  
<http://www.tuwien.ac.at/>
- Universidad ORT Uruguay, Uruguay  
<http://www.ort.edu.uy/>
- Universidad Politécnica de Madrid, Spain  
<http://www.upm.es/>
- Universidad Politécnica de Valencia, Spain  
<http://www.upv.es/index-en.html>
- Universidade de São Paulo (USP), Brazil  
<http://www2.usp.br/ingles>
- Università degli Studi di Roma »Tor Vergata«, Italy  
<http://www.uniroma2.it/>
- University of Alberta, Canada  
<http://www.ualberta.ca/>
- University of Auckland , New Zealand  
<http://www.cs.auckland.ac.nz/>
- University of Bari, Italy  
[http://www.uniba.it/index\\_n.php](http://www.uniba.it/index_n.php)
- University of Calgary, Canada  
<http://sern.ucalgary.ca/~ruhe/>
- University of Castilla-La Mancha, Spain  
<http://www.uclm.es/> Spain
- University of Hawaii, USA  
<http://www.ics.hawaii.edu/>
- University of Maryland, Baltimore County (UMBC), USA  
<http://www.umbc.edu/>
- University of Maryland at College Park, USA  
<http://www.cs.umd.edu/>
- University of New South Wales, Australia  
<http://www.unsw.edu.au/>
- University of Oulu, Finland  
<http://www.tol.oulu.fi/english/>
- University of Sheffield, UK  
<http://www.usc.edu/>
- University of Southern California (USC), USA  
<http://www.usc.edu/>
- University of Strathclyde, Scotland  
<http://www.cis.strath.ac.uk/>
- University of Technology Sydney, Australia  
<http://www.uts.edu.au/>
- University Politecnico di Torino, Italy  
<http://www.polito.it/index.en.php>
- VTT Electronics, Finland  
<http://www.vtt.fi/ele/indexe.htm>

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Further information:

[isern.iese.de](http://isern.iese.de)

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.



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# How to find us

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

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

Getting there by means of electronic navigation: Since most likely, the Fraunhofer-Platz is not yet listed in most electronic navigation systems, we recommend using "Trippstadter Straße 125" as the destination instead. The Fraunhofer Center is located directly across the street.

**By rail and bus**  
 Proceed to the main train station, Kaiserslautern Hauptbahnhof, and then either take a taxi or take TWK city bus no. 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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**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.

## Fraunhofer IESE Contact Persons

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## Information Service

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67663 Kaiserslautern  
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To receive further information, please  
fax us a copy of this page.

Fax: +49 631 6800-1699

### Further Information

- Annual Report 2007 of Fraunhofer IESE, print version (German)
- Annual Report 2007 of Fraunhofer IESE, print version (English)
- Annual Report 2007 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 2007 and other publications (e. g., technical reports, press releases, previous Annual Reports) are available at

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

### Fraunhofer IESE Point of Contact:

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Fax +49 631 6800-1699  
[presse@iese.fraunhofer.de](mailto:presse@iese.fraunhofer.de)

### Return Address

---

Title

---

Last Name, First Name

---

Company

---

Position

---

Department

---

Address

---

Zip Code / City

---

Phone

---

Fax

---

E-mail

---

Date and Signature





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# Network in Science and Industry

## Industrial Partners<sup>1</sup>

- ABB AG, Mannheim
- ABB Corporate Research Ltd., Baden-Dättwil, 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
- Art of Technology AG (AOT), Zurich, Switzerland
- ASTEC SP.Z O.O., Zielona Gora, Poland
- Atmos MedizinTechnik GmbH, Lenzkirch
- Audi Electronics Venture GmbH, Gaimersheim
- Audicon GmbH, Dusseldorf
- a3 systems GmbH, Zweibrücken
- Beecon GmbH, Karlsruhe
- BERGHOF Automatisierungstechnik GmbH, Eningen
- Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege, Hamburg
- Büren & Partner Software Design GbR, Nuremberg
- Bundesamt für Sicherheit in der Informationstechnik, Bonn
- BMW AG, Munich
- Boeing Company, Seattle, USA
- brainbot Technologies AG, Mainz
- CC GmbH, Wiesbaden
- CosmosDirekt, Saarbrücken
- Cosmos Finanzservice GmbH, Saarbrücken
- Cybits Systems Security GmbH, Mainz
- Daimler 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 Deutschland GmbH, Munich
- ESA European Space Agency, Darmstadt
- ETAS GmbH, Stuttgart
- EUROCAT GmbH, Darmstadt
- Europäisches Microsoft Innovations Center GmbH, Aachen
- EWM Hightec Welding GmbH, Mündersbach
- Freudenberg Anlagen und Werkzeugtechnik GmbH, Laudenbach
- FUJITSU Enabling Software Technology GmbH, Munich
- FUJITSU Laboratories of Europe Ltd., Hayes, United Kingdom
- Gasanstalt Kaiserslautern AG, Kaiserslautern
- 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
- Inos Automatisierungssoftware GmbH, Herrenberg
- Insiders GmbH, Kaiserslautern
- John Deere AMS, Zweibrücken
- Jyvasylan Yliopisto, Jyvaskyla, Finland
- imbus AG, Möhrendorf
- INSPIRE AG, Paderborn
- iXtronics GmbH, Paderborn
- Kapsch CarrierCom AG, Salzburg, Austria
- KEIPER GmbH & Co. KG, Kaiserslautern
- Kugler Maag + Comp. Ltd. & Co. KG, Kornwestheim
- KUKA Schweissanlagen GmbH, Augsburg
- LogControl GmbH, Pforzheim
- Lufthansa Systems AS GmbH, Norderstedt
- market maker Software AG, Kaiserslautern
- maxess systemhaus gmbh, Kaiserslautern
- MBtech Consultig GmbH, Sindelfingen
- method park Software AG, Erlangen
- Metropolregion Rhein-Neckar GmbH, Mannheim
- 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
- Nokia GmbH, Bochum
- Panasonic Automotive Systems Europe GmbH, Neumünster
- Pepite SA, Angleur, Belgium
- PikeTec GmbH, Berlin
- POSCO, Pohang City, Korea
- Polska Telefonía Cyfrowa SP.Z O.O., Warsaw, Poland
- Porsche AG, Stuttgart
- proALPHA Software AG, Weilerbach
- Pro DV Software AG, Dortmund

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

- psb intralogistics GmbH, Pirmasens
- 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
- Roche Diagnostics GmbH, Mannheim
- Rodan Systems Spolka Akcyjna, Warsaw, Poland
- SAC Sirius Advanced Cybernetics GmbH, Karlsruhe
- SAP AG, Walldorf
- Schneider electric GmbH, Seligenstadt
- SHE Informationstechnologie AG, Ludwigshafen
- Schraml GmbH, Vagen
- Siemens AG, Munich
- Siemens Information Systems Limited, Mumbai, India
- Siemens Medical Solutions Health Service AG, Erlangen
- 4soft GmbH, Munich
- SOFTEAM, Paris, France
- SOFTWIN S.R.L., Bukarest, Romania
- SPD Landesverband Rheinland-Pflaz, Mainz
- Sportbund Rheinhessen, Mainz
- SQS Software Quality Systems AG, Cologne
- Stadt Kaiserslautern
- Steinbichler Optotechnik GmbH, Neubeuern
- Stryker Leibinger GmbH, Freiburg
- SYSGO AG, Klein-Winternheim
- teamtechnik, Freiberg
- Technische Werke Kaiserslautern Versorgungs-AG, Kaiserslautern
- Telekomunikacja Polska S.A., Warsaw, Poland
- Telenor ASA, Fornebu, Norway
- Testing Technologies IST GmbH, Berlin
- Testo AG, Lenzkirch
- T-Mobile International AG & Co KG, Bonn
- 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 Sistemios, Vilnius, Lituania
- Valeo Schalter und Sensoren GmbH, Bietigheim-Bissingen
- Vision Tools GmbH, Waghäusel
- Josef Witt GmbH, Weiden
- WIKON Kommunikationstechnik GmbH, Kaiserslautern
- ZEA Partners, Louvain-La-Neuve, Belgium

## National Research Partners

- Arbeitsgruppe Softwaretechnik, Universität Bremen (Software Engineering Research Group, University of Bremen), Bremen
- Berufsakademie Karlsruhe (University of Cooperative Education Karlsruhe), Karlsruhe
- 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 Electrical Engineering and Informatics, Muenster University of Applied Sciences), Münster
- Fachbereich Maschinenbau, Fachhochschule Kaiserslautern (Department of Mechanical Engineering, Kaiserslautern University of Applied Sciences), Kaiserslautern
- Fachbereich Physikalische Technik, Fachhochschule Münster (Institute for Physical Technology, Muenster University of Applied Sciences), Steinfurt
- Fachhochschule Furtwangen (Furtwangen University of Applied Sciences), Furtwangen
- Forschungszentrum Informatik (FZI) (Research Center for Information Technologies), Karlsruhe
- Fraunhofer-Verbund Informations- und Kommunikationstechnik (IuK) (Fraunhofer Information and Communication Technology Group), Berlin
- Georg-August-Universität Göttingen (Georg-August-University Göttingen), Göttingen
- Hamburger Informatik Technologie-Center e.V., Universität Hamburg (Computer Science Technology Center of Hamburg, University of Hamburg), Hamburg
- Hasso-Plattner-Institut für Software-systemtechnik, Universität Potsdam (Hasso-Plattner-Institute for Software Systems Engineering, University of Potsdam), Potsdam
- Hochschule der Medien (Stuttgart Media University), Stuttgart
- Institut für Informatik IV, Technische Universität München (Institute for Computer Science, Technical University of Munich), München
- Institut für Technologie und Arbeit, Technische Universität Kaiserslautern (Institute for Technology and Work, University of Kaiserslautern), Kaiserslautern
- Lehrstuhl für Software Systeme, Universität Duisburg-Essen (Institute for Computer Science and Information Systems, University of Duisburg-Essen), Essen
- L3S Learning Lab Lower Saxony, Universität Hannover (Learning Lab Lower Saxony, University of Hannover), Hannover
- Oldenburger Forschungs- und Entwicklungsinstitut für Informatik-Werkzeuge und -Systeme OFFIS e.V. (Oldenburg Research and Development Institute for Computer Science Tools and Systems), Oldenburg
- Rheinisch-Westfälische Technische Hochschule Aachen (RWTH Aachen University), Aachen
- Technische Universität Clausthal (Clausthal University of Technology), Clausthal
- Technische Universität Kaiserslautern (University of Kaiserslautern), Kaiserslautern
- Thüringer Anwendungszentrum für Software, Informations- und Kommunikationstechnologie GmbH (Thüringen Application Center for Software and Technology of Information and Communication), Ilmenau
- Universität Karlsruhe (University of Karlsruhe), Karlsruhe
- Universität Koblenz-Landau (University of Koblenz-Landau), Landau
- Universität Leipzig (University of Leipzig), Leipzig
- Universität Potsdam (University of Potsdam), Potsdam
- Westpfalz-Klinikum GmbH, Kaiserslautern



## International Research Partners

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

**International Software Engineering Research Network (ISERN)**

- Avaya Labs, USA
- Blekinge Institute of Technology BTH, Sweden
- Computer Science and Systems Engineering Program COPPE, Federal University of Rio de Janeiro, Brazil
- 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
- MIT Lean Aerospace Initiative, 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
- SIMULA Research Laboratory, Norway
- SINTEF, Norway
- SUN Microsystems, USA
- Universidad ORT Uruguay, Uruguay
- Universidad Politécnica de Madrid, Spain
- Universidad Politécnica de Valencia, Spain
- University of Alberta, Canada
- University of Auckland, New Zealand
- University of Bari, Italy
- University of Calgary, Canada
- University of Castilla - La Mancha, Spain
- University of Hawaii, USA
- University of 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 of Oulu, Finland
- University Politecnico di Torino, Italy
- University of Rome Tor Vergata, Italy
- University of São Paulo, Campus of São Carlos USP, Brazil
- University of Sheffield, United Kingdom
- University of Southern California, USA
- University of Strathclyde, United Kingdom
- University of Technology Sydney, Australia
- Vienna University of Technology, Austria
- VTT Electronics, Finland

## Visitors Hosted

Prof. Dr. Ross Jeffery, School of Computer Science and Engineering, Sydney, Australia, November 2007

Dr. Horst Köhler, Federal President of Germany, Berlin, Germany, November 7

Mr. Shiro Kondo, President and CEO, Ricoh Co., Ltd., Tokyo, Japan, October 18

Prof. Dr. Dennis Poole, Dean, College of Social Work, University of South Carolina; Paul Eleazer, Director, School of Medicine, University of South Carolina; Dr. Anthony Boccanfuso, Director, Research and Economic Development, University of South Carolina; Dr. Thomas Brown, President, Luther Homes of South Carolina Inc.; Prof. Dr. Victor Hirth, Medical Director, Geriatric Services; Mrs. Haneez Zattam, Executive Director and Mr. Fred Monk, President and Chairman, Columbia World Affairs Council Expert Consortium, South Carolina, USA, July 30

Dr. Mikael Lindvall, Fraunhofer Center Maryland, College Park, Maryland, USA, July 11-13 and November 11-14

Dr. Rüdiger Messal, State Secretary, Ministry of Finances of the State of Rheinland-Pfalz, Mainz, Germany, September 25

Dr. Gruber, Consul General, Sydney, Australia, June 21

Dr. Rafael Capilla, Departamento de Ciencias de la Computacion, Universidad Rey Juan Carlos, Madrid, Spain, May 1 - June 30

Prof. Dr. Victor Basili, University of Maryland, Maryland, USA, April and September 2007

Minister Doris Ahnen, Ministry of Education, Science, Youth and Culture of the State of Rheinland-Pfalz, Mainz, Germany, April 30

Dr. Youngjoo Kim, Senior Vice President, Samsung Electronics, Seoul, South Korea, April 19

Prof. Dr. Barry Boehm, Computer Science Department, University of Southern California, California, USA, March 24

Dr. David Skellern, Chris Nicol, National ICT Australia (NICTA), Alexandria, New South Wales, Australia, March 12-14

Dr. Linda Hole, University of Bournemouth, United Kingdom, February 20

Dr. Nicole Millard, British Telecom, Ipswich, United Kingdom, February 20

Mrs. Meera Shankar, Ambassador, Bangalore, India, February 15

Dr. Hideko Kunii, Vice President, Ricoh Co., Ltd., Tokyo, Japan, February 8

Prof. Dr. Jesse Poore, University of Tennessee, Knoxville, USA, January 1 - May 31

Dr. Karina Villela, University of Salvador (UNIFACS), Salvador, Brazil, Jan 1 - December 31

# Professional Contributions

## Lecturing Assignments

### **Bomarius, B.:**

Lecture  
Informatik 1 – Programming, Data Structures and Algorithms,  
Department of Engineering, University of Applied Sciences Kaiserslautern,  
Winter 2007/2008

Lecture  
Informatik 2 – Introduction to Digital Computers,  
Department of Engineering, University of Applied Sciences Kaiserslautern,  
Summer 2007

Lecture  
Informatik 3 – Object Orientation and C++,  
Department of Engineering, University of Applied Sciences Kaiserslautern,  
Winter 2006/2007 and  
Winter 2007/2008

Lecture  
Informatik 4 – Computer Architecture,  
Department of Engineering, University of Applied Sciences Kaiserslautern,  
Summer 2007

### **Eschbach, R.:**

Lecture  
Requirements Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

### **Dörr, J.:**

Lecture  
Requirements Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

### **Liggesmeyer, P.:**

Lecture  
Safety and Reliability of Embedded Systems,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2006/2007 and  
Winter 2007/2008

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

Lecture  
Software Engineering II,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

Lecture  
Quality Management of Software and Systems,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2007/2008

Practical Course  
Software Project Management,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

Industry Seminar  
Introduction to UML 2,  
Software Technologie Initiative e.V.,  
May - June 2007

### **Münch, J.:**

Lecture  
Process Modeling,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

### **Muthig, D.:**

Lecture  
Software Product Lines,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2006/2007

### **Peine, H.:**

Lecture  
Secure Software Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

Lecture  
Secure Software Engineering,  
Computer Science and Microsystems Technology Department,  
University of Applied Sciences Kaiserslautern,  
Winter 2007/2008

### **Robinson-Mallett, Ch.; Bauer, Th.; Elberzhager, F.:**

Lecture  
Software Quality Management,  
Computer Science Department,  
University of Applied Sciences Mannheim,  
Summer 2007

### **Rombach, D.:**

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

Lecture  
Requirements Engineering,  
Computer Science Department,  
University of Kaiserslautern,  
Summer 2007

Lecture  
Project Management and Quality Assurance,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2006/2007 and  
Winter 2007/2008

Lecture  
Empirical Model Building & Methods,  
Computer Science Department,  
University of Kaiserslautern,  
Winter 2006/2007 and  
Winter 2007/2008

## 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

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

Member, Editorial Board, e-Informatica, since 2006

### **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

Member, Editorial Board, International Journal of Software & Informatics, Beijing, China, since 2007

### **Wessner, M.:**

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



**Committee Activities**

**Becker, M.:**

Member, Program Committee, IUI 2008, Canary Islands, Spain, January 13, 2008

Workshop Organizer, Aml 2007, Darmstadt, Germany, November 10

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

**Dörr, J.:**

Member, Program Committee, IWSM-Mensura 2007, Palma de Mallorca, Spain, November 6

Workshop Organizer, SE 2007, Hamburg, Germany, March 27

**Eschbach, R.:**

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

Co-Chair, ICST 2008, Lillehammer, Norway, April 9-11, 2008

**Jedlitschka, A.:**

Reviewer, IWSM-Mensura, Palma de Mallorca, Spain, November 5-8

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

Session Chair, ISERN 2007, Madrid, Spain, September 17-18

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

**Knodel, J.:**

Member, Program Committee, WCRE 2007, Vancouver, Canada, October 29-31

Member, Program Committee, GI-Tagung Informatik 2007, Bremen, Germany, September 27

Member, Program Committee, CSMR 2007, Amsterdam, The Netherlands, March 21-23

**Kohler, K.:**

Member, Program Committee, Persuasive 2008, Oulu, Finland, June 4-6, 2008

Workshop Organizer, INTERACT 2007, Rio de Janeiro, Brazil, September 12

**Liggesmeyer, P.:**

Member, Program Committee, MetriKon 2007, Kaiserslautern, Germany, November 15-15

Member, Program Committee, STEV 2007, Portland, USA, October 11-13

Member, Program Committee, MOTES 2007, Bremen, Germany, September 27

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

Member, Program Committee, A-Most 2007, London, United Kingdom, July 9-12

Member, Program Committee, SE 2007, Hamburg, Germany, March 27-30

**Münch, J.:**

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

Member, Program Committee, EuroSPI 2008, Dublin, Ireland, September 3-5, 2008

Member, Program Committee, SPPI, Parma, Italy, September 1-5, 2008

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

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

Member, Program Committee, CaiSe 2008, Montpellier, France, June 16-20, 2008

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

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

Member, Program Committee, SEE 2008, Bern, Switzerland, April 28-30, 2008

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

Member, Program Committee, APSEC 2007, Nagoya, Japan, December 4

Member, Program Committee, MetriKon 2007, Kaiserslautern, Germany, November 15-16

Member, Program Committee, IWSM-Mensura, Palma de Mallorca, Spain, November 6

Member, Program Committee, ACM SIGPLAN, Montreal, Canada, October 11-13

Member, Program Committee, CEE-SET 2007, Poznan, Poland, October 10-12

Member, Program Committee, GI-Tagung Informatik 2007, Bremen, Germany, September 27

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

Member, Program Committee, SEAA 2007, Lübeck, Germany, August 27-31

Member, Program Committee, ICGSE 2007, Munich, Germany, August 27

Program Co-Chair, Profes 2007, Riga, Latvia, July 2-4

Member of the Diploma Thesis Awards Committee 2007 (DASMA), June 29

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

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

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

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

**Muthig, D.:**

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

Member, Program Committee, VAMOS 2008, Limerick, Ireland, January 16-18, 2008

Member, Program Committee, SAICSIT 2007, Fish River Sun, Sunshine Coast, South Africa, September 30 - October 3

Program Co-Chair and Co-Organizer, Workshop on "Managing Variability for Software Product Lines", SPLC 2007, Kyoto, Japan, September 10-14

Co-Organizer, 2nd German-Korean Workshop on Software Product Lines, Pohang, South Korea, June 28

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

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

**Ocampo, A.:**

Session Chair, ICSP 2007, Minneapolis, USA, May 19

**Ochs, M.:**

Member, Program Committee, GREW'07, Munich, Germany, August 27

Member, Program Committee, ICCBSS 2008, Madrid, Spain, February 25-29, 2008

**Peine, H.:**

Member, Program Committee, ARES 2008, Barcelona, Spain, March 4-7, 2008

**Ras, E.:**

Member, Program Committee, BCI 2007, Sofia, Bulgaria, September 27-29

Workshop Organizer, ECTEL 2007, Crete, Greece, September 17-20

Member, Program Committee, i-Know 2007, Graz, Austria, September 5-7

**Rombach, D.:**

Member, Steering Committee, METRICS Conference Series, since 2002

Program Chair, ICSE 2008, Leipzig, Germany, May 10-18, 2008

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

**Schwarz, R.:**

Member, Program Committee, ISA 2008, Busan, South Korea, April 24-26, 2008

**Thomas, L.:**

Workshop Organizer, BCI 2007, Sofia, Bulgaria, September 27-29

**Wessner, M.:**

Member, Program Committee, Elearn 2008, Las Vegas, USA, November 17-21, 2008

Member, Program Committee, Mensch&Computer 2008 and DeLFI 2008, Lübeck, Germany, September 7-10, 2008

## 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

Member, Advisory Board, SASQIA / OrgaTech GmbH, Lünen, Germany, since 2007

### 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. Wiprecht-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

Member, Advisory Board, 1. FC Kaiserslautern, Kaiserslautern, Germany, since December 2007

### Wessner, M.:

Chair, GI Special Interest Group "E-Learning", Germany, since 2004

## 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, Stadtparkasse Kaiserslautern, Kaiserslautern, Germany, since 2004

## Participation in Delegations

### Liggesmeyer, P.:

Member, German Delegation with MdB Dr. Annette Schavan to India, Bangalore and Delhi, India, February 4-8

### Rombach, D.:

Member, Delegation of the City of Kaiserslautern in the context of the two-day Germany Innovations Program at the University of Sydney, Sydney, Australia, September 10-13

### Rombach, D.:

Member, Delegation of the U.S. Air Force in Germany, Virginia, Maryland and Illinois, USA, October 1-4

## Memberships in Professional Associations

ACL – Association for Computational Linguistics

ACM – Association of Computing Machinery

AGBC – American-German Business Club Deutschland e.V.

AMS – American Mathematical Society

ASQF e.V. – Arbeitskreis Software-Qualität in Franken

BV-Päd. – Bundesverband der Diplom-Pädagoginnen und Diplom-Pädagogen e.V.

DASMA – German Software Metrics and Effort Estimation Association

DGI – Deutsche Gesellschaft für Informationswissenschaft und Informationspraxis e.V.

gc-UPA – German Chapter of the Usability Professionals' Association

GDM – Gesellschaft für Didaktik der Mathematik

GI – Gesellschaft für Informatik

IEEE – Institute of Electrical and Electronic Engineers

IMA – Institute of Mathematics and its Application

LAP – Liberty Alliance Project

OMG – Object Management Group

STI – Software Technologie Initiative e.V.

Tekom – Fachverband für technische Kommunikation und Dokumentation

## Keynotes

### Becker, M.:

“Software Architecture and Technologies for Ambient Assisted Living Systems”, Dagstuhl Seminar Ambient Assisted Living, Dagstuhl, Germany, November 15

### Rombach, D.:

“Future Challenges in Software Engineering for EADS”, Advanced Technology Workshop, Paris, France, November 2007

“Marine Software Engineering”, First International Conference on Marine Software Engineering, Malta, October 2007

“Formalism in Software Engineering – Myths versus Empirical Facts”, IFIP Conference CEE-SET, Poznan, Poland, September 2007

“Software Development and Globalization”, PROFES 2007, Riga, Latvia, July 2007

## Presentations

### Adam, S.:

“On the Notion of Determining System Adequacy by the Traceability of Quality”, Workshop, BPMDS 2007, Norwegian University of Science and Technology, Trondheim, Norway, June 12

“Toward the Early Consideration of Non-Functional Requirements at the Business Process Level”, Conference Presentation, IRMA 2007, Vancouver, Canada, May 22

“Erfolgreiches Anforderungsmanagement in KMUs dank bausteinorientierter Prozessverbesserung”, Industry Presentation, Jour Fixe, Software Technologie Initiative e.V., Kaiserslautern, Germany, May 9

“Erfolgreiches Anforderungsmanagement in KMUs dank bausteinorientierter Prozessverbesserung”, Conference Presentation, ReConf 2007, HOOD, Munich, Germany, March 5

### Adler, R.:

“Innovative Degradation Concepts for Safety-Critical Embedded Software Systems”, Conference Presentation, Development and Analysis 2007, INRIA LORIA, Nancy, France, October 12

“Development of Safe and Reliable Embedded Systems Using Dynamic Adaptation”, Presentation, Workshop M-Adapt 2007, e-coop 2007, Berlin, Germany, July 29-30

“Software Engineering of Safety-Critical Adaptive Embedded Systems”, DAS-MOD Workshop on Formal Verification of Adaptive Systems (VERAS), University of Kaiserslautern, Kaiserslautern, Germany, July 29-30

“Routine Adaption in Safety-Critical Automotive Systems”, Conference Presentation, Software Engineering 2007, IASTED, Innsbruck, Austria, February, 11-16

**Armbrust, O.:**

“Experiences and Results from Tailoring and Developing a Large Process Standard in a Company”, Paper Presentation, EuroSPI Initiative, Potsdam, Germany, September 26-28

“Das V-Modell XT in der Praxis: Kritische Erfolgsfaktoren”, Talk, 8. Kongress “Neue Verwaltung” der dbb akademie, dbb akademie, Leipzig, Germany, June 13-14

“Prozesseinführung und -reifung in der Praxis: Erfolgsfaktoren und Erfahrungen”, Paper Presentation, 14. Workshop der Fachgruppe WI-VM der Gesellschaft für Informatik, Garching, Germany, March 12-13

**Bauer, T.:**

“Using Partial Models to Support the Testing of Distributed Systems”, Article / Conference Presentation, The 11th IASTED International Conference on Software Engineering and Applications SEA 2007, IASTED, Cambridge / Boston, USA, November 19-21

“Modellbasiertes statistisches Testen von technischen Softwaresystemen”, Presentation, Industrial Workshop: Statistical Testing, marcus evans, Düsseldorf, Germany, October 22-23

“ranTest – Methoden und Werkzeuge zum Testen von nichtfunktionalen Qualitätseigenschaften”, Presentation, Software Technologie Initiative e.V., Kaiserslautern, Germany, April 25

**Becker, M.:**

“Intelligente Lebensassistenten – Wenn die Wohnung mitdenkt”, Conference Presentation, VDE Vortragsreihe, VDS, Mannheim, Germany, September 19

“Intelligentes Wohnen – Wenn die Wohnung den Notarzt ruft”, Conference Presentation, Liberaler Seniorentag, FDP Baden-Württemberg, Stuttgart, Germany, June 30

“Das Assisted Living Labor des Fraunhofer IESE”, Conference Presentation, 7. Bauforum “Zukunft Wohnen – Wohnen wie gewohnt?”, Bauforum Rheinland-Pfalz, Kaiserslautern, Germany, June 14

“Ambient Assisted Living”, Presentation, Fraunhofer-Forum, CeBIT 2007, Hanover, Germany, March 16

**Bella, F.:**

“Comparability Issues with Domain-specific Process Assessment Models”, Conference Paper, SPICE Days 2007, International Software Quality Institute, Frankfurt, Germany, June 19

**Beletski, T.:**

“From Requirements to Automatic Statistical Testing”, Article / Workshop Presentation, 4th International ICSE Workshop on Software Engineering for Automotive Systems, ICSE 2007, Minneapolis, USA, May 26

**Bomarius, F.:**

“Technik für ein autonomes Leben im Alter”, Series of Talks, “When I get older” – Entwicklung einer Alterskultur, Seniorenbüro Speyer, Speyer, Germany, October 24

**Dörr, J.:**

“Qualitätsmodelle und nichtfunktionale Anforderungen: Was ist nützlich, was ist essenziell?”, Presentation, Arbeitskreis Requirements Engineering, GI Regionalgruppe München, Munich, Germany, November 19

“Built-in User Satisfaction – Feature Appraisal and Priorization with AMUSE”, Conference Presentation, RE 2007, Indian Institute of Technology, Delhi, India, October 17

“RE-Wissen.de – A Requirements Engineering Community Portal in Germany”, Conference Presentation, RE 2007, Indian Institute of Technology, Delhi, India, October 15-19

“Erfolgreiche Produkte dank AMUSE”, Industry Presentation, OMG Information Days, Object Management Group / SIGS Datacom, Zurich, Switzerland, July 3

**Eisenbarth, M.:**

“Facilitating Project Management by Capturing Requirements Quality and Volatility Information”, Workshop, Merep 2007, University of the Balearic Islands, Palma de Mallorca, Spain, November 5-7

**Elberzhager, F.:**

“A Comprehensive Planning Framework for Selecting and Customizing Quality Assurance Techniques” and “Unifying Inspection Processes to Create a Framework to Support Static Quality Assurance Planning”, Conference Presentations, SPPI Track, 33rd EuroMicro SEAA Conference, Lübeck, Germany, August 28-31

**Eschbach, R.:**

“Symbolischer Test und formale Verifikation”, Presentation, Seminar Systematisches Testen und Verifizieren von Software, DIA, Heidelberg, Germany, September 7

“Sequence-based Specification and Statistical Testing”, Invited Talk / Industry Seminar, Software Initiative, Siemens TS, Braunschweig, Germany, May 24

**Förster, M.:**

“Determining Configuration Probabilities of Safety-Critical Adaptive Systems”, Conference Presentation, AINA 2007, IEEE, Niagara Falls, Canada, May 21-23

**Göpfert, B.:**

“Aus der Praxis für die Praxis – Best Practice Transfer zum Thema Erfolgsmessung”, Workshop, Fraunhofer-Jahrestagung der Fachinformationsmanager 2007, Erfurt, Germany, October 16



**Grützner, I.; Jeswein, T.:**

“Behördeninterne Qualifikationsmaßnahmen bedarfsorientiert planen und entwickeln“, Tutorial, 8. Kongress “Neue Verwaltung“ der dbb akademie, dbb akademie, Leipzig, Germany, June 13-14

**Grützner, I.; Steffens, P.:**

“eGovernment für die Wirtschaft: Ergebnisse einer Branchenuntersuchung“, Talk, Treffen der Arbeitsgruppe 1 “Staat, Verwaltung & IT“ in Vorbereitung des Brandenburger IKT-Gipfels, IHK Potsdam, Potsdam, Germany, August 1

“Prozesse an der Schnittstelle zwischen Verwaltung und Unternehmen: Ergebnisse einer Branchenuntersuchung“, Presentation, 8. Kongress “Neue Verwaltung“ der dbb akademie, dbb akademie, Leipzig, Germany, June 13-14

**Heidrich, J.:**

“Evaluating Software Project Control Centers in Industrial Environments“, Conference Paper, ESEM 2007, Madrid, Spain, September 21

“Cost-Efficient Customization of Software Cockpits by Reusing Configurable Control Components“, Conference Paper, 4th Smef, Rome, Italy, May 9-11

**Jedlitschka, A.:**

“Relevant Information Sources for Successful Technology Transfer: A Survey Using Inspections as an Example“, Conference Presentation, ESEM 2007, Madrid, Spain, September 20

“Advances of the ISERN Experience Factory“, Workshop, ISERN 2007, Madrid, Spain, September 17

“Experience on Applying Quantitative and Qualitative Empiricism to Software Engineering“, Conference Presentation, PROFES 2007, Riga, Latvia, July 2

**Kalmar, R.:**

“Trends and Challenges in Automotive Software Engineering“, Conference Presentation, International Conference on Automotive Electronics and Intelligent Transportation, Clik India, Bangalore, India, August 17

**Kerkow, D.:**

“AMUSE: Priorisieren von Anforderungen auf der Basis geschätzter Nutzerakzeptanz“, Presentation, GI-Fachguppentreffen, Gesellschaft für Informatik, Berlin, Germany, November 29

“KREA-FUN: Systematic Creativity for Enjoyable Software Applications“, Conference Presentation, Interact 2007, IFIP, Rio de Janeiro, Brazil, September 13

“Influencing Joy of Use in Sales-oriented Websites – A validated Design Framework“, Conference Presentation, Interact 2007, IFIP, Rio de Janeiro, Brazil, September 12

“FUN07 Workshop on Design Principles for Software that Engages its Users“, Conference Presentation, Interact 2007, IFIP, Rio de Janeiro, Brazil, September 11

“Don’t have to know what it is like to be a bat to build a radar reflector – Funktionalism in UX“, Presentation, British HCI-UX Manifesto, University of Lancaster, United Kingdom, September 3

“Exploring the Characteristics of NFR Methods – A Dialogue about two Approaches“, Conference Presentation, Refsq 2007, Trondheim, Norway, June 11

“Best Practices bei der Erhebung und Spezifikation von nichtfunktionalen Anforderungen“, Conference Presentation, SQM 2007, Düsseldorf, Germany, April 25

**Klaes, M.:**

“Prozessverbesserung über Fehlerstrommessung bei einem mittelständischen Unternehmen“, Paper Presentation, MetriKon 2007, DASMA, Kaiserslautern, Germany, November 15

**Kleinberger, T.:**

“Establishing the Market for Assisted Living Solutions“, Conference Presentation, Proceedings of the Dagstuhl Seminar “Assisted Living Systems – Models, Architectures and Engineering Approaches“, Dagstuhl, Germany, November 14-17

“Ambient Intelligence in Assisted Living: Enable Elderly People to Handle Future Interfaces“, Conference Presentation, 4th International Conference on Universal Access in Human-Computer Interaction (HCI 2007), Beijing, China, July 22-27

**Klöckner, K.:**

“Gewusst wie: Positives Nutzererleben mit ernsthafter Software!“, Presentation, 7. Berliner Werkstatt Mensch-Maschine-Systeme, TU Berlin, Berlin, Germany, October 11

**Knodel, J.:**

“Three Static Architecture Compliance Checking Approaches – A Comparison“, Presentation, 9. Workshop Software Reengineering, GI-Fachgruppe Software-Reengineering (SRE), Bad Honnef, Germany, May 4

“A Comparison of Static Architecture Compliance Checking Approaches“, Conference Presentation, Sixth Working IEEE/IFIP Conference on Software Architecture, IEEE/IFIP, Mumbai, India, January 9

**Kohler, K.:**

“,Ich will, ich darf, ich mag“ – Ansätze zur Gestaltung motivierender Software“, Tutorial, Usability Professionals 2007, German Chapter of the Usability Professionals’ Association, Weimar, Germany, September 2

“Building and Evaluation a Pattern Collection for the Domain of Workflow Modeling Tools“, Conference Presentation, International Conference on Engineering Interactive Systems 2007, IFIP, Salamanca, Spain, March 24

**Landmann, D.:**

“Erfolgreiche Produkte dank AMUSE“, Industry Presentation, OMG Information Days, Object Management Group / SIGS Datacom, Zurich, Switzerland, July 4

**Münch, J.:**

“Goal-oriented Measurement with Software Cockpits: Challenges, Research Issues and Needs“, Presentation, Software Cockpit Workshop, TU Munich, Munich, Germany, December 3

“GQM+Strategies: A Comprehensive Methodology for Aligning Business Strategies with Software Measurement, Conference Presentation, MetriKon 2007, DASMA, Kaiserslautern, Germany, November 16

“GQM+Strategies: Aligning Business Strategies with Software Measurement“, Short Paper Presentation, ESEM 2007, Madrid, Spain, September 21

“Models and Guidelines for Empirically-based Technology Transfer, Conference Presentation, ISERN 2007, Madrid, Spain, September 18

“The Importance of Software Process and Quality Engineering in the Aerospace Domain“, Presentation, JAMSS, Tokyo, Japan, September 7

“Focused Identification of Process Models“, Conference Presentation, ICSP 2007, Minneapolis, USA, May 20

“Management by Data“, Tutorial, SQC 2007, Düsseldorf, Germany, April 25-27

**Mukasa, K.:**

“Challenges to the Model-driven Generation of User Interfaces at Runtime for Ambient Intelligent Systems“, Conference Presentation, WS Aml 2007, TU Darmstadt, Darmstadt, Germany, November 7

**Muthig, D.:**

“Software Product Line Evolution & Life Cycle“, Panel Discussion, Software Product Line Conference, Kyoto, Japan, September 13

“Predicting Product Line Payoff with SIMPLE“, Tutorial, Software Product Line Conference, Kyoto, Japan, September 10, 2008

“Trends in Embedded Software Development in Europe“, Presentation, 2nd German-Korean Workshop on Software Product Lines, Pohang, South Korea, June 28

“Trends in Embedded Software Development in Europe“, Presentation, JEITA Industrial Workshop on Product Line Software Engineering, JEITA, Tokyo, Japan, July 3

“Implementation of Industrial Product Lines with Fraunhofer PuLSE“, Presentation, Summer School on Software Reuse, CESAR, Recife, Brazil, December 1

“Umsetzung von Sicherheitsanforderungen beim Entwurf von Softwaresystemen“, Conference Presentation, Kongress “Sicherheitsgerichtete Systeme“, Deutsche Kongress, Stuttgart, Germany, October 24

“Softwarearchitekturen im Wandel der Zeit: Konzepte, Erfahrungen und Trends“, Conference Presentation, Software Technologie Initiative e.V., Kaiserslautern, Germany, November 8

**Neumann, R.:**

“Fehlerverursachende Strukturen in objektorientierter Software“, Conference Presentation, MetriKon 2007, DASMA, Kaiserslautern, Germany, November 16

**Niebuhr, S.:**

“Captivating Patterns – A First Validation“, Conference Presentation, Persuasive 2007, Stanford University, Paolo Alto, USA, April 27

“Engaging Patterns: Challenges and Means Shown at an Example“, Conference Presentation, International Conference on Engineering Interactive Systems 2007, IFIP, Salamanca, Spain, March 24

**Ocampo, A.:**

“Maintaining a Large Process Model Alignment with a Process Standard: An Industrial Example“, Presentation, Euro SPI Initiative, Potsdam, Germany, September 26

“Evolution and Maintenance Support for Software Process Models“, Conference Presentation, SEE 2007, Munich, Germany, June 5

“The REMIS Approach for Rational-driven Process Model Evolution“, Paper Presentation, ICSP 2007, Minneapolis, USA, May 19

**Peine, H.:**

“The SECFLOW Source Code Security Checker: Current Problems and Solution Alternatives“, Conference Short Paper, 23rd Annual Computer Security Applications Conference, Miami Beach, USA, December 11-14

**Ras, E.:**

“Resolving Variations in Learning Spaces for Experimental Learning“, Conference Paper, Second European Conference on Technology Enhanced Learning, (ECTEL 2007), Crete, Greece, September 17-20

“Engineering Tele-Health Solutions in the Assisted Living Lab“, Conference Paper, SmarTEL 2007, Niagara Falls, Canada, May 20-23

**Robinson-Mallett, Ch.:**

“Using Partial Models to Support the Testing of Distributed Systems“, Article / Conference Presentation, The 11th IASTED International Conference on Software Engineering and Applications SEA 2007, IASTED, Cambridge / Boston, USA, November 19-21

“Model-based Testing“, Industry Seminar / Invited Talk, Software Initiative, Siemens TS, Braunschweig, Germany, May 24

**Rombach, D.:**

“Eingebettete Systeme in der Automobilindustrie“, Presentation, Symposium Eingebettete Systeme, Fraunhofer-Gesellschaft, Berlin, Germany, November 2007

“Picture of the Future Automobile“, In-Impulse-Talk, Symposium Embedded Systems in the Automotive Industry, Berlin, Germany, November 2007

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

“Research Careers and Research Models – Experiences from Dieter Rombach and Fraunhofer IESE“, Presentation, Big Picture Seminar, National ICT Australia (NICTA), Melbourne, Australia, September 2007

“Software Engineering Research at Fraunhofer IESE“, Presentation, National ICT Australia (NICTA), Sydney, Australia, September 2007

“Everyday Living – The Impact of ICT and New Technology“, Presentation, University of New South Wales, Sydney, Australia, September 2007

“Fraunhofer-Gesellschaft e.V. – A German Success Model for Applied Research“, Presentation, The German Academic International Network (GAIN), University of California, San Francisco, USA, September 2007

“Computer Science and Software Engineering – Basic Science Versus Engineering?“, Scientific Symposium, Retirement of Prof. Victor Basili as Professor Emeritus, University of Maryland, College Park, USA, September 2007

“Experimental Software Engineering – Building the Scientific Basis for Professional Software Development“, Colloquium, National ICT Australia (NICTA), University of Melbourne, Melbourne, Australia, August 2007

“Clusterbildung zur nachhaltigen Wirtschaftsentwicklung – Beispiel Fraunhofer IESE“, Presentation, Fraunhofer IESE, Kaiserslautern, Germany, June 2007

“Vernetzte Prozesse als Erfolgsfaktor für eGovernment“, Conference Presentation, 8. Kongress “Neue Verwaltung“ der dbb akademie, dbb akademie, Leipzig, Germany, June 2007

“Berufsbild Informatiker“, Presentation, Fraunhofer IESE, Kaiserslautern, Germany, June 2007

“Agile und reichhaltige Vorgehensweisen – Gegensatz oder Ergänzung?“, Panel Discussion, SEE 2007, Munich, Germany, June 2007

“Wege zukunftsorientierten eGovernments – Standards, Netze und Prozesse“, Panel Discussion, 8. Kongress “Neue Verwaltung“ der dbb akademie, dbb akademie, Leipzig, Germany, June 2007

“Cluster Model for Innovation Speed-up“, Presentation, MIT (Boston), Harvard University (Cambridge), John Hopkins University (Baltimore), University of Maryland (College Park), USA, March 2007

**Schneickert, S.:**

“CheckMATE: Erfahrungsmanagement für Service-Roboter zur Realisierung von Self-Healing in Produktionsanlagen“, Conference Presentation, LWA 2007, Halle, Germany, September 24-26

**Snoek, B.:**

“Entscheidungen fundiert treffen durch Erfahrungsmanagement“, Conference Presentation, 8. Kongress “Neue Verwaltung“ der dbb akademie, dbb akademie, Leipzig, Germany, June 13-14

**Steffens, P.; Grützner, I.:**

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**Thomas, L.:**

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Supervisors: **Rombach, D.; Groß, A.; Doerr, J.**

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Supervisors: Schmücker-Schend, A.; Winterstein, G.; **Rech, J.**



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Supervisors: Funk, B.; **Graf, C.**

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Supervisors: Knauber, P.; **Knodel, J.**

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Supervisors: Broy, M.; **Liggismeyer, P.; Hierons, R.; Eschbach, R.; Leucker, M.; Beletski, T.**

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Supervisors: Wetter, T.; Haag, M.

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Design and Implementation of an Architecture Prototype for a Virtual Printer.

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Supervisors: Künkler, A.; **Adam, S.**

## Awards

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Supervisors: **Rombach, D.; Knodel, J.**

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### Internal

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**Schlichting, A.:**

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**Knodel, J.:**

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**Czaja, Ch.:**

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**Kemmann, S.:**

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**Knerr, B.:**

The Fraunhofer IESE 2007 Award for Infrastructure Excellence

### External

**Topp, S.:**

Diploma Thesis Award 2007, DASMA e. V., Kaiserslautern, Germany, November