Annual Report for Academic Year 2013 – 2014

Informatik 5
Information Systems

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• Cooperation Partners:
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  Osnabrück AG, Stadtwerke Trier, strophe.js,
  triagens AG, Universitätsklinikum Düsseldorf
Overview

Today, the field of Information Systems does not include only structured databases, but at least equally important the semi-structured and unstructured data on the web. The Chair of Information Systems addresses both domains, with the management of metadata (data about data) in the kernel of its research interest. Current major themes include mobile web services and metadata model management, but also applications such as personal mobility, metadata life science informatics, and lifelong technology-enhanced learning.

Third-party funding totalling about 2.5 m€ in 2013 came from national and European sources. In 2014, funding of the DFG-funded Excellence Cluster UMIC (EXC 89) is coming to an end after eight successful years of research, the European Network of Excellence GALA on serious games has also been successfully completed. In the same period, several new projects have started, including the Urban Future Outline (UFO) project within the RWTH-2020 excellence initiative HumTec, the BMWi project Mobile Broker, and the EU projects SAGE and BOOST. The SignGes center on sign language and gesture research was formally established in 2014 and enables us to continue our long-lasting collaboration with medicine and language research focussed on supporting the deaf.

In the Internationalization strategy of RWTH Aachen, the chair continued to run the highly successful international master programs of the B-IT Foundation, whereas NRW funding of the B-IT Research School ended as planned with over 20 completed doctoral theses. Dr. Vito Evola who supported B-IT with very popular Media Theory courses for several years, has left for a research position in Portugal and is being replaced by the American colleague Dr. Ray Becker from University of Bielefeld, now a member of the HumTec NeuroPierce group.

Moreover, Informatik 5 once again led the program committees of numerous international conferences, specifically of the two international top conferences CAiSE 2014 (Thessaloniki; Jarke/Quix) and ER 2014 (Atlanta; Jarke), and the WEBIST multi-conference (Krempels), and a number of other workshops and summer schools.

Internationalization remains also a characteristic of the Informatik 5 team itself, with new members from the China, Ukraine, Vietnam, and Iran. Welcome also to our visiting Ph.D. researcher Chao Li from Dalian University of Technology. Four dissertations were defended in the academic year 2013-2014 at Informatik 5 by researchers from B-IT Research School (Dejan Kovachev, Khaled Rashev) and Fraunhofer FIT (Hagen Buchholz, Rene Reiners); four additional doctoral theses -- one from Informatik 5 and three from Fraunhofer FIT -- have been submitted towards the end of the academic year, awaiting their defense in late 2014.

Last not least, we are happy to congratulate Informatik 5 members to several honors and awards. As the first Northrhine-Westfalian researcher, Prof. Jarke was elected as Fellow of the ACM. Moreover, best paper awards were won at the IFIP eGov conference (Peinel, Rose) and at the IEEE ICWE 2014 conference (Koren, Bavendiek, Klamma).
**Research Projects**

**Mobile Community Information Systems Research**

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**eConnect Germany – Stadtwerke machen mobil**

*K.-H. Krempels, C. Terwelp, C. Samsel*

BMWi Lighthouse Project “ICT for eMobility”


In eConnect, the BMWi lighthouse project in the field of ICT for electromobility, seven regional utilities together with software houses and researchers are developing applications for sustainable personal mobility based on electric energy. The objectives of the project include smart grids for renewable energy, mobility concepts for urban areas, smart parking for vehicle to grid scenarios, information systems for public交通运输s, and finally, smart charging for electric vehicles. Informatik 5 coordinates the project activities of the seven participating institutes of RWTH Aachen University. In four workshops with academic and industrial participants, we focused on knowledge acquisition, requirements engineering, and conceptual modelling for mobility concepts in urban and rural areas. For a new mobility concept of the City of Osnabrück, the current public transport situation was analysed and the city master plan was consulted to detect actual conceptual drawbacks and system operation bottlenecks. Near and medium term objectives for urban mobility were defined to improve the public transport infrastructure and mobility efficiency supported by electric vehicles.

The new mobility concept for the City of Osnabrück requires a higher integration of mobile transport systems, e.g., trains, busses, shared e-bikes, shared e-cars, and redesigned mobility points, e.g., integrated bus, e-bike and e-car station, while reducing the usage complexity of this new public transportation system. Representative mobility scenarios were used for use case deduction, requirements analysis for planning and navigation in the new system, and finally, the technical specification of an intuitive smartphone application supporting the user in pre- and on trip planning and navigation.

IXSI (Interface for X-Sharing Information) is a standardization proposal for an interface between travel information systems and ride sharing systems, e.g., car sharing. IXSI enables travel information to combine public transport and ride sharing to intermodal itineraries. The interface is based on a XML schema and uses Websockets for asynchronous transfers. IXSI is collaboratively developed by cantamen GmbH, HaCon Ing.-Ges. mbH and Informatik 5. In eConnect Germany, IXSI is used to connect the carsharing service provided by Stadtteilauto Osnabrück and the travel information system CityNavigator.

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**MobilityBroker – Flexible Intermodal Mobility**

*K.-H. Krempels, C. Terwelp, C. Samsel,*

*S. Gökay, M. C. Beutel, W. Kluth*

BMWi Collaborative Project


Aim of the new BMWi project MobilityBroker, started in October 2013, is the first-time combination of all mobility services in a region on a single virtual marketplace. Travellers
will be automatically presented with multimodal travel chains combining different mobility services (Bus, Train, Carsharing, Bikesharing, Cab etc) based on their personal preferences. As an interface to this marketplace both a mobile and a web platform will be developed.

**UFO: Urban Future Outline**

K.-H. Krempels, M.C. Beutel, M. Jarke,  
M. Ziefle (Communication Science), C. Schröder (Linguistics)  
HumTec Program within  
RWTH Excellence Concept „RWTH 2020“

[Link](http://dbis.rwth-aachen.de/cms/projects/ufo)

UFO is an interdisciplinary research project on quality of life in city quarters in the context of mobility, city structure and Energiewende. It consists of three subprojects: FuMob (Future Mobility), FuEco (Future Ecosystem) and FuEne (Future Energy). Informatik 5 participates in FuMob and FuEne. FuMob addresses requirements, capabilities and limitations of public communication and information when planning and implementing new mobility concepts. New approaches for planning and realizing infrastructure decision-making will be developed with systematic stakeholder involvement (citizens, decision makers, experts, etc.) in a sustained manner. The tasks of Informatik 5 comprise requirements engineering, analysis of perspectives with relation to mobility chain and designspace, selection of suitable prototypical mobility scenarios and a user-centered, adequate communication and information concept.

FuEne focuses on roadmapping sustainable and environmentally suitable energy turnaround. A comprehensive model and methodology for the realization of sustainable resilient energy systems will systematically integrate social factors (customer perception of energy systems) into the technical, economical and informational process of identification, planning and realization of energy scenarios. Informatik 5 will develop of parameters, strategies and solution spaces along with analysis and modeling of future scenarios.

**Future Mobile Internet Services**

M. Jarke, R. Klamma,  
D. Kovachev, I. Koren, D. Renzel, P. Nicolaescu,  
M. Jansen (Shg), G. Toubekis (Shg)  

[Link](http://dbis.rwth-aachen.de/cms/projects/virtualCampfire)

Our ACIS group 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. 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. We have established a research framework for mobile multimedia management with metadata standards and hybrid tagging approaches, cloud computing for mobile multimedia processing and mobile communities, convergence research on mobile and Web 2.0, social network analysis for
mobile communities, and prototyping and engineering of complex community information systems.

Research on different levels has been carried out:

- On the system level: the scalability and flexibility of our cloud framework for fostering cross-domain mobile multimedia services have been demonstrated with approaches to seamless mobile device augmentation with cloud resources, cloud-based video processing and enhancement of user experience with mobile video streams. Requirements and design guidelines of multimedia clouds that enable the execution of web-scale multimedia applications with a few efforts are well considered and analyzed. Research work also includes a hybrid architecture and realization of i5Cloud, which serves as a substrate for scalable and fast time-to-market mobile multimedia services.

- On the mobile multimedia level: focus is placed on advanced collaborative multimedia applications utilizing multimedia metadata standards like MPEG-7 and real-time communication protocols like XMPP. Mobile cloud computing strategies at the convergence of web and mobile endpoints have been applied, too. A variety of mobile devices (Android smartphones & tablets, iPhones & iPads) access different multimedia services via i5Cloud. Moreover, advanced 3D laser scanners and gigapixel image equipment have been integrated within professional workflows powered with i5Cloud services.

- On the user/community level: validation of the research is conducted in different application domains e.g. in technology enhanced learning, mobile community recommender systems with scalable SNA methods to visualize and discover development of mobile communities, and distributed user interfaces over a federation of multiple mobile personal computing devices.
Research results have been published in proceedings of international conferences and workshops, along with many Virtual Campfire and i5Cloud system demonstrations. The ground-laying work was extended in successor projects like Learning Layers (i5Cloud), Nefertiti and Direwolf 2.0. They were all demonstrated at the UMIC day in 2014.

B-IT Research School: Multimedia Cloud Computing
M. Jarke, R. Klamma, D. Kovachev, A. Rafique

http://dbis.rwth-aachen.de/cms/projects/i5cloud

Cloud computing envisions the notion of delivering software services and customizable hardware configurations to public access, similar how public utilities (electricity, water, etc.) are available to the common man. The cloud abstracts infrastructure complexities of servers, applications, data, and heterogeneous platforms, enabling users to plug-in at anytime from anywhere and utilizes storage and computing services as needed at the moment. The goal of our mobile multimedia cloud (i5Cloud, now Tethys) is to provide infrastructure as a service (IaaS) and platform as a service (PaaS) for diverse services and applications in the domain of (mobile) multimedia and large-scale social network analysis. A dissertation project by D. Kovachev was successfully defended in 2014.
The Cooperative Cars (CoCar) project, supported by the German Federal Ministry for Research and Education and Ericsson EuroLabs, tested 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 was 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 identified which traffic management and driver assistance applications are suitable for use of this technology.

Informatik 5 cooperated in this project with Ericsson in Aachen and Fraunhofer FIT and develops data models, algorithms and systems for the data processing of CoCar applications. A data stream-based evaluation framework has been developed which features especially a data quality component enabling the continuous monitoring of multiple data quality measures during data processing. This allows not only to produce new traffic information such as queue-end warnings, but also to add a reliability value for this information. Furthermore, countermeasures can be activated if the data quality drops below a certain threshold. For example, if there is not a sufficient number of CoCars to produce reliable traffic messages, additional sources, such as floating phone data or road-side units can be taken into account.

Architecture of the Ontology-Based Data Quality Framework
Projects in Technology-Enhanced Learning

GALA: Games and Learning Alliance
EU FP7 Network of Excellence
M. Jarke, R. Klamma, M. Derntl, M. Kravcik, A. Hannemann

http://galanoe.eu/

GaLA gathers the cutting-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.

GALA ended in September 2014. During the last project year, i5 has reviewed several serious games for the Special Interest Group on Personal and Social Learning & Ethics. GALA work at i5 led to several publications, including at ICWL 2013 and GALA conference 2013. Furthermore, research and hands-on work on gamification was conducted, in particular on applications of gamification frameworks to serious applications, in collaboration with METIS and SAGE. The result was a joint workshop at the 10th Joint European Summer School on Technology Enhanced Learning (JTEL 2014) in Malta. The picture below shows the workshop facilitators together with the winners of the gamification contest.

Gamification workshop at JTEL 2014
SAGE: Serious Games Pathway within the Undergraduate IT Programs EU Tempus IV Joint Project
M. Jarke, R. Klamma, M. Derntl, M. Kravcik, A. Hannemann

http://sage.ps

SAGE aims to enhance the capacity of the four partner universities in Tunisia and Palestine by enabling them to develop a sustainable curriculum in Serious Games and integrate this curriculum into their existing Computer Science programs. i5 leads two work packages in SAGE: the WP on Teaching Material for Serious Games and Gamification Courses and the WP on Quality Control and Monitoring. In addition we contribute expertise and coordination activities in the other content production WPs, in the setup of the SG lab, in conceiving cross-course case studies, as well as in staff and student exchange. We will deliver tutor training, teach pilot courses at the partner universities, and host students of partner universities for study visits.

During the first project year, i5 has produced the project quality framework, which will guide quality management and reporting in the project. Also, the courses under WP5 were defined and specified under i5 lead; these courses are “Gamification” and “Serious Gaming Fundamentals.”

Learning Layers: Scaling up Technologies for Informal Learning in SME Clusters EU FP7 Integrated Project
M. Jarke, R. Klamma, M. Derntl, M. Kravcik,
A. Hannemann, I. Koren, P. Nicolaescu, D. Renzel,
A. Astorga, B. Bakiu, S. Bakiu, Á. Gavronek, A. Guth, P. de Lange,
G. Lawrenz, K. Liiva, K. Jahns, A. Siddiqui, A. Tafreshi

http://learning-layers.eu

Learning Layers develops a set of modular and flexible technological layers for supporting workplace practices that unlock peer production and scaffold learning in networks of SMEs, thereby bridging the gap between scaling and adaptation to personal needs. Building on mobile learning research, we situate learning into physical work places and practices to support situated, faster and more meaningful learning. Learning Layers provide a shared conceptual foundation independent of the tools people use and the context they are in. Learning Layers are based on a common light-weight, distributed infrastructure that allows for fast and flexible deployment in highly distributed and dynamic settings. We apply these technologies in two sectors that have been particularly hesitant to take up learning technologies, i.e. health care and building and construction.

Our main responsibility in the Layers project is to lead the work package on “Architecture and Integration” with the overall objective being to co-ordinate all technology development tasks across the project. Technically the main objective is to conceive, develop and maintain a distributed, federated Layers architecture for fast and flexible deployment of network communication infrastructure and storage/editing of user-generated multimedia content in testbed environments.
During the previous year, the key objective of i5 work in Layers was to enhance the common infrastructure with flexibility and customizability in use and deployment. The resulting “Layers Box” can be imagined as a bundle of software – and potentially also hardware – artifacts that provide services and tools in particular application environments. A reference implementation integrating the services of several European companies and research institutes is hosted in our Tethys cloud environment (formerly the i5Cloud). The fully transparent and configurable access to all Layers services is achieved by the Layers Adapter. This component was designed as a Reverse Proxy following the established enterprise architecture pattern. Along with the Adapter, a single-sign-on solution for all current and future Layers apps was deployed to support data protection and privacy using the cutting edge standard OpenID Connect. The integration of tools and services developed by project partners proceeded the main topic of the project wide Integration Meeting that we hosted in Aachen in March 2014. The Layers Developer Task Force as a community of practice in coordinating all integration work.

Layers Common Architecture at the End of Year 2

METIS: Meeting Teachers’ Co-Design Needs by Means of Integrated Learning Environments
EU LLL Programme ICT-KA3 Multilateral Project
M. Jarke, R. Klamma, M. Derntl, P. Nicolaescu, R. Uppal

http://metis-project.org/

This project brings together partners from the higher-education, vocational training, and adult education levels, as well as institutions with expertise in learning design research. The project goal is threefold:

1. Provide an Integrated Learning Design Environment (ILDE) based on existing free and open source solutions, including authoring tools; co-design support for teacher communities; and deployment of learning designs on mainstream VLEs;
2. Run a series of workshops for teachers using ILDE to train teachers in learning design and the orchestration of ICT-based learning environments according to innovative pedagogies;

3. Disseminate the project's outcomes in the form of workshops for learning design training, and to promote the creation and maintenance, beyond the project's financial period, of a teacher community using learning design.

Our main tasks of in the METIS project focus on the specification and development of the Integrated Learning Design Environment (ILDE), as well as the adaptation of the open-source IMS Learning Design authoring tool OpenGLM to interoperate with ILDE. Last year, we created an open source framework called SyncMeta. The framework allows real time collaborative editing of conceptual models on the Web based on arbitrary, visually defined metamodels. The pilot application was to use SyncMeta to implement the metamodel of IMS LD, and offer it as a collaborative IMS LD editor (see picture below). The editor was evaluated very successfully. i5 further developed of the desktop-based IMS LD tool OpenGLM with ILDE integration features.

![IMS LD editor based on SyncMeta framework](image)

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**B-IT Research School: Modeling Learning Communities in Social Media Information Systems**

* M. Jarke, R. Klamma, Z. Kensche (née Petrushyna)

The dissertation project by Zinayida Kensche aims to define learning community needs and let community stakeholders to gain an insight into community issues. It is an interdisciplinary research as applications and conducted case studies of the dissertation framework consider requirements of learning theories for information systems design.

The proposed framework consists of a loop with four distinguished phases: modeling, refinement, monitoring and analysis. Learning communities from the beginning are mapped with one of archetypical learning community models to provide a first insight for community stakeholders. Monitoring digital traces of learners and comprehensive analysis of learners’
behaviors characterize communities, their learners and networks at whole. The information is required for further insights about communities and is used as an input for creating learning community goal-oriented agent-based models. The models make stakeholders aware about roles of learners, dependencies between them defined by goals, tasks and resources. The framework provides a realization of all defined phases and serves as a solution that automatically and dynamically specifies needs of any kind for community stakeholders.

**BOOST: Business PerfOrmance improvement through individual employee Skills Training**

EU LLL Programme Leonardo Da Vinci

M. Jarke, R. Klamma, M. Kravcik, K. Neulinger,
E. Badakhshan, A. Tebart, P. Tarasenko


The ROLE results are being further used and developed in a new project called **BOOST (Business perfOrmance improvement through individual employee Skills Training)**, which is part of the Lifelong Learning Programme. Five partners from different European countries plan to integrate a tool for identifying and developing critical business needs with the ROLE approach in order to support vocational education and training in micro enterprises (up to 20 employees). The project started in October 2013 and should run for two years.

In the first year of the project the product requirements were specified, the technical prototype was developed, and interviews with stakeholders have been conducted. Our preliminary outcomes have been presented at various events, including ProS Workshop at UMAP 2014 Conference and ARTEL Workshop at EC-TEL 2014 Conference.
SEKT - Spezifische Detektion von einzelnen Keimen in Rein- und Trinkwasser

T. Berlage, S. Fang

The overall goal of the project funded by the BMBF is to detect bacteria in drinking water by filtering the water and microscopically analyzing the filter surface for a small number of bacteria. The work of RWTH is focused on image analysis, the recognition and discrimination of bacteria, which are labeled with fluorescent antibodies or in-situ hybridization.

Based on the first set of example images, we have finished prototype versions of the object segmentation step from fluorescent images, the object classification into bacteria and other objects using machine learning, and an optimization step that joins or divides segments, mainly needed because of overlapping objects. The software is awaiting testing and refinement with the final hardware.

Toponomics in Cholestatic Liver Diseases

T. Berlage, P.H. Nguyen

Transporter protein topology influences numerous cellular processes. As a part of the DFG-funded Clinical Research Group 217 "Hepatobiliary Transport and Liver Diseases (Speaker: Prof. Dr. D. Häussinger, University Düsseldorf) a workflow for an automatic data analysis was developed.

We have developed an approach to evaluate protein colocalization. Furthermore, a first approach was developed to automatically distinguish regions within a large sample based on an organ-scale model. We have implemented this approach to automatically partition liver sections into areas based on their position within the azinus structure.

Virtual Microscopy in Geoscience

T. Berlage, S. Fang

In collaboration with Fraunhofer FIT, an automated scanning microscope has been developed that is able to scan thin sections of rock automatically in multiple polarization angles. We have implemented a module that segments rocks into minerals based on polarization differences. A plugin exports the polygons that can then be further processed and evaluated using external software. A more integrated approach tailored to particular applications is planned.
SunSITE Central Europe  
*R. Klamma, R. Linde*

[http://sunsite.informatik.rwth-aachen.de/](http://sunsite.informatik.rwth-aachen.de/)

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 8 TB of open source software. Typically, the SunSITE enjoys around 35 million accesses per month.

As additional scientific publication services, the SunSITE hosts the Central Europe (CEUR) Workshop Proceedings (CEUR-WS.org) with now over 1000 volumes and acts as a mirror for the Dagstuhl Research Online Publication Server. Ralf Klamma was appointed for the newly created advisory board of CEUR-WS.org in 2014.

**i* Wiki**  
*M. Jarke, G. Lakemeyer, R. Klamma, D. Renzel*

[http://istar.rwth-aachen.de/](http://istar.rwth-aachen.de/)

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. In 2011, the wiki has been moved to the SunSITE serve for better services to the scientific community.

**The Nefertiti of Aachen case study**  
*Digital reproductions for collaborative work in Science and Education*

*R. Klamma, P. Nicolaescu, G. Touhekis, T. Paffen (I5), A. Markschies, C. Raabe, D. Lohmann, B. Schubert, (Faculty of Architecture), D. Sibbing (Computer Sciences 8)*

The Faculty of Architecture of RWTH Aachen University acquired back in 1924 one of the first gypsum copies for the in-house collection of copies from famous historical artefacts used in architect’s education at that time. The bust’s notable facial proportions have gained Nefertiti international attention among scholars and laymen alike. The copy is considered to be one of the first copies ever made of the original. The copy was digitized using a miniaturized projection technique (MPT) also referred to as ‘white light scanner’ capturing every detail with high precision. In various post-processing steps the digital model was prepared for display in contemporary WebGL enabled browsers. Continuing our cultural heritage showcase started in 2013 on the qualities of the Aachen copy, the digital...
reproduction of the physical copy of the *Aachen Nefertiti* is nowadays in use again for various practical exercises in the field of computer science at RWTH Aachen University. As such, we have extended the browser-based visualization of the 3D model using state of the art libraries. This is currently being generalized to support any 3D model and allow collaborative near real-time annotation of such objects on the Web. The digital copy serves in this context as a study object of a real world phenomenon for the various experts involved in the research. An *ETS Bledend Learning* proposal partly based on the techniques developed in this project and in the ROLE project was successful and will be started in October 2014.

**Web3D digital artifact of the Aachen Nefertitiin a multi-user and multi-device personalized learning Environment prepared for collaborative annotation based on XMPP and WebRTC technologies**

**Algorithms on Complex Dynamic Networks**

*R. Klamma, M. Derntl, M. Kravcik, Z. Kensche, I. Koren, P. Nicolaescu, D. Renzel, M. Shahriari*

http://dbis.rwth-aachen.de/cms/projects/SNA

Social Network Analysis (SNA) is a well-established method in sociology. With the advent of the World Wide Web and growing computational power interests grow in analyzing large sets of network data over time. We apply graph algorithms, dynamic network analysis methodologies and advanced approaches in Web Science to analyze dynamic patterns of human interaction expressed by traces left large scale information systems. Our annual lecture "Web Science" and seminar course "Web Science" contribute to a sound theoretical basis for student and research work. In 2014 we continued our work on community analytics by developing new algorithms for overlapping community detection (paper submitted to WWW 2015) and topic mining (demo accepted at CIKM 2014).
Since 2010, the XMPP Experience project is an ongoing internal project around the application of the Extensible Messaging and Presence Protocol (XMPP) in own and external research. Since 2012 we are actively communicating and contributing our results to the XMPP community at events such as XMPP summits, FOSDEM developer rooms or official IETF gatherings. In previous years, we actively contributed results from ROLE to the Open Source project strope.js\(^1\) in the form of core extensions towards XMPP over WebSocket and several further plug-ins, which were officially accepted into the codebase. One of our student workers continued his service as strope.js official maintainer.

Sharing the notion that XMPP is present in research, but does not yet receive the deserved attention, we started an initiative with TU Dresden and BTU Cottbus-Senftenberg to strengthen the awareness for XMPP in research work in 2013. In this year, our collaboration brought first tangible results. We implemented a distributed federated sensor network scenario ACDSense, including federated XMPP server and sensor installations at Dresden and Aachen. This scenario was successfully published and presented at the 2014 IEEE International Conference on the Internet of Things (iThings 2014).

A further goal of this year was the creation of a web site dedicated to the collection of high-quality XMPP research. During the XMPP summit collocated with FOSDEM 2014 we received positive feedback about such an effort from the XMPP community, coupled with the offer to integrate into the official XMPP web appearance. The website was co-developed by TU Dresden and RWTH and will be launched at the end of this year.

With the completion of the diploma thesis "LAS2peer - A Framework for distributing Community Services in a Peer-to-Peer Infrastructure” in April 2013, the ACIS group laid the foundations for a transition from its former closed-source Community Information System (CIS) service platform LAS to the Open Source P2P CIS platform las2peer. Each node in the las2peer P2P overlay features a simplified and streamlined LAS core and allows secure communication with end-to-end encryption, distributed storage, and federated service access for agents across the network. With this design, a CIS service ecosystem can grow and be used in a much more flexible and scalable way than with monolithic CIS installations. In December 2013, we established the las2peer Working Group with the mission to elaborate and evangelize the initial las2peer prototype to a full-fledged Open Source Software project, thereby focusing on a developer perspective. Since then, members of the group continuously refactored las2peer core components, added new components required to integrate with

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\(^1\) http://strophe.im/strophejs/
existing project work (e.g. Layers), created rich online documentation, designed a logo, and implemented new services. Members of the ACIS group made use of las2peer in thesis work, teaching, and project research. A presentation of the las2peer project is planned to be held in front of a wide OSS developer audience at FOSDEM 2015.

**Direwolf 2.0**

*R. Klamma, I. Koren, P. Nicolaescu, D. Renzel, K. Jahns*


Web applications have overcome traditional desktop applications especially in collaborative settings. However, the bulk of Web applications still follows the "single user on a single device" computing model. Therefore, we created the DireWolf framework for rich Web applications with Distributed User Interfaces (DUIs) over a federation of heterogeneous commodity devices supporting modern Web browsers such as laptops, smart phones and tablet computers. The DUIs are based on widget technology coupled with cross-platform inter-widget communication and seamless session mobility. In particular, we built DireWolf on top of the ROLE SDK and its XMPP-based inter-widget communication. Inter-widget communication connects the widgets and enables real-time collaborative applications as well as runtime migration in our framework.

This year, we extended the DireWolf prototype by changing from a client/server to a peer-to-peer model. The recent WebRTC standard for encrypted communication between browsers allowed us to decrease the latency significantly and enhance the security. The outcome was rewarded with the Best Demo Award at this year’s International Conference on Web Engineering (ICWE 2014) in Toulouse, France.

We are continuing development of the DireWolf framework by switching to a responsive design in order to accommodate further device types in future, like smartglasses and -watches.

**Mobile and Wearable P2P Information Management in Health Net Applications**

*M. Jarke, C. Quix, S. Geisler, S. Kim (MedIT),
M. Hassani (Informatik 9), T. Quadflieg (ITA),
U. Meyer, J. Barnickel (IT Security), C. Li (Dalian University of Technology, China)*

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.
After successful demonstrations of the prototype, the results of the work were published in the International Workshop on Information Management in Mobile Applications (IMMoA) at the International Conference on Very Large Databases (VLDB) in Riva Del Garda, Italy, which was co-organized by Sandra Geisler and Christoph Quix. Furthermore, they served as guest editors of special issues in mobile data management. In cooperation with Chao Li (a visiting PhD student from Dalian University in China), the group worked also on a survey of data stream management system for healthcare applications. In addition, the results on data stream processing on mobile devices have been transferred to an application-oriented project funded by ENIAC JU at Fraunhofer FIT (Nanoelectronics for Mobile AAL-Systems).

ConceptBase - A deductive object manager for meta databases
M. Jarke, C. Quix, M.A. Jeusfeld (University of Skövde, Sweden)

http://dbis.rwth-aachen.de/cms/projects/ConceptBase

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 2013/14, the group focused on continuous improvement of the system and removed several bugs.

Big Data & Model Management
M. Jarke, C. Quix, S. Geisler, D. Yankov

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 2014, the group worked on a schema repository for GeRoMeSuite. The repository should facilitate the schema reuse by providing functions to store, retrieve and merge schema fragments. Furthermore, the benchmarking of model management operators should be supported by providing test datasets for schema matching, integration and mapping. The test cases are generated automatically by transforming a model in several steps into a modified model, while maintaining the relationships between the two models in a logical mapping. Furthermore, the group is developing an integration system for semistructured data which is based on the query language JSONiq.
Other Activities

Service
Matthias Jarke’s major service activities in 2013-2014 included

- Deputy coordinator, UMIC Excellence Cluster on Mobile Information and Communication, RWTH Aachen University
- Executive Director, Fraunhofer FIT, Birlingenhoven
- Chairman, Fraunhofer ICT group, and Member Presidential Board, Fraunhofer Society
- Deputy Speaker, Fraunhofer Alliance Big Data
- Founding Director, Bonn-Aachen International Center for Information Technology (B-IT), and Speaker, B-IT Research School
- Hon. Adjunct Professor, Applied Information Technology, GUtech German University of Technology in Oman
- Member, CONNECT Advisory Forum (CAF) on the HORIZON 2020 Program of the European Commission
- Member, Strategy Expert Council, Austrian Ministry of Traffic, Innovation and Technology (bmvit), Vienna
- Deputy Chairman, Hochschulrat, FH Köln (re-elected 2013-2017)
- Member, Program Board, LOEWE Excellence Initiative Hessia
- Member, CeBIT-Messeausschuss
- Member, Working Group on Reference Data Set, Wissenschaftsrat Germany
- Member, QANU Evaluation Board, CELSTEC Institute, OUNL Heerlen
- Member, Engineering Faculty Advisory Board, University of Duisburg-Essen

- Michael Derntl is serving as editor and maintainer of the Learning Frontiers portal at http://learningfrontiers.eu and the TELroadmaps twitter account at https://twitter.org/telroadmaps.
- Ralf Klamma is WP leader in the EU IP Learning Layers, senior researcher in the EU projects SAGE, METIS and BOOST as well as the Network of Excellence in Serious Gaming GALA. He is founding member of the European Association on Technology Enhanced Learning (EATEL). He is head of the steering committee of the European Conference on Technology Enhanced Learning (SIG EC-TEL) and steering committee member of the International Conference on Web-based Learning (ICWL). In 2014 he was appointed as co-chair of SIG WELL (Wearable Technology Enhanced Learning) within the EATEL. He was also appointed for the advisory board of the CEUR-WS open access proceedings series.
- Milos Kravcik is the coordinator of the BOOST project and senior researcher in the international projects Learning Layers, GALA, METIS, and SAGE. He is serving as maintainer of the JTEL Summer School web site (http://jtelsummerschool.eu) as well as editor of the BOOST portal (http://www.boost-project.eu/) and its social media. He served as external reviewer for one PhD project in Dublin (TCD).
• Wolfgang Prinz is member of the executive committee of the Fachgruppe CSCW (Computer-Supported Cooperative Work) der GI (Gesellschaft für Informatik).
• Wolfgang Prinz is Editor of i-com Zeitschrift für interaktive und kooperative Medien, Oldenbourg Verlag, and Editor of the CSCW Journal, Springer.
• Dominik Renzel continued to be manager of the i* Wiki (http://istar.rwth-aachen.de).
• Thomas Rose acted as reviewer for EU funded projects on “ICT for Energy and Water Efficiency” and “ICT for Low Carbon Economy and Smart Mobility” for the European Commission after serving as evaluation expert for EU Project Proposals on "ICT for Energy and Water Efficiency in Public Housing" in 2010/11.
• Thomas Rose acted as expert on the scientific advisory board of LÜKEX 2013. LÜKEX is the largest German strategic exercise on preparing for major emergencies. It includes command centers from several state as well as national organizations and presents the largest event for crisis training in Europa.

Editorial Boards
• Michael Derntl is serving as executive reviewer for Educational Technology & Society and IEEE Transactions on Learning Technologies.
• Sandra Geisler and Christoph Quix are serving as guest editors of a special issue on Large-Scale Data Management for Mobile Applications in the journal Distributed and Parallel Databases. Furthermore, they are guest editors of a special issue on Information Management for Mobile Applications in the journal Pervasive and Mobile Computing.
• Ralf Klamma serves as associate editor for IEEE Transactions on Learning Technologies (TLT), Springer Journal on Social Network Analysis and Mining (SNAM), and IJTEL. He is section editor for the Springer Encyclopaedia of Social Network Analysis and Mining (ESNAM) and editor for the IEEE Special Technical Committee on Social Networks (STCSN). He has edited an e-letter for IEEE STCSN on large scale requirements engineering. 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 2014 he also became the maintainer of the EATEL website ea-tel.eu. He also served as reviewer for World Wide Web Journal (WWWJ), IEEE Transactions on Learning Technologies (TLT), IEEE Transactions on Management of Information Systems (TMIS), Pervasive and Mobile Computing (PMC), Multimedia Tools and Applications (MTAP), Journal of Networks and
Applications (JNCA), Journal of Universal Computer Science (JUCS), Educational Technology & Society (IFETS), and Künstliche Intelligenz (KI).

- Dejan Kovachev served as a reviewer for the IEEE Wireless Communications Magazine (WCM), Pervasive and Mobile Computing Journal (PMC), the International Journal on Multimedia Tools and Applications (MTAP) and for the 3rd International Workshop on Information Management in Mobile Applications (IMMoA 2013).

- Milos Kravcik serves on the editorial board of the International Journal of Technology Enhanced Learning and is editing a special issue for it as well as for the International Journal of Artificial Intelligence in Education. He is executive reviewer of Educational Technology & Society and IEEE Transactions on Learning Technologies. He also served as reviewer for International Journal of Human-Computer Studies, International Journal of Serious Games, and New Review of Hypermedia and Multimedia.

- Zinayida Petrushyna was a program committee member of the 9th European Conference on Technology Enhanced Learning (EC-TEL 2014), IADIS e-Learning 2014 (EL 2014) and IADIS Web Based Communities and Social Media 2014 (WBC 2014), 4th International Conference on Social Eco-Informatics (SOTICS 2014). She continues to serve as a member of program committee of European Summer School on Technology Enhanced Learning and Doctoral Consortium at the European Conference for Technology Enhanced Learning.

- Dominik Renzel continued to serve as reviewer for the International Journal on Multimedia Tools and Applications (MTAP). He furthermore served as reviewer for the 2014 International Conference on Information Systems (ICIS 2014) and 12th International Conference on Wirtschaftsinformatik (WI 2015).

- Thomas Rose has been Programme Committee member of the workshop for "IT-support of rescue forces", GI conference 2014, Stuttgart.

Conference Organization


- Matthias Jarke (with John Mylopoulos and Christoph Quix) was Program Co-Chairs of the 26th International Conference on Advanced Information Systems Engineering (CAiSE’14), Thessaloniki, Greece; with Gill Dobbie and Eric Yu Program co-chair of the 33rd International Conference on Conceptual Modelling (ER 2014) in Atlanta, Ga; and with Shirley Gregory “IT Artifact” Track Chair at the International Conference on Information Systems (ICIS 2013), held in Milano, December 2013. He was also
program committee member of ER 2013 (Hong Kong), Modellierung 2014 (Vienna), and VHB-Tagung 2014 (Leipzig).

- Ralf Klamma was general chair of the JTEL Summer School in Technology Enhanced Learning, Malta, April, 2014. He also co-organized workshops at the 10th Joint European Summer School on Technology Enhanced Learning (JTEL 2014, Malta). He served as program committee member / reviewer for the following conferences: IEEE International Conference on Advanced Learning Technologies (ICALT’14), European Conference on Information Systems (ECIS’14), Wirtschaftsinformatik’15, Immersive Learning Research Network Conference (iLrn’15), International Symposium on Collaborative Technologies and Systems (CTS’14), IEEE International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom’14), International Conference on Web-based Learning (ICWL’14), European Conference on Technology Enhanced Learning (EC-TEL’14), International Conference on Management of Emergent Digital EcoSystems (MEDES’14), European Immersive Education Summit 2014, Games and Learning Alliance Conference (GALA’14), Conference on Learning Analytics & Knowledge (LAK’15), Workshop Business Process Management and Social Software (BPMS2’14), DELFI’14, I-KNOW’14, CRIWG Conference on Collaboration and Technology (CRIWG’14), IEEE Workshop on Content Based Multimedia Indexing (CBMI’14), Workshop on Personalization Approaches in Learning Environments (PALE’14), International Workshop on Collaboration and Gaming (CoGames’14), Workshop on Pervasive Collaboration and Social Networking (PerCol’14), Workshop on e-Science and Social Networks (eSoN’14).

- Milos Kravcik was program co-chair of 10th Joint European Summer School on Technology Enhanced Learning (JTEL), co-organized 4th Workshop Personalization Approaches in Learning Environments (PALE at UMAP), and 4th Workshop on Awareness and Reflection in Technology-Enhanced Learning (ARTEL at EC-TEL). He was programme committee member of the following conferences and workshops: 13th International Conference on Web-based Learning (ICWL), 9th European Conference on Technology Enhanced Learning (EC-TEL), and its Doctoral Consortium, 13th IEEE International Conference on Advanced Learning Technologies (ICALT), 2nd Games and Learning Alliance Conference (GALA), the Social Personalization Workshop at Hypertext Conference, 12th International Conference on Wirtschaftsinformatik, International Workshop on Human Aspects of Making Recommendations in Social Ubiquitous Networking Environments, Doctoral Conference in Mathematic, Informatics and Education, International Workshop on Peer-Review, Peer-Assessment, and Self-Assessment in Education, and 7th International Workshop on Social and Personal Computing for Web-Supported Learning Communities. He also co-organized workshops at the 10th Joint European Summer School on Technology Enhanced Learning.

- Karl-Heinz Krempels was program chair of the 10th International Conference on Web-Information Systems and Technologies (WEBIST’14) and conference chair of the SmartGreens Conference (SmartGreens ‘14) in Barcelona, Spain.

- Zinayida Petrushyna was a program committee member of the 9th European Conference on Technology Enhanced Learning (EC-TEL 2014), IADIS e-Learning 2014 (EL 2014) and IADIS Web Based Communities and Social Media 2014 (WBC 2014), 4th International Conference on Social Eco-Informatics (SOTICS 2014). She continues to serve as a member of program committee of European Summer School
Christoph Quix was Program Co-Chair of the 26th International Conference on Advanced Information Systems Engineering (CAiSE’14), Thessaloniki, and a member of the program committee of the 33rd International Conference on Conceptual Modeling (ER 2014), of the 13th International Conference on Ontologies, DataBases, and Applications of Semantics (ODBASE 2014), of the 3rd International Conference on Data Management Technologies and Applications (DATA 2014), and of the 6th Asian Conference on Intelligent Information and Database Systems (ACIIDS 2014).

**Software Demonstrations**

- “BOOST Technical Prototype”, Learning Layers General Assembly, Bremen Germany, June 17, 2014
- “Boosting Informal Workplace Learning in Small Enterprises”, ARTEL Workshop at EC-TEL, Graz Austria, September 16, 2014
- “OpenGLM – Open Graphical Learning Modeller”, METIS project meeting, Genoa, Italy, March 18, 2014.
- “OpenID Connect for Layers”, Learning Layers Integration Meeting, Graz, Austria, July 30, 2014.
- “Cloud Video Transcoder 2.0 & SeViAnno 2.0”, Learning Layers Integration Conference, Aachen, Germany, March 27, 2014
- “NOSE Dashboard”, Learning Layers Integration Conference, Aachen, Germany, March 27, 2014

**Open Source Community Involvement**

Since a couple of years, the Advanced Community Information Systems group at Informatik 5 commits to Open Source Software (OSS) development. We increasingly share code bases resulting from our own developments in OSS repositories at different locations, such as GitHub or SourceForge. Learning Layers maintain and share their complete code bases on GitHub. The ACIS group established an own team page on GitHub, thereby aggregating different strands of its OSS development work in own as well as third-party projects. Own projects increasingly include results from thesis work, as for LAS2peer and its accompanying services and modules. Besides hosting own code bases, we also contribute parts of our code to existing OSS projects and communities in the form of patches.

Here, our experience is that the developer communities behind these projects are welcoming new members and are grateful for contributions. However, they prefer sustained collaboration and thus are cautious against unsustainable one-shot patches that are not maintained by their
contributors later. Another experience is that the whole process from preparing a patch to getting it accepted into the official code base of an OSS project usually takes a long time. The preparation of a patch should be discussed with the community beforehand. Therefore, it is recommended to participate in face-to-face meetings organized by the respective OSS communities and present possible own contributions to raise awareness and receive confirming or rejecting feedback. Members of our group thus visit events such as FOSDEM or hackathons organized by OSS projects. As further means of community-building around the services developed in the context of our projects, we also organized such events. Multiple such events have been organized for Learning Layers, inspired by our initial iteration in 2013.

By no means do OSS developer communities guarantee the acceptance of a patch. In the case of our efforts regarding strophe.js, we were successful: all our patches are now part of the official code base, and one of our student workers continued to serve as official maintainer.

Furthermore, we increasingly learn and adopt best practices and tools for OSS development from established organizations such as the Apache Foundation. Common examples are the communication via mailing lists, issue tracking and agile development with professional tools such as Atlassian JIRA and continuous integration with tools such as Jenkins. Best practices and application of support tools were transferred and integrated into the working processes of our projects involving OSS development. We also increasingly integrate the use of such tools and practices into our teaching activities, in particular in our practical lab courses. We also constantly learn about new tools, e.g. GitHub’s built-in issue tracker or Travis CI as alternative to Jenkins.

Our experiences with OSS development until now were mainly positive and not in contradiction with research policies. Here, we mainly pursue a very open licensing policy with the use of BSD-like permissive Open Source Software licenses and Creative Commons content licenses. The involvement and active participation in OSS developer communities gave us a lot of insights which would not have been retrievable from research papers. Furthermore, we experience that sharing our code bases publicly raises the quality of our code and creates new ways of disseminating research outcomes. Here, our experience was further confirmed as a common trend towards sharing code originating from research work. In the future, we will continue to extend our experiences with OSS development in project work, thesis work and teaching. For over a year now, the ACIS group maintains source code on the ACIS Github Team Page (https://github.com/rwth-acis). One of the flag-ships of ACIS OSS development is the group’s own Community Information System platform las2peer.

- M. Derntl, R. Uppal: OpenGLM – Open Graphical Learning Modeler. i5 is the current maintainer of the graphical IMS Learning Design tool OpenGLM, which is hosted on SourceForge.net, and further developed within the METIS project to interoperate with the Integrated Learning Design Environment, to which i5 is also contributing on GitHub. http://sourceforge.net/projects/openglm/  

- M. Derntl, A. Tillmann, B. Rangaraj: D-VITA – Dynamic Visual Topic Analytics. D-VITA is a web based toolkit for interacting with visualizations of dynamic topic models, and for building & managing these models. The source code of all components is hosted publicly on GitHub. https://github.com/rwth-acis/D-VITA

- M. Derntl, P. Nicolaescu, S. Erdtmann: SyncMeta. SyncMeta is a framework for defining and using arbitrary graph-based modeling languages using real-time collaboration in the Web browser. It was implemented as a widget based application on top of the ROLE SDK. SyncMeta is hosted as open source code on GitHub. https://github.com/rwth-acis/syncmeta
A. Guth: *Strophe.js – Official Project Maintenance*. Our student worker Andreas Guth continued to serve as one of the official project maintainers for the XMPP JavaScript library project strophe.js. http://github.com/strophe/strophejs

S. Gökay, K.-H. Krempels: *SteVe (SteckdosenVerwaltung)*. Steve was developed at Informatik 5 for project eConnect Germany to support the deployment and popularity of electric mobility. SteVe provides basic functions for the administration of charge points, user data, and RFID cards for user authentication. It supports the Open Charge Point Protocol (OCPPI) and was tested successfully in operation. SteVe is considered as an open platform to implement, test and evaluate novel ideas for electric mobility, like authentication protocols, reservation mechanisms for charge points, and business models for electric mobility. SteVe is distributed under GPL and is free to use. https://github.com/RWTH-i5-IDS/steve

A. Hannemann, K.Liiva: *Navigation Dashboard for OSS Evolution (NOSE)*. Web-based platform NOSE for project analysis from social perspective was maintained and further developed. https://github.com/learning-layers/NOSE

I. Koren, Á. Gavronek: *Requirements Bazaar*. A new version of the Requirement Bazaar based on the recent las2peer was started as a new open source project. http://github.com/rwth-acis/RequirementsBazaar

I. Koren: *ROLE SDK*. The ROLE SDK as an outcome of the EU IP Role was forked from its former SourceForge repository to the ACIS group’s GitHub repository and integrated into our Jenkins continuous integration server. New features like WebRTC based secure peer-to-peer communication and OpenID Connect were added. http://www.github.com/rwth-acis/ROLE-SDK

I. Koren, P. Nicolaescu, D. Renzel: *Layers Open Developer Library (ODevL)*. ODevL² builds the center of Open Source development activities in the Learning Layers project. The website includes documentation, requirements gathering (Requirements Bazaar), source code repository, issue tracking (JIRA) and continuous integration (Jenkins) processes. JIRA, Jenkins and Requirements Bazaar instances are hosted at RWTH. http://developer.learning-layers.eu

P. Nicolaescu, K. Jahns: *SeViAnno 2.0*. SeViAnno is a semantic video annotation application developed in the Virtual Campfire project scenarios. SeViAnno 2.0’s client side code was improved and open sourced for being used within the Learning Layers project. The code is hosted as open source on GitHub. https://github.com/learning-layers/sevianno

P. Nicolaescu, A. Siddiqui: *Cloud Video Transcoder 2.0 (CIViTra 2.0)*. CIViTra 2.0 is a cloud-enabled RESTful Web service for video upload and scalable video transcoding tasks. CIViTra 2.0 is developed and used within the Learning Layers project and integrated in several Web and mobile applications. CIViTra is hosted as open source on GitHub. https://github.com/learning-layers/Cloud-Video-Transcoder

Z. Petrushyna, A. Ruppert: *i*-REST services are based on las2peer and allows other services to create, store and visualize i*-models. The services are hosted as open source code on GitHub. https://github.com/rwth-acis/LAS2peer-iStarMLModel-Service, https://github.com/rwth-acis/LAS2peer-iStarMLVisualizer-Service

² http://developer.learning-layers.eu
Talks and Publications

Talks

M. Derntl, M. Kravcik, R. Klamma: Gamification of Learning Design Environments. 10th Joint European Summer School on Technology Enhanced Learning, Mellieha, Malta, April 28 & May 1, 2014


R. Klamma: Community Learning Analytics – Challenges and Opportunities, Invited Keynote at ICWL 2013, Kensing, Taiwan, October 7, 2013

R. Klamma: Technical Support for Formative Evaluation with MobSOS, Learning Layers Meeting, Innsbruck, Austria, February 6, 2014


R. Klamma: Ranking in Suchmaschinen auf dem Web, Ringvorslesung Schüler Akademie RWTH Aachen, June 11, 2014

R. Klamma, P. Nicolaescu: SeViAnno 2.0: Web-Enabled Collaborative Semantic Video Annotation Beyond the Obvious, 12th International Workshop on Content-Based Multimedia Indexing, Klagenfurt, Austria, June 20, 2014

R. Klamma: Large Scale Community Information Systems – “From LAS to las2peer”, Doktorandenseminar, Schleiden, Germany, September 10, 2014


M. Kravcik: Personalization Approaches in Learning Environments. 4th PALE Workshop at the UMAP Conference, Aalborg, Denmark, July 11, 2014


Z. Petrushyna: i*-REST: Light-Weight i* Modeling with RESTful Web Services. 7th International i* Workshop at International Conference on Advanced Information Software Engineering (CAISE), Thessaloniki, 16-17 June, 2014

W. Prinz: Cologne IT-summit, Köln, 24.11.2014


W. Prinz: „Glasses“, Smart Watches und „Fuelbands“ – Nochmals neue Herausforderungen für die Sicherheit?, Stadtbibliothek Köln, Oktober 2014


W. Prinz: Neuronale Interfaces – Kunden neue, virtuelle Welten eröffnen, Sparkasse Düsseldorf Mittelstandstag, September 2014

W. Prinz: Digitalisierungstrends und ihr Einfluss auf die Weiterbildung, 3. Fachtagung Managed Training Solutions, HOLM, Frankfurt, Juli 2014

W. Prinz: Digitalisierungstrends, DIHK Netzwerktag, Schloß Gracht, April 2014


W. Prinz: Social Media KPIs und Reifegrade am Beispiel einer Karte des sozialen Intranets, IBM Connect Switzerland, 6.3.2014, Baden, Schweiz


D. Renzel: Towards Integrated Layers Evaluation Data Management with MobSOS, Learning Layers Integration Meeting, Aachen, Germany, April 26, 2014

D. Renzel: Open Source Software Licensing, Learning Layers Integration Meeting, Aachen, Germany, April 27, 2014

D. Renzel: OpenID Connect for Layers, Learning Layers Meeting, Graz, Austria, 30.7. 2014


Publications

Book and Edited Volumes


Journal Articles


N. Jeners, W. Prinz: Kennzahlen kooperativer Arbeitsbereiche, i-com, 9-13, 2/2014.


**Conference Papers, Book Contributions, Patents**


Technical Reports


Awards

M. Jarke: ACM Fellow 2013 awarded for contributions to requirements engineering, conceptual modelling, metadata management, and the promotion of computer science in Germany.


Dissertations at Informatik 5

René Reiners
Title: An Evolving Pattern Library for Collaborative Project Documentation
Examiners: Matthias Jarke, Uwe Zdun
Date: 11.12.13

Abstract:
In distributed research projects, the involved personnel acquires lots of technical and domain-specific knowledge. Generalizable outcomes of single project partners that are relevant to all stakeholders need to be distributed within the project. Since the involved parties may possess very different professional backgrounds, specific jargon and different ways to document results may lead to inefficient exchange. Therefore, within this kind of projects, it is a hard task to communicate and keep general project knowledge current. It is likewise difficult to provide achieved results for future projects.

This thesis proposes to collaboratively describe project outcomes and gathered domain knowledge as evolving design patterns. A design pattern must, by definition, be easy to read and understand by non-experts. This enables all stakeholders to understand the described contents without requiring specific background knowledge. The thesis develops a collaborative pattern formulation and validation process that takes into account the special conditions of joint research projects. Therewith, the research and development personnel can easily draft project knowledge in parallel to their efforts as initial design patterns that are refined over time.

From initial ideas or open problems the formulations evolve to validated and reusable patterns that are organized within a dynamically growing pattern library structure. A lightweight role model supports composing new and reviewing existing submissions as well as administrating the library structure. The derived maturation process ensures the formulation quality of the pattern by reflecting the proposals and opinions of all participants. In addition, all contributors collect evidence to support or refute the solutions suggested by a pattern. The research methodology included, besides research in literature, user-centered, iterative design methods that involve representatives of the research and development personnel.

Khaled Rashed
Title: Community-Centered Semantics for the Detection of Fake Multimedia
Examiners: Matthias Jarke, Harald Kosch
Date: 20.12.2013

Abstract:
Nowadays, it becomes increasingly difficult to find reliable multimedia content on the web. Detecting the fake and providing semantics that can help searching and retrieving fake multimedia remain unsolved problem which is of growing concern in the Web community. Conventional automatic approaches for detecting fake multimedia lack scalability and inability to capture media semantics by means of forgery. Furthermore, they consider all media modification as a fake which is not true in many online communities. This research aims to find ways to manage multimedia authenticity in open, decentralized systems. We propose a trust-aware community approach for detecting and managing fake multimedia. A
general framework of community-based fake multimedia detection systems is developed, where community and automatic techniques can be combined. A Multimedia Quality Profile is developed for multimedia evaluation and semantic classification with one substantial part of estimating media authenticity based on trust-aware community ratings. A corresponding service supports the construction and generation of such profiles. We address several challenges within the proposed framework. The concept of serious gaming is employed in our collaborative fake media detection approach to overcome the cold-start problem and to provide sufficient data powering our Multimedia Quality Profile and expert ranking algorithm. We also present a use case where our community-based fake detection approach can be applicable and a service for trust management that supports this approach. The evaluation reveals that the community members can discover unfair raters in a short time after their participating in the media evaluation process. Finally, we propose an algorithm for searching and ranking experts in the community and trust-aware fake multimedia detection system, ensuring its robustness against Sybil attacks by providing sufficient countermeasures. In different experiments we demonstrate that our approach strategy can be effectively used to detect fake multimedia in collaborative systems.

Dejan Kovachev

Title: Mobile Multimedia Services in the Cloud
Examiners: Matthias Jarke, Ralf Klamma, Juan Quemada (UPM Madrid)
Date: 14.05.2014

Abstract:
Cloud computing is a paradigm shift promising a utility-based delivery of storage and processing capacity, services, and software over the Internet. In essence it aims to reduce costs, facilitate self-automated systems and decouple service delivery from underlying technology. Thus, the cloud paradigm empowers customers with the ability to focus on creating novel services alleviating the burden of software and hardware resource provisioning. The success of cloud computing in the domain of enterprise applications has sparked increasing interest in applying the same principles to the provision of mobile multimedia services. However, the potential benefits are far from being achieved, despite the rapid growth in popularity and omnipresence of mobile multimedia applications.

The combination of cloud computing and mobile multimedia is non-trivial, and many aspects from system, mobile multimedia and user perspectives need to be considered.

For example, mobile applications in the cloud involve a trade-off in terms of what should run on the device and what in the cloud, which is contingent to the application type, the device capability, data locality and the operating environment (network bandwidth, delay, cloud availability). Moreover, the traditional server/client programming models fail to provide seamless cloud execution in volatile mobile networks. Furthermore, distant cloud data centers induce prohibitive latency for certain classes of interactive mobile applications such as 3D games and augmented reality.

This dissertation investigates ways to efficiently apply the concepts of the emerging cloud computing paradigm in the design, development and delivery of mobile multimedia services. It describes an information systems architecture called CAELUS (Cloud Architecture for Enabling Mobile Multimedia Services) which includes both conceptual models and a concrete software platform. The conceptual models capture specific requirements for efficient building of mobile multimedia cloud services and guide the creation of the software platform.
(i5Cloud) which serves as a test bed of the CAELUS architecture. The contributions of this dissertation, in addition to a comprehensive survey of literature, comprise a design view, platform and abstraction levels that lower the barrier for mobile multimedia services to leverage the clouds.

Several case studies have evaluated the CAELUS-based development and delivery of mobile multimedia cloud services. In particular, the case studies were conveyed in the application domains of technology-enhanced learning, digital documentation in cultural heritage and human-computer interaction. Prototype applications together with technical evaluations and user studies demonstrate the validity and applicability of the architecture and the conceptual approach.

**Hagen Buchholz**

Title: Digital Transformatives – Activating User Intrinsic Potentials

Examiners: Matthias Jarke, Wolfgang Prinz, Irene Mittelberg

Date: 08.08.2014

Abstract:

This work defines and characterizes a new class of highly efficient interactive digital systems. Following the idea of cognitive efficiency mechanisms, such as mnemonic devices, it is the goal of such systems to activate hidden user potentials by transforming the original function context into a highly efficient usage context. Since the transformation is implemented digitally within the system they are called Digital Transformatives.

Initially the new class of Digital Transformatives are schematized. The schema is complemented by a new model of efficiency in human communication, which is developed based on evidence based cognitive research, and validated on practical examples. Based on those findings a concept is deduced, describing the Digital Transformatives working principle. Hereby the importance of cognitive prototypes is highlighted and further investigated.

The work follows an iterative research methodology, gradually evolving functional characteristics and design guidelines for the development of cognitive prototype oriented systems; also applicable for human machine interaction in general. Moreover, certain cognitive findings are described, providing a selective perspective on psychological aspects, especially involved in communication of enhanced efficiency. Hereby it should be noted that the structure and relations among the presented processes have been deduced by the author from cognition literature, and may vary from typical presentations in this field. This thesis also provides explanations on the efficiency advantages of further implementations, such as Tangible User Interfaces, User Interface Metaphors, Transitional Objects, Persuasive Technologies, and comparative assessment in user evaluations. Finally, the chances of social network analyses for the identification of cognitive shared prototypes are highlighted.