Annual Report 2009 - 2010
Information Systems

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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.

In the academic year 2009-2010, the group enjoyed once again a significant growth of third-party funding. The total grew to well above 2 m€ for 2009 and is expected close to 3 m€ in 2010. The largest growth in additional projects was in the sector of technology-enhanced learning where several new EU-funded projects and networks of excellence started, but also new projects in cooperation systems and life science informatics with BMBF funding were added; the application domain for mobile communication pursued in our Excellence Cluster UMIC was extended to the field of Car-to-X communication. Prof. Jarke was invited to present an overview talk on UMIC at the German national computer conference, Informatik 2010, which drew over 1,100 participants to Leipzig in September 2010.

Members of the group took leading roles in the organization and program chairing of international conferences, including the IEEE UbiMedia 2010 Conference in Shanghai and the 12th International Conference on Electronic Commerce (ICEC 2010) in Honolulu, several workshops on multimedia metadata and storytelling/educational gaming, and once again the Joint European Summer School on Technology-Enhanced Learning.

The total personnel at Informatik 5 grew to over 40 researchers and administrative personnel, plus over 25 student assistants. The team represents by now almost 20 different nationalities. In personnel development, a major step was the habilitation of Dr. Ralf Klamma which was completed in July 2010 and formally approved by the Faculty of Mathematics, Informatics, and Natural Sciences after the summer break. In addition, doctoral theses were defended by Andreas Lorenz, Dominik Lübbers, Amine Chatti, and David Kensche. To assist guidance of the growing number of doctoral students and management of the many projects, several new postdocs were hired, including Dr. Sukeshini Grandhi (from NJIT, USA), Dr. Milos Kravcik (Open University Netherlands), Dr. Andreas Lorenz (Fraunhofer FIT), and Dr. Karl-Heinz Krempels (until summer 2010 member of Informatik 4). Dr. Amine Chatti joined the CiLE-Learning Center of RWTH Aachen University after completing his doctorate in our group, whereas Dr. Dominik Lübbers joined the HaCon train research center in Hannover.

The cooperation with the Fraunhofer Institute for Applied Information Technology FIT continued in 2010, in research through an increasing number of joint projects and personnel exchanges, in teaching through the Bonn-Aachen International Center for Information Technology (B-IT) and the new B-IT Research School for Doctoral Training. In B-IT, a major effort was preparing and conducting the materials and audit for the re-accreditation of our international master programs in Media Informatics and Life Science Informatics, also for the RWTH master degree on Software Systems Engineering. For the first time, the new European accreditation agency EQANIE was active in Germany as part of this process, so that these programs will be the first computer science programs in Germany accredited both nationally and Europe-wide. In the B-IT Research School, again a huge number of applications for doctoral scholarships were received, making it a hard work to select the last of our now 27 scholarships. A former RWTH library is currently remodeled to improve the B-IT research training facilities.
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.

**Excellence Cluster UMIC Mobile Applications and Services:**

Ultra High-Speed Mobile Information and Communication


The “Ultra High-Speed Mobile Information and Communication (UMIC)” is a research cluster under the German Excellence Initiative. UMIC was 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 groups 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 institutes of electrical engineering, mechanical engineering, architecture, and computer science in two subprojects in the research area of “Mobile Applications and Services”.

![UMIC group at Informatik 5](image-url)
Virtual Campfire aims to provide professional communities such as researchers’ communities for cultural heritage management an advanced framework to create, search, and share multimedia artifacts with context awareness easily and fast. Advanced multimedia storytelling approaches are conceptualized and developed based on metadata standards and Community of Practice concept. Requirements from professional communities are analyzed based on real research scenarios in cultural heritage management in Afghanistan together with researchers from Aachen Center for Documentation and Conservation. Research based on those requirements deals with problems and challenges of mobile multimedia management for professional communities.

In 2010, Mobile Campfire, the mobile version of Virtual Campfire, has been launched on iTunes App Store. Mobile Campfire enables user communities to create, annotate, search, and share photos and share multimedia stories on iPhone, iPod and iPad. The prototype of SeViAnno extends the semantic-enhanced video annotation service for Virtual Campfire to enable collaborative tagging of video frames based on the metadata standard MPEG-7. Research results and prototypes have been presented and demonstrated at several international conferences, including MDM 2010. Upon request of Culture Section of German Foreign Office, an evaluation of the historic city walls of Ghazni in Afghanistan, the future Islamic Culture Capital in 2013, has been conducted using our technology by cultural heritage experts from RWTH Aachen Center of Documentation and Conservation.

Several academic events were organized to discuss research questions for mobile multimedia management. The UMIC Workshop on Future Mobile Applications (UMICWS’10,
http://dbis.rwth-aachen.de/cms/events/umic-workshop-on-future-mobile-applications), jointly organized with Fraunhofer FIT, was held on February 26th, 2010, at UMIC Research Center. Over 40 PhD students and researchers from UMIC and other institutions participated in the workshop. A successive workshop proposal of the First IEEE PerCom Workshop on Pervasive Communities and Service Clouds (PerCoSC 2011) was accepted by the IEEE International Conference on Pervasive Computing and Communication, together with Prof. Christian S. Jensen from Aarhus University, Denmark. The Third International Workshop on Story-Telling and Educational Games (STEG 2010), to be held in conjunction with ICWL 2010 in Shanghai (December 2010) continues with the success of the first two workshops and explores advanced research results and questions with the research communities.

Mobile and Wearable P2P Information Management in Health Net Applications


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 and protected 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 initial prototype includes a body sensor shirt for measuring vital parameters and a mobile device for data integration and analysis. The data collected on the mobile device can be sent to other peers in the network for further analysis. This prototype is now applied in a sports context: a mobile monitoring system for runners. Runners often overestimate their physical condition and overstrain themselves during practice or competitions. Therefore, a mobile monitoring system which measures crucial vital parameters can help to avoid critical situations. It is planned to apply the system in the Lousberglauf 2011, an annual running event in Aachen with more than 2000 participants.

The work of Informatik 5 focuses on the development of the mobile software for data integration, data exchange and data visualization. Requirements for the sports application were collected by several interviews with runners and coaches from the university teams. The software will be developed on the Android platform.

Cooperative Cars – CoCar

M. Jarke, C. Quix, S. Geisler, S. Schiffer, Guido G. Gehlen (Ericsson GmbH Eurolab), Gordian Jodlauk (Ericsson GmbH Eurolab), P. Roy, S. Weber

The Cooperative Cars (CoCar) project, supported by the German Federal Ministry for Research and Education and Ericsson EuroLabs, will test the suitability of UMTS technologies and their foreseeable extensions (such as LTE) 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. Several partners from telecommunications and automobile industry will identify which traffic management and driver assistance applications are suitable for use of this technology. A first phase of the project was finished in 2009; the project is now continued in the Cooperative Cars Extended (CoCarX) project.

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. Based on a quality- and priority-based traffic information fusion architecture, Informatik 5 has developed 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. For example, the simulation framework has been applied to the queue-end detection problem: based on messages which are sent by CoCars (e.g., emergency braking or warning flashers) the system has to identify the location of the end of a traffic jam. This is an important application as many accidents are caused by drivers not realizing a queue-end in front of them.

The queue-end detection scenario

Screenshot from the traffic simulation showing real and forecasted queue end
CAIRO - context aware intermodal routing

O. Spaniol, K.-H. Krempels, U. Christoph, C. Terwelp

Goal of the CAIRO project is to offer a navigation and assistance system for the public transport on mobile devices (mobile or smart phones), which links static data (e.g. railway stations, time schedules) with dynamic data (train delays, route changes for busses) into an intermodal routing service. With help of this system an user can get individual information depending on her current situation. For example, in case of missed connecting trains on long distance travels alternative routes can be determined. CAIRO achieves this by considering intermodal offers (e.g. trains, busses, car or bicycle sharing) and real time information of the public transport systems. Thus for the first time an intermodal, dynamic routing is realized which takes into account the current location of the user and real time data of the public transport system. CAIRO is a joint project in cooperation with Deutsche Bahn AG, HaCon GmbH, InnoZ GmbH, and VBB Verkehrsverbund Berlin-Brandenburg GmbH.

Research Group Metadata in Community Information Systems


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 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 OBIP, TELMAP and GALA in 2010. We have strong funding in technology enhanced learning and cultural heritage management with a “Web Science” research approach. We combine 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.

We organized two workshops in the Multimedia Metadata Community (http://www.multimedia-metadata.info) in Barcelona (WISMA’10) and in Saarbrücken (SeMuDaTe’10) as well as workshops about about storytelling and educational gaming (EC-TEL WS, STEG’10) in Barcelona and Shanghai. Highlights of the year were our strong participation in the organization of the IEEE Ubi-Media in Jinhua, China, in July 2010 and the JTEL Summer School 2010 in Ohrid, Macedonia.
DFG CONTici: Context Adaptive Interaction in Cooperative Knowledge Processes

M. Jarke, R. Klamma, A. Hannemann, C. Terwelp, C. Hocken, C. Kalla, N. Drobek,
G. Hackenberg, M. Hackstein, A. Goer, M. Bachwerk

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 2009-2010, 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.

DFG Research Training Project: Knowledge Discovery in Digital Libraries

M. Jarke, R. Klamma, M.C. Pham, Q. Tran

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 2009-2010, we integrated data from two large digital libraries - DBLP and CiteSeer. Based on this data, we built a so-called map of computer science knowledge to understand how the knowledge in computer science is organized. Clustering is performed on the knowledge network to identify the similar venues (conferences, journals, workshops) and to understand the relations between research domains. Venues are ranked using some SNA measures such as betweenness, PageRank and HITS scores, to identify interdisciplinary, high prestige and top knowledge consumers and producers. The visualization and ranking were integrated in our system called AERCS (An Academic Event Recommender system for Computer Scientist). Furthermore, we evaluated our clustering approach for recommender system in digital libraries using social network. The evaluation on venue recommendation shows that clustering approach outperforms traditional collaborative filtering.
This work was supported in part by NRW State within the B-IT Research School. The goal of the project is to investigate possibilities to augment the capabilities of weak mobile devices and develop middleware that can seamlessly offload the computing and storage of mobile applications into the Cloud. Cloud computing technologies have been emerging recently as a solution to scalable on-demand computing storage resources that can be accessed via the Internet. The never ending strife for increasing mobile processing power and more data, Clouds can be the best possible solution to augment the mobile execution platform. Furthermore, due to changing conditions in the mobile environments, context-awareness can play crucial role in delivering mobile services with best performance.

ROLE Architecture

ROLE 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, psychopedagogical 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 (or mashup) new components and functionalities, which can be adapted by collaborating learners to meet their needs and to enhance the effectiveness of their learning. Informatik 5 is the vice-coordinator of the project, acting as technical leader and community facilitator.

Already in early phases of the project, a project-within-project culture was established in order to drive the development of various stages of ROLE software prototypes, starting with the ROLE Christmas Project resulting in first prototypes for ROLE-enabled Widget PLE, and continued with the ROLE Easter Project, where prototypes were directly developed for the application and evaluation in the five ROLE test-beds. The cooperation of I5 with ZLW/IMA and Fraunhofer FIT resulted in an enhanced version of a Web 2.0 Knowledge Map for the RWTH test-bed, which was designed to support mechanical engineering students during their introductory programming lecture and lab course at RWTH Aachen University. The outcomes of both projects also resulted in publications in TEL journal special issues. Currently, the I5 team is responsible for the management of the subproject Stonehenge kicked-off during the first ROLE Developer Camp held in August 2010 in Lausanne, Switzerland. The expected outcome of Stonehenge is a showcase platform to be publicly presented at fairs, conferences, etc. A further highlight was the first dissemination trophy won by the I5 team for numerous publications, presentations, and community facilitation activities in the context of ROLE. In the second dissemination trophy the I5 team was runner-up.

**EU Support Action TELMAP: Future gazing Technology Enhanced Learning - The Roadmap for the unknown Learning Landscape**

_M. Jarke, R. Klamma, M. Kravcik_

TELMAP focuses on ‘exploratory/Roadmapping activities for fundamentally new forms of learning’ to support take-up of those new forms, via ‘awareness building and knowledge management on the results of EU RTD projects in TEL’ and ‘socio-economic evaluations in education and for SMEs’. We gather information on the current, desired and emerging position of TEL, and on awareness and appropriation (by educators and SMEs) of RTD results in TEL. We codify that information using state-of-the-art knowledge management methods, at three levels of scale: 1) macro (political, economic, social, technological, legal, and environmental), 2) meso (organisation of education and training systems and institutions), and 3) micro (enacted paradigms of learning and teaching). Cutting across these levels of scale is the categorisation of changes as exogenous or endogenous relative to forms of learning and to the TEL community. This provides direct input to TEL-relevant decisions at all three levels, including economic, political, and research discussions.

With a 10-year horizon, we co-develop a portfolio of stakeholder-specific roadmaps and influence maps, to gain insights into fundamentally new forms of Learning, Education and Training activities (LET) and into what makes for effective transfer and scalability. Our collaborative development approach leads to a Multi-perspective Dynamic Roadmap to track, anticipate and manage knowledge about new forms of LET and their impact on TEL. This
EXTENDS established TEL Roadmapping methods in novel, powerful and cost-effective ways, with high potential for sustainability and for targeting each stakeholder’s goals. Outcomes include well-grounded recommendations on TEL and LET innovations, plus a platform and a sustainable dynamic process that will foster collaboration and consensus-building across specialized communities and stakeholder groups.

**EU Network of Excellence GALA: Gaming and Learning Alliance**  
*M. Jarke, R. Klamma, M. Kravcik*

GaLA gathers the cutting-the-edge European Research & Development organizations on Serious Games, involving 31 partners from 14 countries. Partnership involves universities, research centers, and developer and education industries. The GaLA motivation stems from the acknowledgment of the potentiality of Serious Games (SGs) for education and training and the need to address the challenges of the main stakeholders of the SGs European landscape (users, researchers, developers/industry, educators). GALA aims to shape the scientific community and build a European Virtual Research Centre aimed at gathering, integrating, harmonizing and coordinating research on SGs and disseminating knowledge, best practices and tools as a reference point at an international level. The other key focuses of the project are: the support to deployment in the actual educational and training settings; the fostering of innovation and knowledge transfer through research-business dialogue; the development high-quality didactics on SG by promoting and supporting courses at Master and PhD level.

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

The new EU Life Long Learning Project TeLLNet supports the European Schoolnet 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. Within the project we are going to apply 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. Social Network Analysis (SNA) provides a useful approach to identifying social capital and social structure in Schoolnet communities. Small world effect and scale-free networks are observed and analyzed. This research work is based on both theoretical research and practices.

In 2010, we applied SNA as a meta-competence to describe, represent and evaluate social and professional competence for teachers’ lifelong learning. Thus, a competence model is developed for dynamic competence management based on SNA. This new approach brings new methodologies, perspectives and information services of competence management in research areas of lifelong learning and technology enhanced learning. It can be applied in competence management and development within organizations and enterprises. The experiments and evaluation are conducted on the continuously growing data set of the European school network with over 72,000 schools, 130,000 registered teachers, 17,000 projects and a large number of emails and blogs. First evaluation result proves the power law distribution of the teachers’ networks.
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, Greece),
E. Gadolou (Harokopio University, Greece), H. Papadaki (Harokopio University, Greece)

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 community based 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.

IKYDA project meeting at Harokopio University, Greece, 19-11-2009

Researchers from Harokopio University have paid two visits in January and September 2010 to exchange knowledge with the colleagues at Informatik 5. A group of research assistants and students for Informatik 5 have visited Harokopio University in November, 2009. During the exchange stay, the battleship “G. Averof” was scanned with the Riegl LMS-Z390i 3D scanner with over 20 scans from different viewpoints. Y. Cao, A. Hannemann and D.
Kovachev presented research on multimedia storytelling and 3D scanner technologies to the master students with good discussions. The visits from both partners to each other have fostered research cooperation and knowledge sharing well. Two joint papers have been presented in GIS conferences and workshops.

DAAD Dissertation 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 2009-2010, besides to extension faked image dataset, we concentrated on exploiting the Web 2.0 and community of practice advantages for the collaborative fake multimedia detection, considering the trust and quality of community members’ contributions.

Overcoming barriers in the innovation process

M. Jarke, R. Klamma, D. Schmitz, F. Piller (TIM), M. Brettel (WIN), I. Koch (Lehrstuhl f. Psychologie), K. Henning (IMA)

The IMP Boost project “Overcoming Barriers in the Innovation Process” investigates “effectuation”, a new approach to explain the success or failure of entrepreneurs. In contrast to traditional “causation” approaches the entrepreneur is not considered to be driven by a concrete goal and to choose between different alternatives in regard to how well they help to achieve this goal. Instead the entrepreneur evaluates the alternatives, in particular the choice of strategic partners, in regard to their potential for future success. The goals are adapted to the choices and in particular the needs of the strategic partners. The aim of the IMP Boost project is to compare the two approaches, “effectuation” and “causation” by running simulations. Based on theoretical research neither of these two approaches is to be favoured in general. Accordingly, we need to identify the settings, conditions, and constraints that put either of these approaches in front. From first modelling experiences and basic considerations, agent-based approaches towards simulation seem well suited as a means for investigation. Due to the high importance of networking, approaches from social network analysis as well as actor-network theory are expected to become relevant as well. The work is carried out in tight collaboration with our partners from the economics.

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.

**HumTec Project “Natural Media and Engineering”**

*M. Jarke, V. Evola, S. Grandhi, I. Mittelberg (HumTec)*

This 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) is funded 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; the main research attention is directed to the analysis of gestures in conjunction with other “natural media” of the human. The intended long-term practical impact is improved human-machine interaction design based on a deeper understanding of the media. Dr. Sukeshini Grandhi (formerly New Jersey Institute) represents computer science and information systems in this project, focusing on the different roles of computer games in the Natural Media context. She brings to this work extensive experience in mobile technology design, especially from her Ph.D. thesis work on Interruption Management in Mobile Telephony at the New Jersey Institute of Technology.

In the reporting period, a Natural Media Lab allowing for very detailed gesture recognition was set up, and first experiments have been conducted. Moreover, the group organized the four Conference of the International Society for Gesture Studies (ISGS).

**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.
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 2010, the group worked on methods for schema merging and schema matching. A method was developed which allows merging schemas using logical correspondences. The schema matching framework has been extended with methods for semantic matching and new algorithms for more efficient string matching. As in the previous years, GeRoMeSuite participated in OAEI, a competition of ontology alignment systems.

Furthermore, the group started developing a dataspace framework. Dataspaces aim at integrating structured as well as unstructured data in an incremental way. First results are an algorithm for the discovery schemas from unstructured data and an architecture for processing structured queries over unstructured data.

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 hard- 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 architectures 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.

The result of this project is an analysis of the relationships between the existing metamodels in industry automation. These relationships have been formalized in a metamodel which links models from discrete manufacturing and from process engineering.

In this project, Informatik 5 cooperates with the Laboratory for Machine Tools and Production Engineering (WZL, Prof. Brecher) and the Chair of Process Control Engineering (PLT, Prof. Eppe) 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, T. Sagi (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.

During the project, the matching frameworks GeRoMeSuite (from RWTH Aachen University) and SMB (from Technion) have been integrated. The integration can be done in three modes, namely enhance mode, recommendation mode, and learning mode. The enhance mode takes a similarity matrix as input and enhances the clarity of the similarity values, i.e. good values should be increased and bad values should be decreased. The recommendation mode uses a-priori features such as the size of the schemas and number of matching attributes to select the best matchers for a matcher ensemble. A-priori features are recorded by GeRoMeSuite and passes, together with similarity matrices that were generated from different base configurations, to SMB. These are then used by SMB to recommended weighted ensemble of matcher configurations.

In a learning mode, user feedback or reference alignments are used to enhance SMB decision making. The user validates attribute correspondences, which are fed to SMB to induce a learning process and improve future matcher ensemble decisions.

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 modelling, 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 on SourceForge. In the academic year 2009/10, the group focused on continuous improvement of the system and removed several bugs.
The developments concentrated on the identification of pathological structures in breast cancer probes. We first started with a supervised machine learning approach based on annotations by pathological experts. Reliability tests showed that isolated annotations of regions within the digitalized images are an inappropriate starting point. There were significant disagreements between various coders. Therefore we switched to unsupervised image classifications and clustering procedures applying self organizing map (SOM) algorithms. The results were then validated and corrected by human experts. In these cases the contributions of the pathologists were better oriented and therefore stable. Based on these validated classifications of tissue regions further analytical steps were introduced in order to specify the structural heterogeneity of various distribution patterns of tumors. Additionally distribution patterns of hormone receptors (ER, PR) within tumor regions have been analyzed. The results will be merged with clinical data of the patient and via machine learning analysis with respect to the prognostic capacity of the pertinent constellations.

The project in collaboration with the University Hospital Hamburg Eppendorf, Carl Zeiss MicroImaging and Qiagen is funded by the Federal Ministry of Education and Research (BMBF).

Transporter protein topology influences numerous cellular processes. Internalization of transporter proteins into the cells or their directed placement into the cellular membrane regulates flow of substances and, if altered, causes diseases. As a part of the Clinical Research Group 217 "Hepatobiliary Transport and Liver Diseases (Speaker: Prof. Dr. D. Häussinger, University of Düsseldorf) a workflow for an automatic data analysis was developed. The slow and subjective evaluation of microscopic images by human experts is now automated. A machine learning algorithm is applied for the membrane detection, and protein location profiles are automatically extracted at all valid positions. Numerical descriptors were developed and evaluated for the detection of translocation. The automatic analysis evaluates more data points and is sufficiently reliable compared to the manual method.

SurgeryTube develops web-based multimedia training modules for surgery training. Compressed geometrical models and pre-computed visualizations are focussed on laproscopic liver surgery and the usage of novel e.g. navigation-based support systems. Integrated web-based communication among teachers and learners is supported by Web 2.0 mechanisms such as for a and blogs as well as automatic tools for content presentation in various data formats as well as anonymization of patient data. Under the coordination of long-term partner Dr. Raimund Mildner, Lübeck, Informatik 5 cooperates with medical and visualization partners from Magdeburg, the Universities of Lübeck and Gießen, and industry partners.
Other Activities

Services

Prof. Jarke was elected Chairman of the Fraunhofer Information and Communication Technology group, comprising 17 institutes with a total of over 2000 full-time researchers and a budget close to 200 m€. In this role, he also became a member of the Fraunhofer Presidential Board.

Prof. Jarke’s other major administrative and service activities in 2009-2010 included:

• Deputy coordinator, UMIC Excellence Cluster on Mobile Information and Communication, RWTH Aachen University
• Executive Director, Fraunhofer FIT, Birlinghoven
• Founding Director, Bonn-Aachen International Center for Information Technology (B-IT), a joint institute of RWTH Aachen and Bonn University offering international master programs in applied IT
• Coordinator, B-IT Research School, a joint doctoral training school in applied informatics between RWTH Aachen University and Bonn University co-funded by NRW State
• 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) running e.g. the European part of the World Wide Web Consortium W3C
• Scientific advisory board, Faculty of Informatics, University of Vienna, Austria
• Scientific advisory board, Learning Lab Lower Saxony (L3S), Hannover
• Chair, Scientific advisory board, OFFIS e.V., Oldenburg
• Research commission, Free University of Bozen, Italy (until June 2010)
• Advisory board, Large Scale Complex IT Systems Initiative (LSCITS), UK
• Hochschulrat, FH Köln
• Member of Program Board, LOEWE Excellence Initiative Hessia
• Curatory board and scientific advisory board, IBFI, Schloss Dagstuhl
• Jury, Wissenschaftspris Stifterverband der Deutschen Wirtschaft
• Chair/member of several faculty search committees at RWTH Aachen University, GUtech, University of Hamburg, Fraunhofer
• Jury, ACM/AIS Best Dissertation in Information Systems Award 2009
• Reviewer, DFG, NSF, NSERC Canada

Within the RWTH Excellence Initiative “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 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 40%, doctoral students 65%, and significant quality improvements in international master student recruiting can be observed.
R. Klamma is technical leader & community facilitator of the EU IP ROLE, senior researcher in the EU projects TELLNET, TELMAP, and the Network of Excellence in Serious Gaming GALA as well in the DFG project CONTICI. He is standing expert of the W3C in the Media Annotations Working Group.

Dominik Schmitz is a manager of the i* Wiki.

Yiwei Cao is member of DIN NI-32 “Data Management and Data Exchange”.

Thomas Rose is evaluation expert for EU Project Proposals on "ICT for Energy and Water Efficiency in Public Housing" 21.-23.6.2010. He is the program committee member of the workshop for 'IT-support of rescue forces", GI conference 2010, Leipzig.

**Editorial Boards**

Yiwei Cao was reviewer for International Journal on Multimedia Tools and Applications.


Ralf Klamma serves as associate editor for IEEE Transactions on Learning Technologies (TLT), Springer Journal on Social Network Analysis and Mining (SNAM) 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 special issues of the World Wide Web Journal (WWWJ) for the IEEE Ubi-Media 2010 conference and of i-com journal for the Digital Networks workshop at Informatik 2010. He also served as reviewer for IEEE Transactions on Management of Information Systems (TMIS), IEEE Transactions on Learning Technologies (TLT), IEEE Multimedia, VLDJ Journal, Multimedia Tools and Applications (MTAP), and Journal of Networks and Applications (JNCA).


Wolfgang Prinz is member of the Editorial Boards of the CSCW Journal and of i-com: Zeitschrift für interactive und cooperative Medien.

Christoph Quix served as a reviewer for the journal on Data & Knowledge Engineering, IEEE Internet Computing, the Journal of Web Semantics, and the VLDB journal track (PVLDB).

**Conference Organization**

Yiwei Cao was co-chair of Third International Workshop on Story-Telling and Educational Games (STEG’10), and the UMIC Workshop on Future Mobile Applications (UMICWS’10). She was program committee member of 6th International Workshop on MOBILE and NETworking Technologies for social applications (MONET’10), 11th and 12th Workshop of the Multimedia Metadata Community (WISMA’10 & SMCT’10), The 3rd IEEE International
Matthias Jarke served as General Co-Chair of the 12th International Conference on Electronic Commerce (ICEC 2010) in Honolulu, Hawaii, August 2-4, 2010. He is also Theme Track Chair “Gateway to the Future” at the International Conference on Information Systems (ICIS 2010) in St. Louis, Missouri, Dec. 13-14, and program committee member of the following conferences: Software Engineering 2010 (SE 2010, Paderborn, February 2010), Modellierung 2010 (Klagenfurt, March 2010), 22nd CAiSE 2010 and First Intl. Workshop on Empirical Research in Process-Oriented Information Systems (Hamammet, Tunesia, June 2010), 16th REFSQ ’10 (Essen, June 2010, Group Decision and Negotiation (GDN ’10, Delft, June 2010), and MobileHCI 2010 (Lisbon, September 2010). He also serves on the Advisory Board of the CIO Colloquium, a network of the Chief Information Officers in German industry.

Nils Jeners served on the program committee of Workshop “Anforderungen und Lösungen für die Nutzung interaktiver Displays im Kontext kollaborativer Arbeit” at Mensch & Computer 2010 in Duisburg, Germany, September 2010.

Ralf Klamma was program co-chair of the 3rd IEEE International Conference on Ubiquitous Media Computing (U-Media 2010), Jinhua, China, 5-7 July, 2010. He was also co-chair of the following events: 6. JTEL Summer School in Technology Enhanced Learning, Ohrid, Macedonia, July 2010, Doctoral Consortium at EC-TEL 2010, Barcelona, Spain, September 2010, UMIC Workshop on Future Mobile Applications (UMICWS’10), Aachen, Germany, February 2010, 11th Workshop of the MPEG-7 Community on Multimedia Metadata (WISMA’10), Barcelona, Spain, March, 2010, 12th Workshop of the MPEG-7 Community on Semantic Multimedia Databases (SeMuDaTe’10), Saarbrücken, Germany, December, 2010, IFIP PRO’VE’10 Special Track on Collaborative Networks, St. Etienne, France, October 2010, and PerCOSC’11 at the IEEE PerCom, Seattle, USA, March 2011. He was area editor for the ICIS’10, St. Louis, USA, December 2010, special track organiser on competence management in personal learning environments at the Professional Training Facts 2010, Stuttgart, Germany, October 2010, and senior reviewer for the PLE’10, Barcelona, Spain, July 2010. He served as program committee member / reviewer for the following conferences: ACM CHI’10, ACM Group’10, ACM SAC’11, ACM Multimedia’10 Workshop P2P Networks, ACM Multimedia’10 Workshop MTDL’10, ACM CSCW’11, ACM Workshop RecSysTel’10, IEEE ICALT’10, IEEE DEST’10, IEEE EDUCON’10, IEEE EDUCON’11, IEEE EUROCON’11, MUE’10, MUE’11, WMM’10, Wirtschaftsinformatik’11, International Symposium on Collaborative Technologies and Systems (CTS’10), Communities & Technologie’s’11, ICWL’10, EC-TEL’10, GI-Workshop Digital Social Networks (GIDSN’10), Workshop Business Process Management and Social Software (BPMS2’10), Interactive Computer Aided Learning (ICL’10), I-KNOW’10, Workshop Computer-based Knowledge & Skill Assessment and Feedback in Learning Settings (CAF’10), eKnow’10, Workshop on Text Information Retrieval (TIR’10), MMedia’10, BASNA’10, STEG’10.


Zina Petrushyna co-organized the Joint European Summer School on Technology Enhanced Learning 2010. She was a program committee of the IADIS E-learning conference 2010.

Manh Cuong Pham was reviewer of the First and Second International Conference on Complexity, Informatics and Cybernetics (IMCIC 2010, IMCIC 2011), and the IEEE International Conference on Ubimedia Computing (U-Media) 2010.

Wolfgang Prinz was Technical Paper Co-Chair of the ACM GROUP Conference 2010. Moreover, he served on the program committees of the conferences Mensch & Computer 2010, ECSCW 2009, and CRWIG 2010.

Dominik Renzel was technical program chair of the ROLE Developer Camp 2010 and co-organizer of the workshop "Storytelling and Educational Games in the Learning Flow" at ECTEL 2010. He was member of the program committee for Workshops on Semantic Multimedia Database Technologies (SeMuDaTe 2009) and Interoperable Social Multimedia Applications (WISMA 2010). He was also reviewer for Multimedia Tools and Applications (MTAP), ACM GROUP’10, a special issue in the Journal on Distant Education Technologies (JDET), and the IEEE International Conference on Ubimedia Computing (U-Media) 2010.

Dietlind Zühlke chaired a Workshop on Computational Intelligence in Siegburg, March 2010.

**Software Demonstrations**

Virtual Campfire, STEG Workshop at ECTEL’10, September 29, 2010, Barcelona, Spain

Virtual Campfire, 11th International Workshop of the Multimedia Metadata Community (WISMA 2010), May 19-20, 2010, Barcelona, Spain

Virtual Campfire, UMIC Workshop on Future Mobile Applications, Aachen, Germany, February 26, 2010, Aachen, Germany

Virtual Campfire, SeMuDaTe Workshop at SAMT 2009, December 2, 2009, Graz, Austria

Virtual Campfire, UMIC Day 2009, October 20, 2009, Aachen/Germany

MobSOS Application/XMPP Server, Workshop on Semantic Multimedia Database Technologies (SeMuDaTe2009), December 2, 2009, Graz, Austria

ROLE X-Mas Project Prototype, ROLE Christmas Project Meeting, December 17, 2009, Aachen, Germany

ROLE Easter Project Prototype - RWTH Test-bed "Web 2.0 Knowledge Map" in cooperation with ZLW/IMA, ROLE 1st Annual Review, April 20, 2010, St. Augustin, Germany

PALADIN II and Mediabase commander, ROLE Development Strategy meeting, September 07, 2009, Aachen, Germany


CoCarX - Data Stream Management zur Verkehrsdatenanalyse, aktiv Final Presentation, Mendig, June 23-24, 2010

Interdisciplinary HealthNet Project, UMIC Open Day, April 21, 2010
Talks and Publications

Talks

Y. Cao: Mobile Multimedia Management for Virtual Campfire - The German Excellence Research Cluster UMIC. Joint Lab of Next Generation Internet Interactive Computing, Shanghai University, Shanghai, China, July 9, 2010 (invited).


Y. Cao and X. Chen: Virtual Campfire iNMV -Storytelling on the iPhone. UMIC Workshop on Future Mobile Applications, Aachen, Germany, February 26, 2010.


S. Geisler: Einführung in SQL Server Spatial, PASS (Professional Association for SQL Server) Regionalgruppe Ruhrgebiet, August 12, 2010

S. Geisler: Dynamische Erstellung von SSIS-Paketen, PASS (Professional Association for SQL Server) Regionalgruppe Ruhrgebiet, February 11, 2010

M. Jarke: Information Technology for Engineering and Management. DAAD Review of GUtech, Muscat, Oman, 2.11.2009.


D. Kensche: Solving ORM by MAGIC: MApping GeneratIon and Composition. Third International Conference on Objects and Databases (ICOODB), Frankfurt/Main, Germany, September 30, 2010.


R. Klamma: Reflection Support for Communities on the Web, ROLE WP Meeting, Aachen, Germany, April, 2010.


D. Kovachev: Context-aware Mobile Multimedia Services in the Cloud, the 10th International Workshop of the Multimedia Metadata Community in Semantic Multimedia Database Technologies (SeMuDaTe’09), Graz, Austria, December, 2009.


X. Li: *Towards a Unified Framework for Schema Merging*. PhD Workshop, 36th Intl. Conference on Very Large Databases (VLDB), Singapore, 13.9.2010


Manh Cuong Pham: *The Structure of the Computer Science Knowledge Network*. The IEEE International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2010), Odense, Denmark, 9-11 August, 2010.

Manh Cuong Pham: *Clustering Technique for Collaborative Filtering and the Application to Venue Recommendation*. The 10th International Conference on Knowledge Management and Knowledge Technologies (I-KNOW 2010), Graz, Austria, 1-3 September, 2010.

W. Prinz: *Innovation Trends in IT*, European Leadership Committee, Bayer AG, Leverkusen, 27.4.2010

W. Prinz: *PMO Maturity Studie 09: Status Quo & Entwicklungstrends*, Keynote PMO Symposium 09, Düsseldorf, 30.4.2009


W. Prinz: *Supporting the change of cooperation patterns by integrated collaboration tools*, Thessaloniki, October 2009

W. Prinz: *Developing Collaborative Working Environments – what can we learn from Web 2.0?* Keynote, CoopIS 2009, Villamoura, Portugal, November 2009

D. Renzel: *Virtual Campfire: Collaborative Multimedia Semantization with Mobile Social Software*. Workshop on Semantic Multimedia Database Technologies (SeMuDaTe2009), December 2, 2010, Graz, Austria.


D. Schmitz: *Agent Instantiation in i*, University of Toronto, Canada, May 10, 2010.

D. Schmitz: *Analyzing Agent-Based Simulations of Inter-Organizational Networks*, 6th Int. Workshop on Agents and Data Mining Interaction, ADMI 2010, Toronto, Canada, 11.5.2010.

D. Schmitz: *Applications of ConceptBase in the ZAMOMO Project*, RWTH Aachen University, May 25, 2010.


D. Zühlke: *Learning vector quantization for heterogeneous structured data*. 18th European Symposium On Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN 2010), Bruges, Belgium, 28.4.2010.

D. Zühlke: *Unsupervised learning for heterogeneous structured data*. Mittweidaer Workshop for Computational Intelligence, 30.6.2010

D. Zühlke: *Neural Computation in industrial applications of life science informatics*. Invited Talk, Colloquium Informatica, Johann Bernoulli Institute for Mathematics and Computer Science, University of Groningen, 8.8.2010

D. Zühlke: *Machine learning in life science informatics - industrial applications*. Invited Talk, ICOLE-2010, German–Polish Workshop on Computational Biology, Scheduling and Machine Learning, Lessach, Austria, 26.09.2010

**Publications**

**Books and Edited Volumes**


Ralf Klamma, R. W. H. Lau, Shu-Ching Chen, Q. Li, Ishfaq Ahmad, Jianmin Zhao: *Proceedings of the 3rd IEEE International Conference on Ubi-Media Computing (U-Media), 5-7 July 2010, Jinhua, China*

Ralf Klamma, Harald Kosch, Matthias Lux and Florian Stegmaier: *Proceedings of the 10th International Workshop of the Multimedia Metadata Community on Semantic Multimedia Database Technologies (SeMuDaTe'09), CEUR Workshop Proceedings, Vol. 539, Graz, Austria, December, 2009*


**Journal Articles**


Yiwei Cao, Anna Hannemann, Ralf Klamma, Dominik Renzel: *A Community Success Model for Gaming Communities*, Journal of Multimedia, Vol. 4, No. 2: 87-93, April 2009, Academy Publisher (not listed in Annual Report 2009)


S. Hansen, K. Lyytinen, Matthias Jarke: *Interview with Fred Brooks on "Building Effective Large-Scale Requirements"*. BISE 2, 3 (2010): 191-194 (German version "Erhebung effektiver Anforderungen im großen Zusammenhang" in Wirtschaftsinformatik 52, 3 (2010))


**Conference, Book Contributions, Patents**


Sandra Geisler, Yuan Chen, Christoph Quix, G. G. Gehlen: Accuracy Assessment for Traffic Information Derived from Floating Phone Data. Proc. 17th Intelligent Transportation Systems and Services World Congress, Busan, Korea, 2010
Sandra Geisler, Christoph Quix, A. Schmeink, David Kensche: **Ontology-based Data Integration: A Case Study in Clinical Trials.** To appear in: Database Technology for Life Sciences and Medicine

Sandra Geisler, Christoph Quix, Stefan Schiffer: **A Data Stream-based Evaluation Framework for Traffic Information Systems.** Proc. 1st ACM SIGSPATIAL International Workshop on GeoStreaming (IWGS) 2010, November 2, 2010, San Jose, USA

W. Graether, N. Jeners: Neuartige Interaktionsformen beim Kartenspielen mit iPhones und MS Surface. Workshop Anforderungen und Lösungen für die Nutzung interaktiver Displays im Kontext kollaborativer Arbeit am Mensch & Computer 2010, Duisburg, Germany

S.A. Grandhi, G. Joue, I. Mittelberg: **There is more than what meets the hand: using semiotic principles to understand the use of communicative hand gestures in interaction design.** Proceedings Workshop on Whole Body Interaction, at SIGCHI, Atlanta, Ga, July 2010

S.A. Grandhi, R. Schuler, Q. Jones: **Telling calls – making informed call handling decisions.** Proc. 8th ACM Conf. on Designing Interactive Systems, Aarhus, Denmark, 2010


Matthias Jarke, Markus Klann, Wolfgang Prinz: **Serious Gaming -- The Impact of Pervasive Gaming in Business and Engineering.** In C.M. Schlick (ed.): Industrial Engineering and Ergonomics - Visions, Concepts, Methods and Tools, Springer 2009, pp. 281-292


Matthias Jarke, Hans W. Nissen, Thomas Rose, Dominik Schmitz: **Goal-Based domain modeling as a basis for cross-disciplinary systems engineering.** In S. Nurcan, C. Salinesi, C. Souveyet, J. Ralytê (eds.): Intentional Perspectives on Information Systems Engineering. Springer 2010, 83-100

Ludwig Jäger, Matthias Jarke, Ralf Klamma, Marc Spaniol: **Transkriptivität -- Operative Medientheorien als Grundlage von Informationssystemen in den Kulturwissenschaften.** In H. Bublitz, R. Marek, C.L. Steinmann, H. Winkler (Hrsg.): Automatismen, pp. 299-314. Wilhelm Fink Verlag 2010


Dejan Kovachev, Ralf Klamma: Context-aware Mobile Multimedia Services in the Cloud. Published in Ralf Klamma, Harald Kosch, Matthias Lux and Florian Stegmaier (Eds.): Proceedings 10th International Workshop of the Multimedia Metadata Community on Semantic Multimedia Database Technologies (SeMuDaTe'09), CEUR Workshop Proceedings, Vol. 539, Graz, Austria, December, 2009

David Kensche, Christoph Quix, Xiang Li, Sandra Geisler: Solving ORM by MAGIC: MApping Generation and Composition. Proceedings of the 3rd International Conference on Objects and Databases (ICOODB 2010), Frankfurt am Main Germany, September, 2010.

Xiang Li, Christoph Quix, David Kensche, Sandra Geisler: Automatic Schema Merging Using Mapping Constraints Among Incomplete Sources. Proc. 19th ACM international conference on Information and knowledge management (CIKM’10), October 2010, Toronto, Canada


Oleksandr Lobunets, Nils Jeners: Designing an iPad prototype for collaborative brainstorming. Workshop Anforderungen und Lösungen für die Nutzung interaktiver Displays im Kontext kollaborativer Arbeit at Mensch & Computer 2010, Duisburg, Germany


Andreas Lorenz, Marc Jentsch, Cyril Concolato, Enrico Rukzio: A Formative Analysis of Mobile Devices and Gestures to Control a Multimedia Application from the Distance. 15th IEEE Mediterranean Electrotechnical Conference, pages 796–801. IEEE Xplore, 2010


Haroula Papadaki, Eleni Gadolou, Emmanuel Stefanakis, Georgios Kritikos, Yiwei Cao, Anna Hannemann, Dejan Kovachev, Ralf Klamma: The role of CMS in the education of GIS using storytelling. Seventh European GIS Education Seminar (EUGISES 2010), September 2010, Serres, Greece


Manh Cuong Pham, Ralf Klamma: The Structure of the Computer Science Knowledge Network. In Proceeding 2010 IEEE International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2010), August, 2010, Odense, Denmark

Manh Cuong Pham, Yiwei Cao, Ralf Klamma: Clustering Technique for Collaborative Filtering and the Application to Venue Recommendation. Proc. 10th Intl. Conf. Knowledge Management and Knowledge Technologies (I-KNOW 2010), September 2010, Graz, Austria


A. Schmeink, Sandra Geisler, A. Brauers, Christoph Quix: A Method and Module for Linking Data of a Data Source to a Target Database. Patent Application, No. PCT/IB2009/055537


D. Zühlke, F.M. Schleif, T. Geweniger, S. Haase, T. Villmann: Learning vector quantization for heterogeneous structured data. 18th European Symposium On Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN 2010), Bruges, Belgium.

Position Papers and Interviews (Selection)


Matthias Jarke: Multimedia(macht) für alle. Editorial, InnoVisions 2, Fall 2010, p. 3.


The mission of the Fraunhofer Institute for Applied Information Technology FIT, located in Birlinghoven Castle, Sankt Augustin, and at RWTH Aachen University, 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. About 130 researchers, technical and administrative personal, and student assistants work in the institute. Third-party funding in 2009 was about €6.4 mio.

Since January 2010, FIT Executive Director Prof. Dr. Matthias Jarke also serves as Chairman of the ICT Group and Member of the Presidency of the Fraunhofer Society. With ca. 4.100 employees and a budget of over €210 mio. across its 17 member institutes (about 70% externally funded), the Fraunhofer ICT Group is the largest European research organization in the field of Information and Communication Technologies. In addition to Prof. Jarke, three of the four department leaders in Fraunhofer FIT also hold faculty positions at RWTH Aachen University: Thomas Berlage, Wolfgang Prinz, and Thomas Rose.

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).

FIT.CSCW (Prof. Wolfgang Prinz, PhD) investigates the field of Cooperation Support Systems. Technological development has been changing collaboration within and between organizations significantly. When complex, interdisciplinary jobs must be done effectively and efficiently, knowledge workers today need to be able to cooperate flexibly, ad-hoc and across organizational boundaries. Developing integrated system support for this type of cooperation was the mission of the international ECOSPACE project that was coordinated by FIT and involved more than 20 European partners and a budget of over 12 million €. The project ended in December 2009 and yielded integrated solutions to reduce information and communication overload. ECOSPACE developed a reference architecture for integrating different cooperation tools based on a service-oriented approach (SOA). It used Semantic Web technologies for the selection of suitable services and linked together a broad range of services and applications. Thus, for the first time, different groupware systems have been seamlessly integrated. Together, the results improve contextual and presence awareness, make available information on user behavior when using the cooperation tools and offer a broad range of Web 2.0 tools in a consistent, interoperable cooperation platform.

Social media, smart-phones and surface computing strongly influence today’s use and development of cooperation systems. While social network services have many millions of private users, companies hesitate to use the technology. Several of our projects deal with this discrepancy. Based on a study of the salient characteristics of prominent Web 2.0 applications we developed recommendations on how to adapt these cooperation platforms to the use within
organizations. Companies could thus integrate the characteristic features of social platforms into their application systems and processes, thus providing their staff with better tools for communication and cooperation. A methodology to study cooperativity, which measures the cooperation in an organization, indicates the room – and need – for improvements. Our initial experience indicates that these tools improve the way people communicate and help to reduce the flood of emails bogging down many organizations.

IdeaPitch is novel application brings together desktop computers, iPhones and the multi-touch table Microsoft Surface for communicating, generating and structuring ideas. IdeaPitch lets its users exchange short notes with a simple gesture. It provides a novel, intuitive form of interaction for brainstorming sessions and documents the results for future use. Another Microsoft Surface application, NETme, supports social networking among visitors to events like conferences that requires advance registration. With the registration visitors can enter – besides the usual information like name, address and affiliation – their user names in social networks (XING, Facebook, Twitter, buzz etc.), upload a photo and add information on their professional interests. At the conference the visitors receive badges with a 2D barcode that identifies them to the NETme system. They can use the Microsoft Surface with NETme, explore the social networks, and contact other visitors that are of interest to them.

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. The MobiGuide BMBF project represents a flagship of the activities and integrates multiple lines of research. The goal of this project is to address the needs of prostate surgery, in particular, the detection and assessment of remaining tumor cells. Together with Karl Storz GmbH, a laparoscopic instrument will be extended with a micro-fluidic diagnostic device that captures and analyzes cells from several positions on the surgical site. Those cells will be analyzed with respect to multiple parameters to be integrated into an overall assessment of the surgical situation to aid in the benefit/risk decision how to proceed. Surgical navigation, pathological analysis, micro-molecular diagnosis and visualization are integrated into a medical device.

Further research is conducted on image analysis in tissue, particular the characterization of tumors, and the therapeutically modeling. Another line of research develops miniature diagnostic devices for point-of-care and personal diagnostics.

With the TopoScan platform, the group has developed a modular platform for optical scanning devices. This platform is being refined and several applications are under development. From this platform, specialized automated instruments can be derived that incorporate significant software-driven functionalities, such as content-based autofocus and region-of-interest selection and assay-adaptive scanning strategies. Data management and service integration capabilities are also included. The functionality can be tailored for individual application to domain-specific languages.
FIT.ICON (Prof. Dr. Reinhard Oppermann, Univ. Koblenz-Landau) develops context-adaptive and mobile systems for eLearning and mobile work. Jointly with Informatik 5, they are main partners in the ROLE EU 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. In 2009, two large European integrated projects were successfully completed, addressing metadata for architectural learning (MACE) and middleware for mobile, networked device integration (HYDRA). FIT is coordinator of a new 12 m€ EU integrated project called ebbits which extends HYDRA results to Enable Business-Based Internet of Things and Services in cooperation with SAP AG and eight other business and science partners, and a large partner in the 19 m€ BRIDGE project which investigates the suitability of multi-agent systems for coordination tasks in large-scale emergency management.

FIT.PRO (Prof. Dr. Thomas Rose) develops process management solutions for domains that can be characterized by the complexity of their decision processes, especially emergency management. Methods and tools for process capture and business models for operating services, including related data integration and data warehousing questions, are a major topic. Mobile data integration applications such as car-to-car information management settings (see report on CoCar project in report by Informatik 5) are also pursued.

In the new BMBF project InfoStrom (www.infostrom.org) we cooperate with companies such as RWE, PSI and SAP to develop tools for the informal capture of knowhow about processes that help to deal with the break-down of the electric power supply network. Since private and public organizations have to cooperate, transparency of processes is decisive.

EU Project Profitex (www.project-profitex.eu) develops advanced navigation and communication support systems for fire services. For engineering these systems we pursue a simulation-based design methodology developed within the precursor wearIT@work project to study the use of partially simulated prototypes under realistic operational conditions. Requirements elicitation and field trials will be conducted with several fire services across Europe. In EU project Socionical (www.socionical.eu) we are analysing complex socio-technical systems by means of complexity science and various simulation methods. In particular we are exploring the impact of ambient intelligence technologies on rescue forces in case of large-scale emergencies, e.g. how can mobile phones be used to gather information on a crisis. In EU project Vicon (www.vicon-project.eu) we study the use of virtual simulations to support product design, and develop tools that provide users with age-related impairments to operate virtual prototypes of household appliances such as laundry machines and phones.

Complementing the four research areas, three FIT competence centers support the German government with microeconomic simulations for the impact analysis of proposed new laws, and the industry and public sector with advanced usability studies as well as methods and tools for enabling web compliance checking and inclusive accessibility to the internet.
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. B-IT aims at the internationalization of elite study programs in Applied Informatics. Prof. Matthias Jarke serves as Founding Director together with Prof. A.B. Cremers, Bonn, and Prof. K. Witt, FH Bonn-Rhein-Sieg, Prof. Otto Spaniol is Study Coordinator of the Media Informatics program (from October 2010: Prof. Jan Borchers), Dr. Jürgen Rapp its study advisor. In fall 2010, the re-accreditation audit for the B-IT Master Programs is conducted, not just with the German ASSIN agency but – for the first time in Germany – also with the European agency EQANIE.

**English-Language International Master Programs**

Supported by the €57 mio. 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. 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 a kind of honor class support for the undergraduate computer science curricula at Bonn and RWTH Aachen University.

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 Zheijiang, have been attracted to the program. In 2010, the new Erasmus-Mundus scholarship program India4EU strengthened the cooperation with top Indian universities, such as IIT Delhi. B-IT students have been unusually successful in obtaining attractive competitive scholarships. The 180 B-IT students come from over 40 countries.

All study programs are 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 close to 90%. 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 ETH Zürich, the Universities of Cambridge and Oxford as well as Stanford. Meanwhile some of the early B-IT graduates have already finished their doctoral degrees.
B-IT Research School

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 three rounds of applications from October 2008 to April 2010, a total of 29 doctoral scholarships to candidates from 11 countries were awarded from over 500 applications all over the world. Six of the scholars are graduates from the B-IT master programs.
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 2009-2010, this concerned e.g. Prof. Dr. Manfred Nagl (Informatik 3). 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.

Two further hiring processes are underway.

The initial IT student population has started very small in 2008, with only four students, but has been growing to 6 in 2009, and 12 students in 2010. 17 students have joined the foundation year for a bachelor start in 2011. Omani companies showed themselves impressed by the quality of the early students who by now have been performed their first internships.

The quality management support offered by RWTH Aachen University, and the exchange visits, are funded by a major grant of the German international exchange service DAAD. In October 2009, an external review of this project characterized it as outstanding within the set of currently forty similar programs DAAD is supporting worldwide.

In fall of 2010, a further major step was accomplished by moving acquiring an additional GUtech building near Muscat Airport.