Information Systems

Staff

- **Professors:**
  - Prof. Dr. rer. pol. Matthias Jarke
  - Prof. Gerhard Lakemeyer, Ph.D.
  - Prof. Dr. rer. nat. Thomas Berlage
  - Prof. Wolfgang Prinz, Ph.D.
  - Prof. Dr. rer. nat. Thomas Rose

- **Secretaries:**
  - Gabriele Hoeppermanns
  - Daniele Glöckner
  - Tel: (0241) 80-21501
  - Fax: (0241) 80-22321
  - E-mail: sekris@dbis.rwth-aachen.de
  - WWW: [http://dbis.rwth-aachen.de](http://dbis.rwth-aachen.de)

- **Researchers:**
  - Elisabeth Birk
  - Sebastian Brandt
  - Yiwei Cao
  - Mohamed Amine Chatti
  - Sandra Geisler
  - Sukeshini Grandhi (since 24.09.2009)
  - Anna Hannemann (ne Glukhova)
  - Matthias Häusler (since 04.05.2009)
  - Jessica Huster (since 15.05.2009)
  - David Kensche
  - Dr. Ralf Klamma
  - Dejan Kovachev (since 01.05.2009)
  - Stefan Kreutter (since 01.01.2009)
  - Xiang Li
  - Dominik Lübbers (since 02.06.2009)
  - Zinayida Petrushyna
  - Manh Cuong Pham
  - Dr. Christoph Quix
  - Dr. Jürgen Rapp
  - Khaled Rashed
  - Dominik Renzel (since 16.03.2009)
  - Dominik Schmitz (since 01.05.200)
  - Dr. Satish Srirama (until 31.07.2009)
  - Yao Wang (since 15.04.2009)
  - Dietlind Zühlke (since 01.04.2009)

- **Visiting Lecturers:**
  - Dr. Wolfgang Broll, Fraunhofer FIT
  - Stefan Hirschmeier, Fraunhofer FIT (until 31.03.2009)
• **Technical Staff:**
  Tatiana Liberzon
  Reinhard Linde
  Daniel Plötzer

• **Student Researchers:**
  Martin Bachwerk, Aleksandar Bojinovic, Xi Chen, Niels Drobek, Darko Dugosija, Martin Frericks, Adam Gasior, Marcus Gelderie, Ahmet Goer, Christian Haasler, Georg Hackenberg, Stephan Hackenbracht, Michael Hackstein, Andreas Hahne, Christian Hocken, Zille Huma, Holger Janßen, Christian Kalla, Florian Linke, Can Liu, Tim Niemüller, Tomas Novotny, Sebastian Rüsche, Patrick Selders, Leszek Seweryn, Patrick Schlebusch, Christoph Schwering, David Sosnitza, Quan Tran, Edwin Yaqub, Ming Zhang, Ziquan Zhu

• **Cooperation Partners:**
  aiXtrusion GmbH, Daimler AG, Ericsson Eurolabs, European Microsoft Innovation Center Aachen, European Schoolnet, Feuerwehr Düsseldorf, IBM Zurich Labs, IKV Aachen, Inform GmbH, Microsoft Deutschland GmbH, European Philips Research, SAP AG, T-Systems GEI Aachen, WZL Aachen
Overview

Today, the field of Information Systems includes not just structured databases, but at least equally important the semi-structured and unstructured data in the World Wide Web. The Chair Informatik 5 addresses both domains, with the management of so-called metadata (data about data) in the kernel of its research interests. Current major themes include mobile web services and applications, metadata model management, and technology enhanced learning.

The academic year 2008-2009 has been extremely busy for us. After ten years of funding, the Aachen-Bonn-Cologne SFB 427 “Media and Cultural Communication” was completed successfully in December 2008. In 2009, Prof. Jarke was elected vice coordinator of the excellence cluster UMIC (Ultra-High speed Mobile Information and Communication) in which we participate with two major projects and a postdoc. In addition to continuing the DFG-funded requirements engineering project CONTici jointly with four other NRW universities, two large European projects on technology enhanced learning began. One focuses on Responsive Open Learning Environments (ROLE), and the other supports the European Schoolnet for Teachers’ Lifelong Learning Networks (TeLLNet), a cooperation network of over 45,000 schools. The subgroup of Prof. Berlage secured the new ExPrimago BMBF project in medical informatics. Smaller projects were also started in cultural heritage (with Harokopio University, Greece), on model-based data integration (with Technion, Israel), and on model-based information integration in mechanical engineering (RWTH Pathfinder project with WZL and PLT). Within the university-wide future concept “RWTH-2020: Meeting Global Challenges”, we continued with the strategic activity “International Recruiting” and started a junior research group on “Natural Media” jointly with colleagues from the Humanities and from Medicine within RWTH Aachen HumTec initiative. Within the Future Concept, we also coordinate the RWTH-wide strategic activities on International Recruiting. Last but not least, the cooperation with Ericsson Eurolabs in the field of mobile web services was complemented by a major data integration and analysis project within the German national CoCar initiative.

Informatik 5 organized the 8th International Conference on Web-based Learning (ICWL’09) in Aachen with over 150 participants. We also co-organized a Dagstuhl Perspective Seminar on High-Impact Requirements Engineering, the European Summer School on Technology Enhanced Learning in Slovakia, and the 11th International Conference on Mobile Interaction (MobileHCl’09) in Bonn.

In terms of teaching, two large undergraduate courses with a total of well over 400 students were taught in the summer semester 2009 alone, leading to heavy teaching load on top of the specialist courses and seminars offered by the group. We also were among the first five universities in Europe to introduce a focused lecture program on the new field of Web Science. Another noteworthy teaching-related activity concerned the accreditation of the Bachelor program in ICT for Business and Engineering at the German University of Technology in Oman (GUtech).

Informatik 5 cooperates closely with the Fraunhofer Institute for Applied Information Technology (FIT) of which Prof. Jarke is Executive Director and Deputy Chairman of the Fraunhofer ICT group with 16 institutes and over 2000 researchers. Two FIT area managers, Prof. Wolfgang Prinz and Prof. Thomas Berlage, hold cross-appointments as Associate Professors in Informatik 5. Prof. Jarke is also one of the Founding Directors of the Bonn-Aachen International Center for Information Technology (B-IT). Within B-IT, a third joint professorship has been established and filled with Prof. Thomas Rose. The new B-IT Research School for doctoral training funded by the NRW State Government started its
operations in the fall of 2008 under the coordination of Prof. Jarke and Prof. Cremers (Bonn), and is now already supporting 18 doctoral candidates with scholarships.
Research Projects

Research projects at Informatik 5 are organized according to the groups of mobile applications and services, technology enhanced learning and communities, model and data management.

Mobile Applications and Services UMIC:
Ultra High-Speed Mobile Information and Communication

M. Jarke, R. Klamma, C. Quix, Y. Cao, S. Geisler, D. Kensche, X. Li, S. Srirama, M. Jansen (Sbg), G. Toubekis (Sbg), C. Hocken, X. Chen, C. Liu

The “Ultra High-Speed Mobile Information and Communication (UMIC)” is a research cluster under the German Excellence Initiative promoted by the German Federal and State Government at German Universities. UMIC is the only Excellence Cluster fully dedicated to the field of information and communication technology approved in the first excellence competition in 2006.

More than 20 institutions at RWTH Aachen participate in UMIC, aiming at interdisciplinary design of ultra high-speed mobile information and communication systems. Concepts and demonstrators for smart, mobile, broadband, low-cost systems will be developed to support the demanding applications of the next-decade mobile Internet.

Based on previous work in SFB 427 and in the GK “Software for Mobile Communication Systems”, Informatik 5 works closely together with many institutes of electrical engineering, mechanical engineering, architecture, and computer science in two subprojects in the research area of “Mobile Applications and Services”.

Future Mobile Internet Services: Virtual Campfire

M. Jarke, R. Klamma, Y. Cao, S. Srirama, M. Jansen (Sbg), G. Toubekis (Sbg), A. Hahne, C. Hocken, P. Schlebusch, D. Kovachev, X. Chen, C. Liu

A “Mobile Host” capable of providing basic web services from smart phones was developed and the performance analysis of the tool proved the technical feasibility of the concept. The huge number of Web services possible, with each Mobile Host providing some services in the wireless network, makes the discovery of these services quite complex. The aspects of service discovery, mediation, and quality of service issues like security and scalability, application and usability analysis strategies for mobile web service providers were analyzed.

As a demonstration scenario for mobile social software based on mobile internet services, the Virtual Campfire scenario has been further developed to bridge media and communities across mobile platforms. In Virtual Campfire, user-generated cultural heritage information is to be integrated into a multimedia non-linear digital storytelling system to enhance
information reuse, learning and sharing across professional communities. Furthermore, research focuses on context-aware semantic mobile multimedia data management. MPEG-7 based metadata and Web 2.0 tagging approaches are applied to annotate, search and share multimedia data in a unified way. A mobile multimedia test bed is established to evaluate and monitor the mobile service calls by various mobile clients and to measure mobile multimedia communities based on certain information system success models.

The concept and prototypes were successfully demonstrated on a number of international conferences (e.g. the 10th IEEE International Conference on Mobile Data Management 2009 in Taipei, Taiwan) and workshops, as well as other events such as UMIC Day 2008. In the real world setting of the Bamiyan Community (http://www.bamiyan-development.org) Informatik 5 and Aachen’s Urban History department bring together international researchers, governmental and administrative officers for the conservation work in Bamiyan, Afghanistan. The results were presented e.g. to the Afghan Ministers of Information and Culture, and of Urban Development.

Mobile Multimedia Service Monitoring Architecture and Mobile Storytelling on iPhone within the Virtual Campfire Scenario

Mobile and Wearable P2P Information Management in Health Net Applications

M. Jarke, C. Quix, S. Geisler, D. Kensche, X. Li, N. Sonjampa, S. Kim (MedIT), P. Kranen (Informatik 9), N. Jungbecker (ITA), U. Meyer, J. Barnickel (IT Security)

Informatik 5 cooperates with the institute for textile technology (ITA), the Philips Chair for Medical Information Technology (MEDIT), Informatik 9 (Data Management and Exploration) and the UMIC research group IT Security. The aim is to develop a P2P network in which patients, doctors, nursing staff, and emergency services have full access to information and services in their mobile work environment. Data about the health status of a patient is collected by a network of sensors integrated in the textile clothes. The data can be reviewed by doctors to consult the patients online, or by the emergency service to improve the diagnosis in an emergency situation.
The groups have created a prototype for a body sensor shirt which includes an ECG sensor and accelerometer. The sensor information is processed by a device which sends the data to a mobile client (e.g. a PDA or a mobile phone). The client forwards the patient's data to a server where health experts can analyze the data in detail. To avoid sending of a huge amount of data, the data is pre-classified on the mobile client according to normal and emergency situations. In normal situations, only a highly aggregated summary of the data will be sent; if an emergency situation is suspected, detailed information will be sent to the server.

The work of Informatik 5 in this project focuses on the development of a peer data management system which supports the information exchange between the devices (PDAs and smart phones of patients and medical staff on the one hand, integrated information systems such as hospital information systems on the other hand). This work applies the basic research results of the model management project. In addition, requirements for the integration of mobile devices in a hospital information system have been analyzed. The integration of the sensor data into a hospital information system will use the HL7 message standard.

The Cooperative Cars (CoCar) project, supported by the German Federal Ministry for Research and Education, will test the suitability of UMTS technologies and their foreseeable extensions for direct, targeted transmission of traffic data arising from both stationary and vehicle-based sensors. The CoCar project is a part of the research initiative Adaptive and Cooperative Technologies for the Intelligent Traffic (AKTIV) led by the German automotive industry. Five partners from telecommunications and automobile industry will identify which traffic management and driver assistance applications are suitable for use of this technology.

Informatik 5 cooperates in this project with Ericsson in Aachen and Fraunhofer FIT and develops data models, algorithms and systems for the data processing of CoCar applications. One focus is the research on a data quality model to simulate and estimate the effect of various parameters in data acquisition and processing for the traffic state estimation and forecasting. Furthermore, we investigate data stream management systems as the core component for the data processing, and we study data mining algorithms for the traffic state estimation. First results are quality- and priority-based traffic information fusion architecture and a simulation test bed to identify the properties of roadway networks and system design parameters which have a significant impact on the quality of the traffic state estimation.
Community information systems are a combination of work practices, information, people, digital media theories organized in a way that they support the goals of the community. Metadata in community information systems stabilize the ongoing change management process in these systems. The research goal of the working group is a better understanding of the creation, use, and maintenance of metadata in the context of community systems. These community information systems are designed and applied meeting communities’ real needs. With the emerging Web 2.0 paradigm, the connection between user communities and information systems is even tight. The group started three new research projects ROLE, IKYDA and TeLLNet in 2009 and finished the EU TEMPUS project CUELC. We have now strong funding in technology enhanced learning and cultural heritage management with “Web Science” research approach. We combine strong analytic methods for the Web like social network analysis, community/multimedia/text & data analysis with advanced Web engineering methods (single-login, variable and fine-granular access control, mobility support, multimedia management, multimedia annotation, interoperable search and retrieval, matching) for the support of professional communities in domains with ever changing and demanding requirements.

The new lecture “Web Science” started in WS 2008/09 was very successful with two guest lecturers: Dr. Marc Spaniol from the Max Planck Institute for Computer Science in
Saarbrücken and Prof. Markus Strohmaier from the Technical University in Graz, Austria. We organized two workshops in the Multimedia Metadata Community (http://www.multimedia-metadata.info) in Toulouse (WMM’09) and in Graz (SeMuDaTe’09) as well as workshops about social software engineering environments (SENSE’09) in Kaiserslautern and about storytelling and educational gaming (STEG’09) in Aachen. Highlight of the year was our strong participation in the organization of the ICWL’09 in Aachen in August 2009.

The following projects have been worked on in the year 2008-2009:

**DFG SFB 427: “Media and Cultural Communication”**
and HumTec Project “Natural Media”

M. Jarke, R. Klamma, Y. Cao, M. A. Chatti, M. Spaniol, M. Bachwerk, N. Drobek, Z. Petrushyna, D. Renzel, S. Grandhi, I. Mittelberg (HumTec)

The collaborative research center was completed successfully in December 2008 with a symposium about “The planetary – Culture –Technology – Media in the Age of Post-Globalization”. The symposium and the final newsletter demonstrated again the claim and the ability of the research center to think new media as a game changer for societal processes at large. Consequently, the sub-project “Agency in Digital Social Networks by Visualization of Multidimensional Patterns of Disturbance” incorporated the newly developed media theory of transcriptivity in design processes for complex community information systems in as different application domains as cultural heritage management, entrepreneurship, aphasics’ therapy, and technology enhanced learning. A number of new concepts like agency and patienthood were jointly researched in the context of the Web 2.0 and social software dominating lately information systems development. Main results included the development of a new reflective information systems architecture based on those media processes in professional communities of practice and the concept of Mediabases. These are very large pattern-oriented data management systems for Web 2.0 media for conducting interdisciplinary empirical research and knowledge discovery by visualizing dynamic network analysis results. The strongly transdisciplinary research was documented in a number of international journal and conference publications with an inclusion in the special issue of German Informatik Spektrum about computer science and the humanities in 2008.

Building on these successful experiences, an interdisciplinary project on natural human media (multimodal interaction) between linguistics (Prof. Jäger), informatics (Prof. Jarke), psychology (Prof. Koch, Prof. Willmes, Prof. Huber) and psychiatry (Prof. Schneider, Prof. Mathiak) has been approved for funding within the Human Technology (HumTec) initiative of the Future Concept RWTH-2020, under coordination of Profs. Jäger and Koch. A team of three newly hired international Junior Professors and Postdocs has been formed under the direction of Prof. Irene Mittelberg; Sukeshini Grandhi (former New Jersey Institute) represents computer science and information systems there, focusing on the different roles of computer games in the Natural Media context.
The aim of this DFG-funded cluster project of four NRW universities is development and research of context adaptive systems for knowledge processes. The main goal of the Informatik 5 subproject “Traceable Cooperative Requirements Engineering for Communities-of-practice” is the extension of earlier context, process or cooperation models by comprehensible evolution histories, this leading towards a cycle of comprehensible information collection, processing and employment for learning and re-engineering.

In 2009, three new community-oriented requirements engineering tools were developed. The Bubble Annotation Tool (BAT) allows enjoyable collaborative requirements elicitation by multimedia annotation with speech bubbles. The core service of BAT combined with different social community analysis measurements served as basis for the CONTici Dashboard (DABA). Community-awareness within DABA fosters participation of community members in the requirements engineering process. The third system captures agent-oriented scenarios of processes or systems in a story-telling approach: “MIST-M” presents a mobile story-telling platform, allowing requirements sharing within community anywhere at any time while Similarity Search (SiSe) provides conflict and similarity identification between different scenario stories.

This project is supported by Graduiertenkolleg (GK) “Software for mobile communication systems”. The aim of the project is to represent and analyze scientific knowledge in the field of Computer Science and develop recommendation techniques that support researchers to find conferences and journals to submit papers, to search for interesting research communities and potential collaborators. Social Network Analysis (SNA) is applied to discover the pattern of interaction between researchers, especially in Web 2.0 environment. Visualization techniques are used to represent and identify research communities and their evolution in term of knowledge diffusion and research collaboration.

In 2008-2009, we concentrated on data mash-up issue with the investigation of possible techniques which can be used to integrate data from digital libraries. Two large data sources (DBLP and CiteSeer) are currently considered as a case study. We further investigate dynamic network analysis, especially clustering techniques, and the possibility to apply these techniques to recommender system (especially Collaborative Filtering recommendation) to improve the performance of traditional recommendation algorithms and make them more suitable for application in digital libraries. A prototype called AERCS (An Academic Event Recommender system for Computer Scientist) provides visualization and recommendation tools for research communities of conferences in Computer Science.
EU Integrating Project ROLE: Responsive Open Learning Environments  
M. Jarke, R. Klamma, Z. Petrushyna, D. Renzel, D. Dugosija, F. Linke, D. Sosnitza

ROLE, started in February 2009, is an EU-funded large-scale integrating project within the 7th Framework Program in the domain of technology enhanced learning (TEL). The project aims at delivering and testing prototypes of highly responsive TEL environments, offering breakthrough levels of effectiveness, flexibility, user-control and mass-individualization, thereby advancing the state-of-the-art in human resource management, self-regulated and social learning, psycho-pedagogical theories of adaptive education and educational psychology, service composition and orchestration, and finally the use of ICT in lifelong learning. ROLE offers adaptivity and personalization in terms of content respectively navigation and the entire learning environment and its functionalities. This approach permits individualization of the components, tools, and functionalities of a learning environment, and their adjustment or replacement by existing web-based software tools. Learning environment elements can be combined to generate (to mashup) new components and functionalities, which can be adapted by collaborating learners to meet their needs and to enhance the effectiveness of their learning. Learners are empowered to generate new tools and functions according to their needs, and can help to establish a livelier and personally more meaningful learning context and experience. The generic ROLE framework uses an open source approach, interoperable across software systems and technology.

The project consortium consists of 16 partners across Europe and China from both academia and industry and covers all required pedagogical and technical competencies necessary for research and development in this highly interdisciplinary project. Informatik 5 is the vice-coordinator of the project, acting as technical leader and community facilitator. This year’s highlight was the ROLE general assembly in conjunction with ICWL 2009 in Aachen.

EU Life Long Learning Program TeLLNet: Teachers’ Lifelong Learning Networks  
M. Jarke, R. Klamma, Y. Cao, Z. Petrushyna, R. Vuorikari (European Schoolnet)

The new EU Life Long Learning Project TeLLNet supports the European Schoolnet, a cooperation network of over 45,000 schools, in cooperation with the European Schoolnet, Open University the Netherlands, and Institute for Prospective Technological Studies (IPTS) as one of European Commission Joint Research Centers. Social Network Analysis (SNA) applies graph theories, network analysis methodologies and approaches on social networks to analyze patterns of human communication, cooperation, and other kinds of interaction taking place in business, organizations and the World Wide Web. SNA provides a useful approach to identifying social capital and social structure. Small world effect and scale-free networks are observed and analyzed. This research work is based on both theoretical research and practices. A couple of practical prototypes provide user communities useful tools to get to know their networks well and to find out their social network patterns. The eTwinning Network
Visualization (eVA) provides the visualization and performs Social Network Analysis of 45,000 schools in Europe.

**EU Tempus Project CUELC: Cairo University E-Learning Centre**

M. Jarke, R. Klamma, M.A. Chatti, Z. Petrushyna, S. Hackenbracht, M. Fayek (Cairo University), K. Maillet (INT Evry)

CUELC aims to bridge the currently existing gap between the advanced technology enhanced teaching (TEL) and learning methods in Europe and Egypt. In 2008 a CUELC Programming Competition was organized and the winning team consisting of three students from RWTH Aachen received their prizes - iPod Shuffles - personally from Prof. Dr. Matthias Jarke. The CUELC team presented the project results at two important TEL events, namely ICT-Learn’08 and EC-TEL’09. Furthermore, during the last year, three project meetings have been organized at the different partner institutions in Aachen, Paris, and Cairo.

**RWTH-DAAD Research Project: Closing the Semantic Gap of Image and Video Retrieval for Faked Multimedia**

M. Jarke, R. Klamma, K.A.N. Rashed, M. Lux (U. Klagenfurt), H. Kosch (U. Passau)

The project is supported by German Academic Exchange Service (DAAD). The goal of the project is the integration of content-based multimedia search and retrieval techniques with respect to low-level semantics of multimedia and high-level semantics (generated from social networks like Flickr) to detect and classify faked multimedia. Main objectives of the project are: analyzing visual features of suspected multimedia, investigating the impact of community involvement in detection of faked multimedia, and developing methodologies to combine low-level and high-level semantic techniques to detect faked multimedia. In 2008-2009, we concentrated on constructing the faked multimedia dataset, analyzing the impact of low-level descriptors (e.g. color, texture) in multimedia fake detection, and investigating possible alternative techniques and descriptors.

**DAAD IKYDA: Non-linear Digital Storytelling for the Battleship “G. Averof”**

M. Jarke, R. Klamma, Y. Cao, A. Hannemann, D. Kovachev, E. Stefanakis (Harokopio University, Greece), G. Kritikos (Harokopio University)

Non-linear digital storytelling for the battleship “G. Averof” is an interdisciplinary research project with Harokopio University, Athens, starting in 2009 within the IKYDA program. The IKYDA program is an integrated action program between German Academic Exchange
Service (DAAD) and the Greek State Scholarship Foundation (I.K.Y) since 2000 to promote academic research cooperation between German and Greek researchers. The battleship “G. Averof” is the world's only surviving heavily armored cruiser of the early 20th century and serves as a museum operated by the Greek Navy today. This research project aims at the promotion and enrichment of the museum archives for cultural heritage management. We seek to share knowledge on advanced storytelling platforms and services for the battleship "G. Averof" with advanced 3D scanners, helicopter cameras to capture objects on the battleship. It provides communities more opportunities to create, access, share, and even reuse the large valuable multimedia collection about the battleship “G. Averof” with Web 2.0 storytelling technologies. It will contribute to advanced research on social software, storytelling, multimedia metadata, GIS, and cultural heritage management together with the project Virtual Campfire etc. Researchers from Harokopio University have paid two visits in June 2008 to exchange knowledge with the colleagues at Informatik 5.

SunSITE Central Europe (http://sunsite.informatik.rwth-aachen.de)

M. Jarke, R. Klamma, R. Linde

Since 1995, Informatik 5 is active in the field of internet-based community support, both in terms of research on community and web service tools and in terms of providing infrastructures for scientific communities worldwide. For example, Informatik 5 hosted the first website for the city of Aachen in 1995 and, since the same year, manages one of the most successful public-domain Internet servers in the German science net, SunSITE Central Europe. Supported by Sun Microsystems with powerful hardware and base software, SunSITE Central Europe focuses on scientific community support, including mirrors of some of the most important research literature indexes, workspaces for Internet cooperation, and about 3 TB of open source software. Typically, the SunSITE enjoys around 23 million ftp and http accesses per month.

i* Wiki (http://istar.rwth-aachen.de)

M. Jarke, G. Lakemeyer, R. Klamma, D. Schmitz, D. Renzel

Since September 2005, Informatik 5 is hosting the i* Wiki, a platform for researchers and users to foster investigation, collaboration, and evaluation in the context of the i* modeling language.

Model Management

M. Jarke, C. Quix, M.A. Chatti, S. Geisler, D. Kensche, X. Li, C. Schwering
Research in model management focuses on the formal definition of structures and operators for the management of complex data models to support applications dealing with the integration, maintenance, and evolution of data models. Based on the generic role-based meta model GeRoMe, the group developed the generic model management GeRoMeSuite which includes support for model management operations such as schema matching, composition of mappings, schema integration, and model transformation.

In 2009, the group worked particularly on methods for query rewriting in peer data management systems. The GeRoMeSuite application was extended by a user interface for defining generic queries and a component for peer-to-peer communication. A query posed to one peer is rewritten into a query against the schema of another peer using the generic mapping language of GeRoMe. A number of master thesis projects were conducted in this context, including in particular master students within the European Master of Informatics Erasmus-Mundus program in cooperation with the University of Trento (Prof. Fabio Casati, Prof. Maurizio Marchese) and the University of Edinburgh. In addition, the following projects were worked on beyond participation in UMIC:

Conceptual Design of a Metamodel for Industry Automation

M. Jarke, C. Quix, D. Schmitz, M. Zhang

The control of production plants employs the research for decades. Due to a large variety in production processes, machine types, factory layouts, and many component suppliers, a large quantity of device controls, communication systems, production control software, engineering and visualization software, production planning systems and further control systems in hardware and software have been developed at the market. The grown heterogeneity makes interoperability and thus the flexibility in component selection more difficult. This is because for the operation of a production plant, all components must be interconnected using interfaces and protocols such that an integrated automation architecture is formed.

Most important aids for the control of the complexity of such automation architecture are models. They formally describe both control components and production processes, and thereby support planning, control and regulation of production processes. The diversity of the component suppliers and of the involved communities implies heterogeneity in the models and used modeling languages: they are proprietary, domain specific, and often incompatible. This applies also to production plants, which combine both discrete and continuous manufacturing processes.

A goal of this project is it to define the requirements for a common, uniform metamodel for industry automation, both for discrete manufacturing and for process engineering. This includes the definition of a common terminology and the basic structures of the metamodel. Informatik 5 cooperates with the Laboratory for Machine Tools and Production Engineering (WZL, Prof. Brecher) and the Chair of Process Control Engineering (PLT, Prof. Eppele) of RWTH Aachen University. The project is funded as a Pathfinder project in the context of the Exploratory Research Space at RWTH Aachen.
Models for Quality Management in Schema Matching with Applications to Medicine  

M. Jarke, C. Quix, S. Geisler, D. Kensche, X. Li, A. Gal (Technion Haifa)

Schema matching is the task of providing correspondences between concepts describing the meaning of data in various heterogeneous, distributed data sources. Schema matching is recognized to be one of the basic operations required by the process of data and schema integration and thus has a great impact on its outcome. As such, schema matching has impact on numerous modern applications. Somewhat surprisingly, up until recently there was little fundamental research that can lead to a theoretically rigorous infrastructure for further development of algorithmic solutions to the problem of schema matching. Having a theoretical basis in place, one could start and design a set of algorithms to support the design of schema matching, enhancing user effectiveness. In this pilot project, which is funded by the Umbrella Cooperation Program, Informatik 5 cooperates with Avigdor Gal (Technion Haifa, Israel) to investigate the following open fundamental research question: What qualifies as a good schema matcher? Most research work offer empirical, explanatory analysis, testing their proposed schema matchers using common a posteriori metrics such as recall and precision. An interesting question is whether one can suggest a priori measures to identify a good schema matcher for a specific problem instance. A positive answer to this question would allow the use of schema matching and data integration even if the outcome is somewhat uncertain. Two applications in the area of medicine of such an outcome are online monitoring of patient's health and personal medical records.

IT Summit 2008: Interactive Project Map for erlebe-it.de  

M. Jarke, C. Quix

Informatik 5 and Fraunhofer FIT developed an interactive map for the technology recruitment initiative of BITKOM, the Federal Association for Information Technology, Telecommunications and New Media. The website http://www.erlebe-it.de features information about cooperation projects between IT industry and schools. The initiative provides information at pupils about education and study programs in IT. The interactive map provides a geographical overview of the activities in Germany. IT-Scouts (professionals with an expertise in education and IT) and companies participating in this initiative are shown on the map such that a school can easily find a local contact point to learn more about the education possibilities in the IT industry.

ConceptBase: A Deductive Object Manager for Meta Databases  

M. Jarke, C. Quix, D. Kensche, S. Geisler, X. Li, M.A. Jeusfeld (Uni Tilburg, NL)
ConceptBase is a multi-user deductive object manager mainly intended for conceptual modeling, metadata management and model management. The system implements the knowledge representation language Telos which amalgamates properties of deductive and object-oriented languages. Since summer 2009, ConceptBase is available as an open-source system under FreeBSD license. In addition, version 7.2 includes many improvements in query evaluation and object processing.

The book Metamodeling for Method Engineering, edited by Manfred A. Jeusfeld, Matthias Jarke, and John Mylopoulos is now available. It presents the theoretical basis of metamodeling for method engineering, and reports also on applications of the metamodeling approach to method engineering. These applications have been developed using the Telos language and the ConceptBase system.

**AdMIRE: Advanced Music Information Retrieval Environments**

*M. Jarke, D. Lübbers*

In this project we investigate user-friendly music information retrieval systems that combine content-based feature extractors and collaborative similarity functions. Our main focus is the development of an immersive multimodal three-dimensional virtual landscape in which the user can freely navigate guided by surrounding acoustic clues and explore a given music collection which has been organized according to a well-defined notion of similarity.

In this academic year we primarily focused on the integration of personalized similarity measures into our research prototype soniXplorer. Observing the user’s interaction with the exploration environment we reweight a mixture of implemented distance functions covering different musical aspects and thereby adapt the organization strategy to his notion of similarity.

**BMBF ExPrimage: Automated Multi-dimensional Tissue Diagnostics to Improve Prognosis and Therapeutic Recommendations in Breast Cancer**

*T. Berlage, D. Zühlke, Y. Wang, M. Häusler*

In this projected, supported by the German Ministry of Research (BMBF), we are working on the image analysis in multiple layers of magnification. The goal is to combine findings at the cellular and local level with an analysis of the global tumor structure. In 2009, we were able to geometrically register multiple images of adjacent slides through the tumor, which were treated with different markers. Using this integrated information, we could identify classes of tumor tissue, both using supervised learning and unsupervised clustering. These annotations will then be combined with local findings, such as areas of inflammatory cells. The work has been conducted in close cooperation with the University of Hamburg (Pathology Niendorf) as the medical partner and Zeiss and Qiagen as major industrial partners.
Other Activities

Service

Within the RWTH Future Concept “RWTH-2020”, Prof. Jarke is responsible for the activity “International Recruiting”. In cooperation with Prof. Hornke (Psychology), Z. Petrushyna, V. Busch (International Office), A. Schulz (RWTH International Academy), and representatives of four pilot departments, the team analyzed the present situation, the departmental requirements, and future strategies for the recruiting of more top international faculty and top international graduate students. A number of measures were piloted in both areas, and the roll-out of some successful ones is planned for the coming year. Since the start of RWTH-2020, the share of international hires at the professorial levels has increased by almost 50%, and very significant quality improvements in international master student recruiting can be observed in several study programs.

Prof. Jarke’s other major administrative and service activities in 2008-2009 included:

• Deputy coordinator, UMIC Excellence Cluster on Mobile Information and Communication, RWTH Aachen University
• Executive Director, Fraunhofer FIT, Birlinghoven, and Deputy Chairman, Fraunhofer Information and Communication Technology group
• Founding Director, Bonn-Aachen International Center for Information Technology (B-IT), and Coordinator, B-IT Research School
• Inaugural Dean, Applied Information Technology, German University of Technology in Oman (GUtech)
• Past President, GI German Informatics Society; also Chair, GI Fellow selection commission and jury chair, GI Innovationspreis
• Vice President, European Research Consortium for Informatics and Mathematics (ERCIM)
• Advisory Board, RWTH Aachen International Academy
• Scientific advisory board, Faculty of Informatics, University of Vienna, Austria
• Scientific advisory board, Learning Lab Lower Saxony (L3S), Hannover
• Scientific advisory board (chair), OFFIS, Oldenburg
• Scientific Advisory Board, CIO Colloquium Germany
• Research commission, Free University of Bozen, Italy
• Advisory board, Large Scale Complex IT Systems Initiative (LSCITS), UK
• Review board, Quality Assurance Netherlands Universities (QANU) evaluation of Dutch Economics and Business Faculties 2008-2009
• Review Board, WWTF Austria ICT Initiative
• Reviewer, Learning Media Program, Open University of the Netherlands, Heerlen
• Member in several faculty selection committees
• Reviewer, DFG, NSF, NSERC Canada
• Hochschulrat, FH Köln
• Member of Program Board, LOEWE Excellence Initiative
• Curatory board and scientific advisory board, IBFI, Schloss Dagstuhl
• Jury, Wissenschaftspreis Stifterverband der Deutschen Wirtschaft
• Jury, Campus Online competition, Stifterverband der Deutschen Wirtschaft
• Jury, ACM/AIS Best Dissertation in Information Systems Award 2009

R. Klamma is technical leader and community facilitator of the EU IP ROLE.

Y. Cao is member of DIN NI-32 “Data Management and data exchange”.

Editorial Boards

Matthias Jarke serves on the editorial boards of the following journals: ACM Transactions on Management Information Systems (ACM-TMIS), Decision Support Systems, Group Decision and Negotiation, Wirtschaftsinformatik/ Business Information Systems Engineering, Journal of Intelligent Information Systems, Cooperative Information Systems, Requirements Engineering Journal, Journal of Universal Computer Science (J. UCS), VLDB Journal Track. He is currently Guest Editor of a Special Issue of Wirtschaftsinformatik on High Impact Requirements Engineering. He also served as reviewer of several journals, including IEEE TSE and IEEE TLT.

Ralf Klamma serves as associate editor for IEEE Transactions on Learning Technologies (TLT), IJASS, IJTEL, and IJHSC. He is editor-in-chief for the SunSITE CEUR and several community information systems like the PROLEARN Academy (www.prolearn-academy.org), the Multimedia Metadata Community (www.multimedia-metadata.info) and the Bamiyan Development Community (www.bamiyan-development.org). In the moment he is editing a special issue of the International Journal of Emerging Technologies in Learning (i-JET) for the MASHL 2009 special track at the ICL 2009. He also served as reviewer for IEEE Software, IEEE Internet Computing, IEEE Multimedia, IEEE Transactions on Software Engineering, Annals of Information Systems, JEMA, ET&S, Multimedia Tools and Applications, ILE, VLDB Journal, IJTEL, JTICL, Simulation & Gaming and AIS.

Conference Organization

Yiwei Cao was local co-chair of 8th International Conference on Web-based Learning (ICWL’09), chair of Second International Workshop on Story-Telling and Educational Games (STEG’09). She was member of the program committee of 4th International Workshop on MOBILE and NEtworking Technologies for social applications (MONET’09), 9th and 10th Workshop of the Multimedia Metadata Community (WMM’09 & SeMuDaTe’09), SIRTEL’09, 7th Annual IEEE International Conference on Pervasive Computing and Communications Work in Progress (PerCom’09-WiP), ICWL’09, STEG’09, ACM MEDES’09, Complex’09, MIMIC’09, DEXA’09, IWCES’09, Special issue Multimodal Interaction and MultImodal Content management (MIMIC) on the Multimedia Tools and Applications (MTAP) International Journal. Yiwei Cao was also reviewer for ICALT’09, special issue on context-aware and mobile multimedia databases and services (JDIM-MMD), special issue on mobile and networking technologies for modeling social applications and services published in the Journal of Computing Science and the Engineering, and the PsychNology Journal.

Mohamed Amine Chatti was publicity co-chair of Fourth European Conference on Technology Enhanced Learning (EC-TEL’09), 29 September-2 October 2009, Nice, France. He organized the First International Workshop on Future Learning Landscapes at EC-TEL’09. He was member of the program committee of Second World Summit on the Knowledge Society (WSKS’09), First International Workshop on Building Sustainable Open Source Communities (OSCOMM’09) in conjunction with OSS’09, Workshop on Exploitation of Usage and Attention Metadata (EUAM’09) in conjunction with Informatik 2009, Second International Workshop on Social Software Engineering and Applications (SoSEA’09) in conjunction with ESEC/FSE’09, Second International Workshop on Mash-Up Personal Learning Environments (MUPPLE’09) in conjunction with EC-TEL’09, IEEE ICALT’09, IADIS EL’09.

Anna Hannemann was publicity co-chair of 8th International Conference on Web-based Learning (ICWL2009), RWTH Aachen University, Aachen, Germany, 19-21 August 2009.
She organized First International Workshop on Software ENgineering within Social software Environments (SENSE09) held together with Collaboration and Knowledge Sharing in Software Development Teams in conjunction with the Conference on Software Engineering (SE2009) Fraunhofer Institute Experimental Software Engineering, Kaiserslautern, Germany, 2-6 March, 2009 and the Second International Workshop on Story-Telling and Educational Games (STEG’09) RWTH Aachen University, Aachen, Germany, 21 August, 2009 in conjunction with the 8th International Conference on Web-based Learning (ICWL 2009) RWTH Aachen University, Aachen, Germany, 19-21 August, 2009.

Matthias Jarke was co-chair of the Dagstuhl Perspective Seminar “Science of Design: High-Impact Requirements for Software-Intensive Systems” with Kalle Lyytinen (Case Western) and John Mylopoulos (Toronto/Trento) in October 2008. He served as general chair of the ICWL 09 in Aachen, as program co-chair of the Mobile HCI 2009 in Bonn, and as chair of the SME conference Symposium “Werkstoff Software – Software Engineering Symposium 2009” at the B-IT in Bonn. Furthermore, he served on the following program committees: CAiSE 2009, Amsterdam; EUAM 2009 Workshop at Informatik 2009, Lübeck; ICIS Doctoral Symposium 2008, Paris; ICOODB 2009, Zürich; REFSQ 2009, Amsterdam; SE-2009, Kaiserslautern; WWW 2009, Madrid. He also serves on the Advisory Board of the CIO Colloquium, a network and conferences series of the Chief Information Officers in German industry.

David Kensche was reviewer for Information Sciences (Informatics and Computer Science Intelligent Systems Applications), Elsevier.

Ralf Klamma was general co-chair of the 8th International Conference on Web-based Learning (ICWL 2009), Aachen, Germany, 19-21 August, 2009. He was also co-chair of the following events: 5. JTEL Summer School in Technology Enhanced Learning, Terchova, Slovakia, June 2009, 9th Workshop of the MPEG-7 Community on Multimedia Metadata (WMM’09), Toulouse, France, 19-20 March, 2009, 10th Workshop of the MPEG-7 Community on Semantic Multimedia Databases (SeMuDaTe’09), Graz, Austria, December 2, 2009, First International Workshop on Software ENgineering within Social software Environments (SENSE09), Kaiserslautern, Germany, 2-6 March, 2009. He served as program committee member / reviewer for the following conferences: ACM CHI’09, ACM Group’09, ACM Multimedia’09, ACM MTDL’09, ACM CHI’10, IEEE ICALT’09, IEEE SITIS’09, American Control Conference ACC’09, Complex’09, Workshop Virtual Worlds (ViWo’09) at ICWL’09, Wissensmanagement WM’09, Web-based Information Systems (WEBIST’09), Mobile Learning’09, International Conference on Computer Supported Education (CSEDU’09), WMM’09, International Symposium on Collaborative Technologies and Systems (CTS’09), CTS’10, Communities & Technologies’09, Web-based Communities (WBC’09), ICWL’09, International Conference on Web and Information Technologies (ICWIT’09), EC-TEL’09, Gl-Workshop Digital Social Networks (GI-DSN’09), Workshop Business Process Management and Social Software (BPMS2’09), Special Track Mashing up Learning Environments (MASHL’09), Interactive Computer Aided Learning (ICL’09), ELearning’09, I-KNOW’09, STEG’09, Workshop Open Design Spaces (ODS’09), SciTEL’09, HICSS’10, Workshop Computer-based Knowledge & Skill Assessment and Feedback in Learning Settings (CAF’09), Workshop Semantic Multimedia Database Technologies (SeMuDaTe’09), eKnow’09, eKnow’10, International Symposium on Computers in Education (SIIE’09), TenCompetence’09.

Zinayida Petrushyna co-organized the JTEL Summer School 2009, Terchova, Slovakia and was treasurer of 8th International Conference on Web-based Learning (ICWL2009), RWTH
Software Demonstrations

- Virtual Campfire, UMIC Day 2008, October 19, 2009, Aachen, Germany
- Virtual Campfire, IKYDA Kick-off Meeting, April 24, 2009, Aachen, Germany
- Virtual Campfire - Cross-Platform Services for Mobile Social Software, the 10th IEEE International Conference on Mobile Data Management (MDM’09), Taipei, Taiwan, May 18, 2009
- Virtual Campfire was demonstrated to visitors including Karl Aberer (EPFL), Markus Strohmaier (TU Graz), M. Zia Afshar (Deputy Minister of Afghan Ministry of Information and Culture), and M. Yousaf Pashtun (Minister of Afghan Ministry of Urban Development) in 2009
- UMIC HealthNet prototype was demonstrated at RWTH Aachen Transparent, January 30, 2009, Aachen
Talks and Publications

Talks


Y. Cao: *Mobile Access to MPEG-7 Based Multimedia Services*, the Tenth International Conference on Mobile Data Management, Taipei, Taiwan, May 18-20, 2009

Y. Cao, R. Klamma: *A Multimedia Service with MPEG-7 Metadata and Context Semantics*, the 9th Workshop on Multimedia Metadata (WMM'09), Toulouse, France, March 19-20, 2009

Y. Cao: *A Web 2.0 Personal Learning Environment for Classical Chinese Poetry*, ICWL 2009, 8th International Conference, Aachen, Germany, August 2009


A. Hannemann: *Community Driven Elicitation of Requirements with Entertaining Social Software*, the First International Workshop on Software Engineering within Social Software Environments, Kaiserslautern, Germany, March 3, 2009


M. Jarke: *Mobile Applications and Services*, UMIC Advisory Board, Aachen, October 20, 2008

M. Jarke: *Informatik überall – neue Ziele für das Informatikstudium?* Invited talk, 50 Years IT at Hamburg University, Hamburg, November 1, 2008; and 1. Gummersbacher Informatik-Forum der FH Köln, Gummersbach, April 4, 2009


M. Jarke: *Holistic engineering of ultra-highspeed mobile information and communication systems*, Invited Talk, 25th Anniversary of the Faculty of Informatics at Passau University, Passau, January 16, 2009
M. Jarke: *Das Institutszentrum Schloss Birlinghoven*, Presentation to Fraunhofer Board, Birlinghoven Castle, February 2, 2009


M. Jarke: *Fraunhofer Institute Center Birlinghoven Castle*. Presentations to the Fraunhofer Board, 2.2.2009; and to the Science and Culture Attachés of the Embassies in Germany, Birlinghoven, May 11, 2009


M. Jarke: *Requirements modeling – past, present, future*, Symposium in Honor of John Mylopoulos, University of Toronto, June 27, 2009

M. Jarke: *Meta modeling with Datalog and Classes – ConceptBase at the Age of 21*, Invited Talk, 2nd Intl. Conf. Object-Oriented Data Bases (ICOODB 09), ETH Zürich, June 3, 2009

M. Jarke: *Fraunhofer im Bundeswettbewerb Informatik*. Opening statement, award ceremony of Bundeswettbewerb Informatik, Essen, September 25, 2009

R. Klamma, Y. Cao: *You Never Walk Alone: Recommending Academic Events Based on Social Network Analysis*, the First International Conference on Complex Science (Complex’09), Shanghai, China, February 23-25, 2009

R. Klamma: *No Country for Old Men*, Online Round Table, October 8, 2009


R. Klamma: *Offene Lernumgebungen – Chancen, Herausforderungen, Grenzen*, AK E-Learning’09, Berlin, Germany, September 15, 2009


R. Klamma: *ROLE Vision*, ROLE Kick-off Meeting, Lausanne, Switzerland, March 2, 2009

Z. Petrushyna: *The TEL researcher's guide to social network analysis*, JTEL Summer School 2009, Terchova, Slovakia, June 1, 2009


**Publications**

**Books and Edited Volumes**


Journal Articles


Conference and Book Contributions


S. C. Brandt, M. Schlüter, M. Raddatz, M. Jarke: Management of Experience Knowledge in Continuous Production Processes, 13th IFAC Symposium on Information Control Problems in Manufacturing, Moscow, RUS, June 3-5, 2009


R. Klamma, M. C. Pham, Y. Cao: You Never Walk Alone: Recommending Academic Events Based on Social Network Analysis, Proceedings of the First International Conference on Complex Science (Complex’09), Shanghai, China, February 23-25, 2009


H. W. Nissen, D. Schmitz, M. Jarke, T. Rose: How to Keep Domain Requirements Models Reasonably Sized, 2nd Int. Workshop on Managing Requirements Knowledge, MaRK @ RE, Atlanta, USA, September 2009


C. Quix, X. Li, D. Kensche, S. Geisler: View Management Techniques and Their Application to Data Stream Management. In Evolving Application Domains of Data Warehousing and Mining: Trends and Solutions, 2009


Other Publications (Selection)

The 8th International Conference on Web-based learning (ICWL 2009) was held on August 19-21, 2009 in Germany's westernmost located and truly European city Aachen. ICWL 2009 was jointly organized by the Hong Kong Web Society, Informatik 5 (Information Systems, Prof. M. Jarke) at RWTH Aachen University, and Max-Planck-Institute for Computer Science.

Authors that submitted to the ICWL 2009 conference came from more than 30 countries with remarkably many submissions from across Europe. ICWL is an annual international conference series on Web-based learning that has so far been held in Asia, Australia and Europe. This series represents the cooperation of European and Asian researchers to advance the field of Web-based learning. A lot of joint research papers and joint projects have emerged from the successful track record of ICWL.

Altogether, a total of 106 valid submissions have been received. After a rigorous reviewing process, we decided to accept a total of 38 papers as full papers, representing an acceptance rate of 36%. In addition, we accepted another 14 papers as short papers. Moreover, we included three invited papers of renowned researchers into the conference proceedings. As a novelty, for the first time we had four co-located workshops with the conference. Having immediately attracted four workshops we interpreted this as an indicator of the significance and visibility of this conference series within the Web-based learning community.

The conference organizers were able to invite renowned Web-based learning experts to give keynote talks and invited paper talks: Erik Duval from Katholieke Universiteit Leuven,
Wolfgang Nejdl from L3S Lab and University Hannover, Ulrik Schröder from RWTH Aachen University, Won Kim from Kyungwon University, and Helen Ashman from University of South Australia.

Prof. Jarke handed presents to the invited Speaker Prof. Erik Duval from Katholieke Universiteit Leuven, after he gave a talk on “Learning in Times of Abundance: The Snowflake Effect”
The mission of the Fraunhofer FIT Institute for Applied Information Technology in Sankt Augustin and Aachen (Director: Prof. Dr. Matthias Jarke) is to support human-centered computing in the context of organizational processes. Researchers in FIT study lifecycle-wide methods for the design and evolution of adaptive, user-oriented information and cooperation systems in the interplay of human work practice with organizational processes. After three years of strong growth in third-party funding from 4.6 m€ to 7 m€ per year, 2008 saw a consolidation at this historically high level. About 100 researchers, 15 technical and administrative personal, and 50-60 student assistants work in the institute. FIT pursues its mission in four major research areas which are complemented by special business fields and competence centers (see www.fit.fraunhofer.de for details).

The first mobile underwater augmented reality system for diver training, recently developed by FIT.CSCW, caused a lot of attention in the media.
FIT.CSCW (Prof. Wolfgang Prinz, PhD) investigates the field of Cooperation Support Systems. In the reporting period the department was working a number of EU-funded projects. ECOSPACE is an integrated project (IP) coordinated by FIT.CSCW. The project goal is the development of reference architecture, a collaboration middleware and services, as well as new cooperation tools to enable seamless and instant collaboration among knowledge workers, beyond organizational boundaries. CoSpaces, another IP, focuses on innovative collaborative work environments for individuals and teams in design and engineering. The third IP, C@R investigates collaboration technologies for rural areas. The vision of the IPCity project (another IP coordinated by FIT.CSCW) is to provide citizens, visitors, as well as professionals involved in city development or the organization of events with a set of technologies that enable them to collaboratively envision, debate emerging developments, experience past and future views or happenings of their local urban environment, discovering new aspects of their city. Two BMBF funded projects on a collaboration and task management platform for distributed development and engineering processes (SAGE) and on a toolbox for the development of service oriented applications for collaboration environments (MITSOA) were successfully finished in 2009.

The Summer Olympics inspired Bayer Business Services (BBS), a German company with 89 offices worldwide, with an exciting idea: A symbolic baton travels round the earth, from one office to the next, from employee to employee, and gathers greetings, ideas, or stories in a multimedia album that is open to the company staff worldwide. Under the banner “We are a people company, be part of it“, the project was to build bridges between the BBS offices, enhance social interaction and thus improve communication within the organization. Fraunhofer FIT developed the conceptual design and technical realization of this project. The main challenge initially was how to motivate the company staff worldwide to be spectators and symbolic runners in the relay, i.e. to contribute to the album. Focusing on the latter, we decided to translate the idea of a symbolic baton into a tangible tool that is an attractive piece of technology and at the same time makes it easy to create messages for the album. For the hardware we settled on a VAIO ultra-mobile PC from Sony. It is optimized to enable non-specialist users to create short multimedia or text messages. In regular intervals the finalized messages are uploaded to a shared workspace that delivers the contributions to the web page of the relay. The relay was started in July 2008 at the summer party of Bayer Business Services in Berlin. By the end of the year staff from twenty-five offices had contributed to the relay. The messages by the employees presenting themselves and their colleagues, the business focus of their office, local or regional highlights already are a very impressive collection of facets of a global company. Six months after the project start demand for the Baton is still lively. Comments by the staff confirm that the virtual relay has indeed enhanced social interaction within Bayer Business Services.
From left to right: DWD Vice President Prof. Adrian, Minister of Research Dr. Schavan, FIT Director Prof. Jarke, and entrepreneur Helmut Hund announced the deployment of the first DWD pollen monitor in Freiburg, Germany, in February 2009.

FIT.LIFE (Prof. Dr. Thomas Berlage) investigates the field of Life Science Informatics, addressing navigational support for micro-surgery, system environments for large-scale bioinformatics research, and assistive devices for users with special needs. In the FUSION project on minimally-invasive liver therapy http://www.somitfusion.de, we have prepared for conducting a clinical study of the developed navigation system for treatment of liver tumors. We have designed and implemented a novel automated microscope with extensive software support, the TopoScan system, which will be used at the University Hospital Düsseldorf (Prof. Dr. D. Häussinger) in a joint clinical research project. In the IMIKRID project we have realized a miniaturized diagnostic device that can detect molecular markers in blood in small amounts. Together with Helmut Hund GmbH, we have developed a system for detection and classification of pollen that is being installed in a monitoring network by the German weather service (DWD) as the worldwide first fully automatic system in this domain. With full rollout of the system throughout Germany, significant relief for the ca. 12 million pollen allergetics can be expected through localized and timely prediction.
MACE links architectural archives in Europe into a coherently accessible information network for research, teaching, and practice; in the Biennale 2008 in Venice/Italy, MACE demonstrated collaborative access to this information network through a multitouch table.

FIT.ICON (Prof. Dr. Reinhard Oppermann) develops context-adaptive and mobile systems for eLearning and mobile work. Jointly with Informatik 5, they are main partners in the ROLE project in Personalized Technology-Enhanced Learning; other large eLearning projects include the AILB project which develops novel tools to enhance the basic professional competencies for hearing-impaired young workers; the latter is a joint project with the DESIRE research team at RWTH Aachen University led by Prof. Dr. Ludwig Jäger. Contextualization in mobile work settings is also the main topic of the MICA project that demonstrates novel mobile user interface solutions in RFID-based warehouse worker scenarios. A number of European integrated projects are ongoing, addressing metadata for architectural learning (MACE), self-organizing photo collections (aceMedia), and middleware for mobile, networked device integration (HYDRA). In 2008 a new research group CAPLE (Context and Attention in Personalized Learning Environments) was established. CAPLE focuses on utilizing the observations about and context of the learner to facilitate application and task independent support of individualized learning experiences. Information is plenty today, with a continuously growing number of information sources and new ways to interact with them. Consequently, learners need to focus more and more on managing digital information thus severely increasing the cognitive load of learners beyond meaningful states. In 2009, a major joint focus between FIT.ICON and FIT.PRO lies in the area of emergency management. For example, FIT has contributed user-centered design methods to the development of wearable firefighting systems in the largest civil wearable computing project worldwide, the EU Integrated Project wearIT@work; other current projects address topics such as rapid damage estimation after earthquakes and protection of energy networks.
Iterative game-based design is an important approach pursued in the development of novel technologies for critical applications to make firefighting professionals able to envision the technological future, and assess its chances and risks (wearIT@work project)

FIT.PRO (Prof. Dr. Thomas Rose) develops process management solutions for domains that can be characterized by the complexity of their decision processes. Doctoral theses on business models for eGovernment in public-private partnerships, and on workflow support for quality control in intensive care units have been completed in 2008. Usability of tools for process capture and business models for operating services is major topic of FIT.PRO. After successfully finalizing projects on methods and tools for identifying trends in the home textile industry (AsIsKnown), requirements engineering for control software in the automotive industry (Zamomo), and electronic risk management platforms (ERMA), we are currently devising methods and tools that allow domain experts in the emergency domain to “voice” their expertise. The latter is based on experiences gained in formally modeling rescue management procedures in the context on the event of mass casualties (Massenanfall von Verletzten und die überörtliche Varianten ÜMANV).

FIT organized a Software Symposium 2009 for the promotion of project findings and prototypical results developed in the BMBF Initiative SE-2006 for the generation of software-enabled innovations for the German industry. The forum has attracted a balanced mixture of participants from industry and academia and was held at the B-IT premises in Bonn.

Together with the University of Siegen, and in cooperation with Aachen’s UMIC Excellence Cluster and the B-IT Research School, FIT organized the annual international Mobile Human-Computer Interaction conference 2009 (MobileHCI09) where more than 350 participants from 28 countries presented and discussed latest results about novel applications and interaction techniques with mobile devices for users on the move.
The Bonn-Aachen International Center for Information Technology (B-IT) is a pioneering activity of the German Federal government and the state of North Rhine-Westphalia in their effort to establish excellence clusters across universities and research institutes in Germany. B-IT is a joint institute of RWTH Aachen University and Bonn University in cooperation with the Fraunhofer Institute Center Birlinghoven Castle and the FH Bonn-Rhein-Sieg in Sankt Augustin. B-IT aims at the internationalization and acceleration of study programs in Applied Informatics. Prof. Dr. Matthias Jarke serves as Founding Director together with Prof. Dr. A.B. Cremers, Bonn, and Prof. Dr. K. Witt, FH Bonn-Rhein-Sieg, Prof. Dr. Otto Spaniol is Study Coordinator of the Media Informatics program, Dr. Jürgen Rapp its study advisor.

**English-Language International Master Programs**

Supported by the 57 m€ B-IT Foundation and supplementary NRW-state and federal funds, BIT offers highly selective English-language master programs in Media Informatics, Life Science Informatics, and Autonomous Systems. The Master Programs prepare students for successful international careers that require technical excellence and leadership, creativity and the ability to innovate. B-IT master programs include a significant share of research lab courses in the participating Fraunhofer institutes of Applied Information Technology FIT, Intelligent Analysis and Information Systems IAIS, and Scientific Computing and Algorithms SCAI. A second goal of B-IT is the optimization of existing undergraduate computer science curricula at University of Bonn and RWTH Aachen University for selected top students.

Well before the current debate on how to make Germany more competitive in the worldwide “battle for the best brains”, B-IT has been active in attracting the best international Bachelor graduates in the ICT sector. Due to intense international networking, applicants from some of the best international undergraduate programs, e.g. from top Chinese universities such as Tsinghua, Nanjing, or Zhejiang, have been attracted to the program. B-IT students have been unusually successful in obtaining attractive competitive scholarships, ranging from university scholarships via industrial ones to the prestigious Erasmus-Mundus program of the European community. In total, the roughly 180 students at B-IT come from over 40 countries.

All study programs are now operating at full capacity. The Media Informatics program managed by RWTH Aachen accepts about 30-35 students annually after a strict pre-selection which leads to a success rate of student around 90%, the currently highest at RWTH Aachen University. The placement record of B-IT remains excellent. Master graduates have been accepted as doctoral candidates in many leading universities and research institutes worldwide, including places such as the University of Cambridge and Oxford as well as Stanford. Significant third-party funding acquired by B-IT faculty also offers local opportunities.
B-IT Research School

In spring 2008, a proposer team of the B-IT partners led by Professors Matthias Jarke (Speaker) and Armin Cremers (deputy speaker) were among the winners of the North-Rhine Westphalian Research School competition – one of only two computer science programs among the 17 winning teams. Since late 2008, the B-IT Research School offers doctoral training in eight areas of applied information technology and its formal fundamentals. Key training concepts include:

• the teambuilding within research areas across the organizational boundaries of the B-IT partners, to achieve a critical mass similar to the large top universities worldwide;

• a system of compact specialized courses for each area enabling not just holders of doctoral scholarships but also “normal” research assistants with heavy teaching and project duties to participate; in 2009, half a dozen initial compact courses, plus several contributions to larger summer schools, were organized;

• stress on quality, diversity, and international recruiting through a selective scholarship system, incentive travel funds, and personalized research training plans commensurate with the funding situation and other individual aspects and interests.

In two rounds in October 2008 and April 2009, the first 18 doctoral scholarships to candidates from 11 countries were awarded from over 250 applications all over the world. Six of the scholars are graduates from the B-IT master programs.

Faculty and scholarship holders celebrated the first general assembly of the B-IT Research School in September 2009 with a keynote talk by Prof. Martini, University of Bonn, about his analysis of the infamous Conficker worm.
The German University of Technology in Oman (GUtech) is a new privately funded University in Muscat, Oman, set up since 2007 with assistance and quality assurance by RWTH Aachen University. Former RWTH Rector Prof. Burkhart Rauhut serves as Founding Rector of GUtech. GUtech currently offers four Bachelor of Science programs in fields of particular strategic interest to the Sultanate of Oman, an Arabic country with significant oil reserves, one of the most interesting geologies in the world, a historically important geo-strategic location at the straits of Hormuz with corresponding seafaring traditions and logistical needs, and a thriving high-class tourism development. All four Bachelor programs – applied geosciences, urban planning and architecture, sustainable tourism and regional development, and IT for Engineering and Management – have been defined by adapting corresponding programs from RWTH Aachen to regional needs and preconditions; a Foundation Year and stiff entrance exams ensure quality of student intake. After successful and unconditional accreditation by the AQUIN agency in early 2009, they are the first accredited bachelor programs in the country, two of them also being the only ones of their kind on the Arabic peninsula.

In cooperation with the Business Informatics group (Prof. Michael Bastian), the Informatics department at RWTH Aachen – coordinated by Prof. Matthias Jarke as Inaugural Dean -- has assisted the set-up of the bachelor program in Information Technology for Engineering and Management in several ways. The basic course structure follows the Bachelor of Informatics at RWTH Aachen University. The minor field of study has been fixed to be Business Administration, and specialization courses can be linked to locally important application domains such as the oil, gas, and minerals sector or the field of logistics. Moreover, the program is expanded by significant course work on language and cultural skills, because from the beginning, all courses are taught in English (rather than the local Arabic) and the student population needs to understand both the local culture and the Western one. This was one of the reasons why the bachelor is scheduled for four years rather than three.

Besides taking responsibility for the curriculum development in cooperation with the GUtech university management, RWTH faculty and senior researchers also taught some of the first-year courses in Muscat and will continue to offer fly-in compact courses in specialized fields. In 2008-2009, this concerned PD Dr. Matthias Westermann (Informatik 1) and Dominik Lübbers (Informatik 5). GUtech IT students in good standing are also offered the opportunity to visit RWTH Aachen at least twice in their study program, in the first year to get acquainted with the technology and culture, at the end of the third year for a lab course internship in one of the Informatics research groups.

Strategically even more important, several faculty from the department participated in the GUtech search committees for permanent faculty at GUtech. In 2008, three excellent assistant and associate professors were hired:
Nahla Barakat, with industry experience from Philips, long teaching experience in the region, and a Ph.D. in data mining from the University of Queensland, Australia

Lucia Cloth, a former RWTH student who obtained her doctorate and held a postdoc position at the University of Twente, Netherlands;

Bernhard Heim, researcher at the Max-Planck institute of Mathematics in Bonn and former IT manager at Deutsche Bahn, with a doctorate from Heidelberg and the habilitation from the University of Mannheim.

The initial IT student population has started very small in 2008, with only four students, but has been growing to 6 in the second intake 2009, and 17 students are preparing for the 2010 intake in the Foundation Year.

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