

Nothing is as powerful as an idea whose time has come.

Victor Hugo



Research Report 07/08

Institute of Software Technology
and Interactive Systems (ISIS)

I F S E C
B I G I M S



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“Research requires two things above all others: time and freedom.”

Source: Konrad Paul Liessmann, *Theorie der Unbildung: Die Irrtümer der Wissensgesellschaft*, Zsolnay, Wien (2006)

Dear readers,

It is a great pleasure for me to present to you this bi-annual report on the activities of the Institute of Software Technology and Interactive Systems (ISIS) of the Vienna University of Technology in 2007-2008.

In these two years, we were able to significantly increase the number of researchers at the institute.

The excellent involvement of ISIS in new national and international (especially European) research projects established the basis for this increase in researchers. The details of the projects can be found in the individual project descriptions. Quite a few of the results are extremely relevant for the transfer of knowledge to society and have attracted public interest in the field.

The years 2007 and 2008 were characterized by the considerable growth and strengthening of Business Informatics at ISIS. The establishment of the Electronic Commerce Research Group of Professor Hannes Werthner, who was appointed in 2006, and the appointment of Professor Christian Huemer from the University of Vienna in the field of Business Informatics were an important basis for this.

The most important research activities of ISIS in these two years are reflected in more than 200 peer-reviewed publications and 30 doctoral dissertations.

I want to stress that a high percentage of these dissertations was performed by young scientists from abroad thanks to the close cooperation of the institute in international networks such as ASEA-UNINET and with neighboring countries.

I would like to thank the entire staff of ISIS for their high level of identification and motivation, thanks to which ISIS plays a leading role on the Austrian and international scene and will continue to attract talents from all over the world as an excellent breeding ground for young researchers.

A Min Tjoa

The Institute: Facts and Figures

Staff

In the reporting period the institute faculty consisted of 4 full professors and 8 associate professors, 9 full-time equivalent (FTE) positions for scientific personnel and 6 persons in administrative and technical positions. There was a total of 44 FTE positions in externally funded research projects and 25 FTE positions for external teaching staff.

TU staff (full-time equivalents)

Full professors.....	4
Associate professors.....	8
Scientific personnel.....	9
Administrative & technical positions.....	6

Project staff

Researchers in externally funded projects.....	41
Externally funded non-scientific personnel.....	3
External teaching staff.....	25

External project funding

In 2007 and 2008 external funding for research projects was over 2.1 million Euro per year on average, which amounts to over 100,000 Euro of external project funds per faculty FTE scientist per year.

Scientific publications

In the reporting period the scientists at the institute published 14 books and book sections, 19 peer-reviewed journal publications, and 117 peer-reviewed conference papers and posters on average each year.

In 2007 and 2008 a total of 30 students successfully completed their doctorate studies.

Scientific publications	2007	2008
Books and book sections	9	19
Journal publications	21	18
Conference papers and posters	119	116
Dissertations	17	13

Outstanding Recognitions and Awards for Research Conducted at the Institute

The scientific work of the members of the institute was recognized with numerous international awards and honors (see Section Awards). The following highlights summarize outstanding public recognitions in Austria, which significantly add to the visibility of research performed at the institute at the national level.

Margrit Gelautz received the “FEMtech Award - Expert of the Month” (September 2007), granted by the Austrian Ministry BMVIT for significant achievements of women in science and technology. The goal of the FEMtech program is to increase public perception and to emphasize the accomplishments of female researchers and institutions that promote the careers of women scientists. The FEMtech Award gave rise to several reports about our research results in Austrian press and media.

Andrei Grecu was awarded the “OCG Förderpreis” for his master’s thesis on “Musical Instrument Separation” (October 2007). The “Förderpreis” of the Austrian Computer Society (OCG) honors outstanding diploma and master’s theses in the fields of Informatics and Business Computing. All master’s theses approved within the last two years at an Austrian university are eligible, with the awardee being selected by a jury of professors from different universities. Andrei Grecu not only received the 2009 Förderpreis for his thesis, but also won the Best Poster Award of the Faculty of Informatics of TU Wien at the presentation of all master’s theses.

Stefan Fenz was awarded the “Rudolf Sallinger Preis” for his diploma thesis on “Security Ontologies: Improving Quantitative Risk Analysis” (February 2008). The “Rudolf Sallinger Preis” honors outstanding diploma theses in order to improve the visibility of high-quality research relevant to small and medium-sized enterprises. In 2007, the Rudolf Sallinger society awarded 11 diploma theses and dissertations across Austria. The thesis of Stefan Fenz was the only winning thesis that came from the Vienna University of Technology.

Manuel Wimmer received the “Excellence Dissertation Award” of the Federal Ministry of Science and Research (2008). This award honors outstanding dissertations in order to improve the visibility of high-quality research. In 2008, the Federal Ministry of Science and Research awarded 33 doctoral theses in various disciplines all over Austria. The thesis of Manuel Wimmer was one of three theses coming from the Vienna University of Technology and the only winning thesis at the Faculty of Informatics. The newspaper “Die Presse” also reported on this achievement in its series “Dissertation of the week”.

Testimonials www.isis.tuwien.ac.at/testimonials

“... fantastic work ... is going on in the Institute of Software Technology and Information Systems (ISIS), led by Prof. A Min Tjoa. ISIS has a lot of cutting edge national and international research projects which have managed to attract the attention of the international community. The various awards and publications of the ISIS faculty are a testimonial to the quality of research happening at ISIS. ... really impressive ... research projects ... relevant to ... society at large. This is a hallmark of true avant-garde research institute. ...”

Mukesh Mohania

Information Management Research IBM Research India

“... I am deeply impressed by the range of the research approached during last years ... I have to underline that your institute is clearly ahead of the other institutes in this Region of Europe because of ... leading projects and their contemporary profile. ...”

Andrzej Gospodarowicz

Economic University of Wroclaw (Poland)

In leading the works of alleviating Indonesia’s toils to strengthening the country’s Academicians, Business, and Government (ABG) network system, as always had been, Austria will become one of my personal choice of reference of a successful in deliberate synergistic-interconnection enhancement among the three groups. In this matter, I am convinced Austria’s ISIS - The Institute of Software Technology and Interactive Systems of the Vienna University of Technology - has distinctly successful in materializing the broader sense of The Triple Helix -- ABG, whereas the Business and Academics groups would naturally establish their unified position in societal servitude once as the government yield a solid foundation in liaising each other.

I ... can summarize my idea about ISIS: it is a landmark of modern ages of human civilization that signifies by its constituents’ compelling readiness to build value generalization among one another. In this case, I humbly to state that now it is Indonesia’s homework to follow your path.

Kusmayanto Kadiman

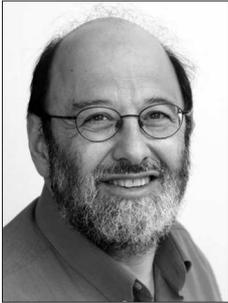
*State Ministry of Research and Technology
Republic of Indonesia*

“... the Institute represents a respectful and strong University body with internationally recognized research results in a broad scope of disciplines tightly connected with the latest software technologies. I ... appreciate all the efforts of the Institute staff members to collaborate with Czech Universities and to motivate and help them in the involvement into EU research initiatives. The Institute has contributed to excellent scientific reputation of the Vienna University of Technology and the Austria as a whole.”

Vladimir Marik

Czech Technical University, Prague

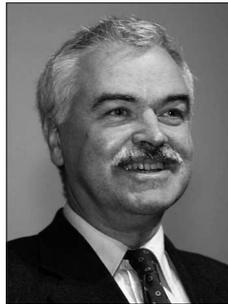
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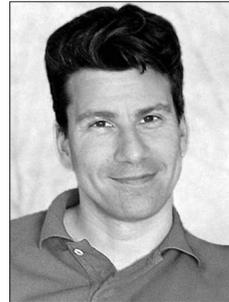
A Min Tjoa
Monika Lanzenberger
Amin Anjomshoaa
Marion Brandsteidl



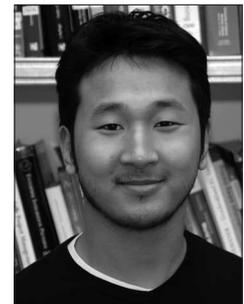
Andreas Rauber
Thomas Lidy
Mark Guttenbrunner
Rudolf Mayer



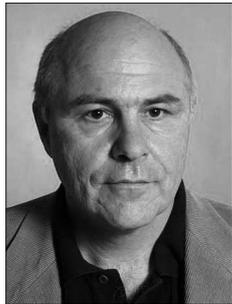
Gerald Futschek
Edgar Weippl
Alexander Schatten
Dindin Wahyudin
Wikan Sunindyo



Stefan Biffel
Thomas Moser
Richard Mordinyi
Dietmar Winkler



Maria Schweikert
Natascha Surnic
Michael Schadler
Gia Phu Liu



Hannes Werthner
Birgit Dippelreiter
Rainer Schuster



Jürgen Dorn
Michael Pöttler



Thanh Tran Thi Kim
Gudrun Kellner
Christoph Grün



Marco Zapletal
Thomas Motal



Dieter Merkl
Rozeia Mustafa

big



Horst Kargl
Michael Strommer
Sabine Graf



Birgit Korherr
Manuel Wimmer
Nevena Stolba
Elke Michlmayr

Gerti Kappel
Marion Murzek
Petra Brosch
Veronika Stefanov

Martina Seidl
Philip Langer
Gerlinde Notter
Beate List

Christian Huemer
Martina Umlauft
Philipp Liegl
Andrea Schauerhuber

Research Group Business Informatics

The group's focus on business informatics is about integrating theory and methods of organizational science and computer science. In particular, BIG works on those information technology aspects that have a significant effect on the way organizations do their business. In this context, BIG addresses the gap between the business strategy of why/what to do and the information technology aspect of how to do it by electronic means.

Research areas:

- » Model Engineering
- » Data Engineering
- » Process Engineering
- » Web Engineering
- » Services Engineering

Gerti Kappel
Petra Brosch
Sabine Graf
Christian Huemer
Horst Kargl
Birgit Korherr
Philip Langer
Philipp Liegl
Beate List
Marion Murzek

Gerlinde Notter
Andrea Randak
Andrea Schauerhuber
Martina Seidl
Veronika Stefanov
Nevena Stolba
Michael Strommer
Martina Umlauf
Manuel Wimmer



ims



Margrit Gelautz
Mathis Csisinko
Asmaa Hosni
Christian Schönauer



Christian Breiteneder
Dalibor Mitrovic
Michael Hödlmoser



Hannes Kaufmann
Horst Eidenberger
Christoph Rhemann



Ingrid Lissa
Michael Bleyer
Susanne Kastner-
Masilko



Maia Zaharieva
Florian Seitner
Thomas Pintaric

PROJECTS

ISIS INSTITUTE RESEARCH AREAS

		PIPE - E-Health privacy	Security Ontologies	Austrian Grid	CSDE - Complex Systems	CzechVMXT Reliable systems	SWIS - system configuration	AmbulanceRoute	Test-Driven Automation	SkyDreamer - building sim.	Digital Preservation Europe	PLANETS	Davis - Data Mining Vis.	FODOK Austria	DELOS - Digital Libraries	Muscle	
TUW	Information & Communication Technol.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Sustainable Technologies									X							
Informatics Faculty	Computational Intelligence					X				X			X	X	X	X	
	Simulation				X	X		X	X	X							
	Distributed & Parallel Systems			X	X	X	X	X	X		X	X					
	Software Engineering				X	X	X	X	X			X					
	Media Informatics & Visual Computing														X	X	
	Business Informatics				X	X	X	X	X								
	Complex Systems			X	X		X	X	X								
	Security	X	X	X													
Institute of Software Technology and Interactive Systems (ISIS)	Data Engineering															X	
	Data Warehousing																
	Data Mining												X	X	X	X	
	Data Modeling																
	Information & Knowledge Engineering		X	X	X	X	X	X	X	X	X						
	Semantic Web									X							
	Information Visualization							X		X			X	X			
	Digital Libraries										X	X		X	X		
	Knowledge Management																
	Competence Management																
	Process Engineering									X	X	X					
	Adaptive Workflow Management										X	X					
	Service-Oriented Architectures				X					X	X	X					
	Software Engineering				X	X	X	X	X			X					
	Software Quality Management					X			X								
	Verification & Validation				X				X								
	Software Project Management				X				X								
	Web Engineering											X					
	Ubiquitous Web-Applications																
	Integration of Web & Database Systems													X			
	Model Engineering		X		X	X	X		X	X							
	Model Transformations				X		X		X								
	Conceptual Modeling & Ontologies		X	X	X		X		X	X							
	Model-Driven Software Development				X	X	X		X	X							
	Virtual & Augmented Reality																X
	Media Processing																X
	Multimodal Information Retrieval															X	X
	Media Understanding															X	X
	Image & Video Analysis																
	Privacy & Security	X	X	X													
	E-Commerce & E-government												X				
	Business Modeling																
	Recommender Systems											X					

PROJECTS

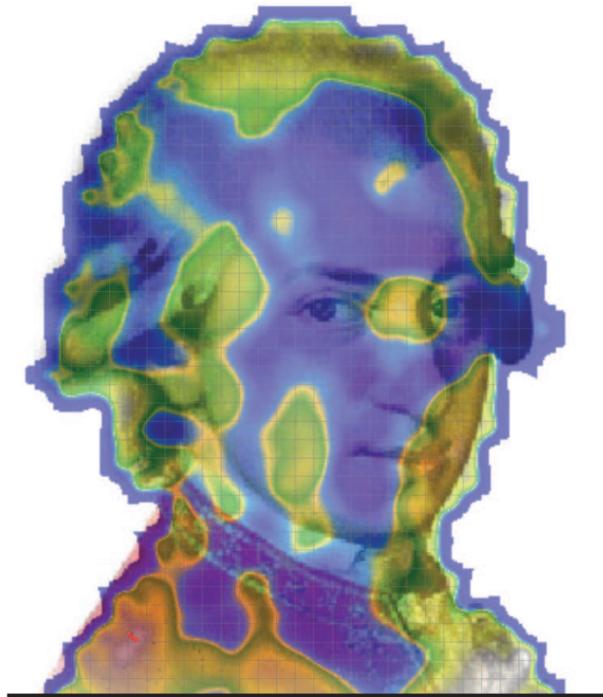
ISIS INSTITUTE RESEARCH AREAS

		PCP - KompetenzMgmt.	TechScreen	SemProM	SEMAMO	OnTourism	BSopt	Public Private Interoperability	ModelCVS	TRACK and TRADE	Digital Formalism	3D TV Stereo	VIDEOMAT	Global Stereo Matching	PLAYMANCER	VISION	ARST	VENDOR	
TUW	Information & Comm. Technol.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Sustainable Technologies																		
Informatics Faculty	Computational Intelligence	X	X																
	Simulation																	X	
	Distributed & Parallel Systems				X	X				X								X	
	Software Engineering			X	X	X			X	X								X	
	Media Inf. & Visual Computing										X	X	X	X	X	X	X	X	
	Business Informatics	X	X	X	X	X	X	X	X	X									
	Complex Systems																		
	Security																		
Institute of Software Technology and Interactive Systems (ISIS)	Data Engineering				X			X		X									
	Data Warehousing				X					X									
	Data Mining		X		X					X									
	Data Modeling							X	X										
	Information & Knowledge Eng.			X	X	X		X						X					
	Semantic Web		X	X	X	X		X											
	Information Visualization			X	X	X		X			X			X					
	Digital Libraries							X											
	Knowledge Management	X	X																
	Competence Management	X	X																
	Process Engineering						X	X											
	Adaptive Workflow Mngmnt																		
	Service-Oriented Architectures						X	X		X									
	Software Engineering			X	X	X			X										X
	Software Quality Management			X	X														
	Verification & Validation				X														X
	Software Project Management			X	X														
	Web Engineering					X				X									
	Ubiquitous Web-Applications					X				X									
	Integration of Web & DBS				X	X				X									
	Model Engineering				X		X	X	X										X
	Model Transformations						X	X	X										
	Conceptual Mod. & Ontologies				X		X	X	X	X									
	Model-Driven SW Development						X	X	X										X
	Virtual & Augmented Reality											X	X	X	X	X	X	X	
	Media Processing											X	X	X					X
	Multimodal Informat. Retrieval										X								
	Media Understanding																		X
	Image & Video Analysis											X	X	X					X
	Privacy & Security																		
	E-Commerce & E-government					X	X	X											
	Business Modeling						X	X											
	Recommender Systems																		

In the reporting period, the research areas of **Information and Software Engineering** were investigated in the following projects:

The project PIPE (Pseudonymization of Information for Privacy in e-Health) develops an information security system for the pseudonymization of e-health data that differs from existing systems in its ability to securely integrate primary and secondary use of e-health data. The security ontology (SecOnt) - based on the National Institute of Standards and Technology Special Publication 800-12 - provides an ontological structure for information security domain knowledge, incorporating best practice guidelines and concrete knowledge of the considered organization. Austrian Grid (AGrid) is a project to advance research in grid computing where researchers from different affiliations participate in order to form a national level of knowledge in all grid-relevant domains (such as security) to keep pace with international development. The Secure 2.0 project addresses the semi-automatic conceptualization challenges of Web 2.0 content by applying Semantic Web technologies to provide assistive services, facilitate resource sharing, and for self-monitoring purposes in Web 2.0 social networks. The SkyDreamer project extends the model element of architectural models of buildings with semantic annotations to allow linking of model elements from different sources for improving the analysis of the building properties, for example energy efficiency or lighting conditions.

The Complex Systems Design and Engineering Lab investigates modeling, integration, and multi-agent simulation approaches to develop, verify, and control complex distributed systems in mission-critical application areas such as production automation. The EU Marie Curie project CzechVMXT addresses software process improvement in the V-Modell XT framework for dependable-systems research to develop large and complex knowledge-intensive automation systems with consistently high quality based on empirical evidence. The project System-Wide Information Sharing (SWIS) leverages system integration based on the Enterprise Service Bus concept and semantic integration based on innovative ontologies to derive foundations for model-driven development of flexible and robust business process orchestration in the air traffic management domain. The project Ambulance Route combines multi-objective optimization of ambulance scheduling in order to reduce the waiting time for ambulance rides and keep sufficient emergency area coverage with the information visualization for ambulance dispatchers who decide the actual schedule. The project Test-Driven Automation adapts agile software engineering approaches like test-driven development with a focus on test automation to improving processes, methods, and tools for engineering complex automation systems.



Map of Mozart's music based on self-organizing maps

The projects FODOK Austria and DELOS Network of Excellence (NoE) address research issues in digital libraries, providing means to integrate information from distributed sources, analyze it using computational intelligence techniques, and visualize it using advanced concepts of information visualization. The MUSCLE NoE extends this work into the domain of multimedia, with a specific focus on audio/music data, in the fields of multimedia information retrieval, visualization and interaction. While digital information can be duplicated without loss of quality, it is in many cases more prone to decay and loss than its analog counterparts. The integrated project PLANETS as well as the CA DPE address the challenge of digital preservation. Techniques originally devised within the sector of digital libraries as part of the DELOS NoE are being extended and applied in e-government as well as industry settings, with a specific focus on the modeling of preservation requirements, as well as workflows for auditable decision processes. DAVIS applies the techniques used in the fields of digital libraries and multimedia retrieval in a pure data mining setting, forming the basis for novel information visualization techniques.

Pseudonymization of Information for Privacy in e-Health (PIPE)

Project type:

FFG - Österr. Forschungsförderungsgesellschaft mbH; Wien; Österreich

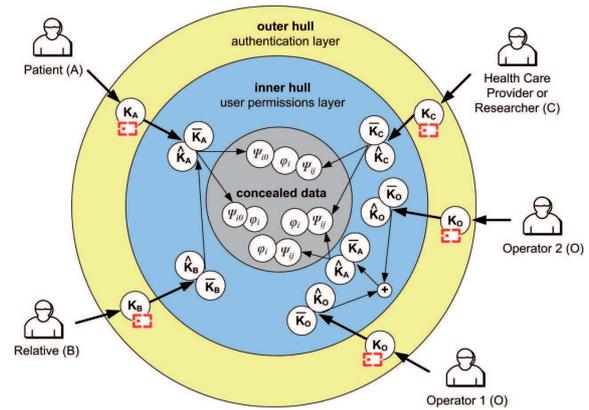
Project partners:

Braincon, Genosense, JKU University Linz, Secure Business Austria (SBA)

Project period: 01.03.2008 — 31.08.2010

Abstract: The discussion of privacy is one of the fundamental issues in health care today and demands a trade-off between the patient's requirement for privacy and society's needs for improving efficiency and reducing costs of the health care system. Electronic health records (EHR) promise to improve communication between health care providers, thus leading to better quality of patients' treatment and reduced costs. However, with informative and interconnected health-related data comes highly sensitive and personal information. As a result of the high sensitivity, there is increasing social and political pressure to prevent the misuse of health data. It is the fundamental right of every citizen to demand privacy, and furthermore, the disclosure of medical data can cause serious problems for the patient. In addition to social and political pressure, legal acts demand the protection of health data in order to protect the privacy of individuals. In 2006, the United States Department of Health & Human Services issued the Health Insurance Portability and Accountability Act (HIPAA), which demands the protection of patients' data that is shared from its original source of collection. Since 2005, the processing and movement of personal data has been legally regulated by the EU with Directive 95/46/EC. A citizen's right to privacy is also recognized in Article 8 of the European Convention for the Protection of Human Rights and Fundamental Freedoms. Additionally, domestic acts in many EU member states (e.g., the Austrian Data Protection Act) contain strict regulations concerning the processing of personal data. With the increasing interconnection of systems comes an increasing fear of data abuse, which has led to the development of a variety of techniques and the adoption of a number of laws for protecting patients' identity and privacy. The concept of pseudonymization allows data to be associated with a patient only under specified and controlled circumstances, but existing approaches have a number of shortcomings, such as centralized patient-pseudonyms lists or the concealment of the applied algorithms.

Within this project we develop - based on our patent - the new system PIPE (Pseudonymization of Information for Privacy in e-Health). It differs from existing approaches in its ability to securely integrate primary and secondary use of health data. The aim of this project



PIPE Architecture

is (a) to broaden our patented approach to support (semi-)structured metadata, (b) to develop alternative secure storage and retrieval techniques, (c) to provide for secure storage and access to medical emergency data, (d) to provide a secure viewer that prevents man-in-the-middle attacks, and (e) to demonstrate our system in the context of genome analysis, storage, and retrieval. The project has the important goal to provide for privacy in the context of electronic health records, which do not only promise a higher level of service quality for the patients, but also reduce costs for social insurance systems and therefore for society as a whole.

Project results: <http://privacy.securityresearch.at>

Publications:

- » Neubauer, T. & Kolb, M. (2009), 'An Evaluation of Technologies for the Pseudonymization of Medical Data', Springer Studies in Computational Intelligence.
- » Neubauer, T. & Riedl, B. (2008), 'Improving Patients Privacy with Pseudonymization', Proceedings of the International Congress of the European Federation for Medical Informatics'.
- » Riedl, B.; Neubauer, T. & Boehm, O. (2007), 'Patent: Datenverarbeitungssystem zur Verarbeitung von Objektdaten', Austrian Patent, Nr. 503291
- » Riedl, B.; Grascher, V. & Neubauer, T. (2008), 'A Secure e-Health Architecture based on the Appliance of Pseudonymization', Journal of Software.
- » Neubauer, T. & Mück, T. (2008), 'PIPE: Ein System zur Pseudonymisierung von Gesundheitsdaten' Proceedings of e-Health 2008'.

Results:

- » Broaden the PIPE approach to support meta data
- » Alternative secure storage and retrieval techniques
- » Secure Viewer
- » Pseudonymization Prototype
- » Demonstrate our system in the context of genome analysis
- » Security Analysis

People involved:

Johannes Heurix, Thomas Neubauer, A Min Tjoa, Edgar Weippl

Security Ontology

Project type:

FFG - Österr. Forschungsförderungsgesellschaft mbH; Wien; Österreich

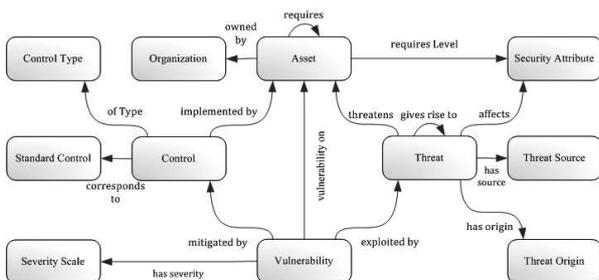
Project partners:

FFG (Dissertationsstipendium, no industrial partners)

Project period: 01.03.2008 - 28.02.2011

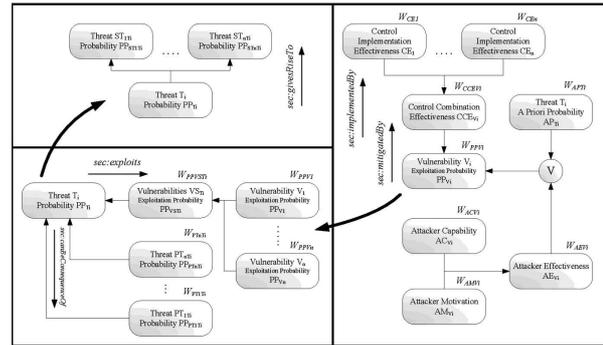
Abstract: Information security risk management is crucial for ensuring long-term business success, and thus numerous approaches to implementing an adequate information security risk management strategy have been proposed. The error-prone manual application of general information security knowledge to the infrastructure of the organization, the subjective threat probability determination, and the common lack of knowledge regarding appropriate control implementations are not addressed by existing approaches. Often these shortcomings result in an inadequate information security strategy that endangers the performing of the organization's mission. To address these issues, this project elaborates on the underlying assumptions, differences, and commonalities of existing information security risk management approaches and implements, based on the identified requirements, a formal knowledge model of the information security domain (security ontology):

In the context of the developed knowledge model, a threat gives rise to follow-up threats, represents a potential danger to the organization's assets and affects specific security attributes (e.g., confidentiality, integrity, and/or availability) as soon as it exploits a vulnerability in the form of a physical, technical, or administrative weakness. Additionally, each threat is described by potential threat origins (human or natural origin) and threat sources (accidental or deliberate source). For each vulnerability a severity value and the asset on which the vulnerability could be exploited is assigned. Controls have to be implemented to mitigate an identified vulnerability and to protect the respective assets by preventive, corrective, deterrent, recovery, or detective measures (control type). Each control is implemented as asset concept, or as combinations thereof. Controls are derived from and correspond



Security ontology - main concepts and relationships

to best practice and information security standard controls (e.g., German IT Grundschutz Manual). The controls are modeled on a highly granular level and are therefore reusable for different standards. When implementing the controls, a compliance with various information security standards is implicit. The coded ontology follows the OWL-DL (W3C Web Ontology Language) standard and ensures that the knowledge is represented in a standardized, formal, and, therefore, machine-interpretable form.



Bayesian threat probability determination

In addition to the core security ontology, comprising concepts such as threat, vulnerability, and control, concepts and relations necessary to formally describe the organization and its assets are incorporated as well. In order to enrich the knowledge model with concrete information security knowledge, the German IT Grundschutz Manual is superimposed on the security ontology and more than 500 information security concepts and 600 corresponding formal axioms are integrated into the ontological knowledge base. Reasoning techniques are applied to the ontological knowledge base to automatically obtain the implementation status of each information security control. To quantify the security status of the organization a Bayesian approach for determining asset-specific and comprehensible threat probabilities is implemented. Since the security ontology provides detailed knowledge about threat, vulnerability, and control dependencies, this knowledge could be utilized to build up the Bayesian network for the threat probability determination. The advantage of the proposed Bayesian threat probability determination is that it gives the risk manager a methodology to determine the threat probability in a structured and, by incorporating the security ontology, comprehensible way. The calculation schema is fully documented and each state of the Bayesian network can be explained and justified mathematically and formally taking the given input factors into consideration.

Compared to existing approaches, the tool implementation of the elaborated concepts (AURUM) enables risk managers (1) to automatically map general information security knowledge to the infrastructure of their organization, (2) to comprehensibly quantify the current security status of their organization by using the

Bayesian threat probability determination, and (3) to automatically check the organization's compliance with existing best practices such as the German IT Grundschutz Manual.

Project results:

<http://securityontology.securityresearch.at>

Publications:

- » Fenz, S. & Ekelhart, A. Formalizing information security knowledge ASIACCS ,09: Proceedings of the 2009 ACM Symposium on Information, Computer and Communications Security, ACM, 2009
- » Fenz, S.; Pruckner, T. & Manutscheri, A. Abramowicz, W. (ed.) Ontological Mapping of Information Security Best-Practice Guidelines Business Information Systems, 12th International Conference on Business Information Systems, BIS 2009, Springer Berlin / Heidelberg, 2009
- » Fenz, S.; Tjoa, A. M. & Hudec, M. Ontology-based generation of Bayesian networks Proceedings of the Third International Conference on Complex, Intelligent and Software Intensive Systems - International Workshop on Ontology Alignment and Visualization (OnAV2009), 2009
- » Ekelhart, A.; Neubauer, T. & Fenz, S. Automated Risk and Utility Management 2009 Sixth International Conference on Information Technology: New Generations, 2009

Results:

- » Security Ontology
- » Methodology for the ontological mapping of information security best-practice guidelines
- » Methodology for the ontology-based generation of Bayesian networks
- » Bayesian Threat Probability Determination Methodology
- » AURUM (Automated Risk and Utility Management) Prototype

People involved:

Stefan Fenz, **A Min Tjoa**, Edgar Weippl

Security on the Grid (Austrian Grid)

Project type:

BMWF (Federal Ministry of Science and Research)

Project partners:

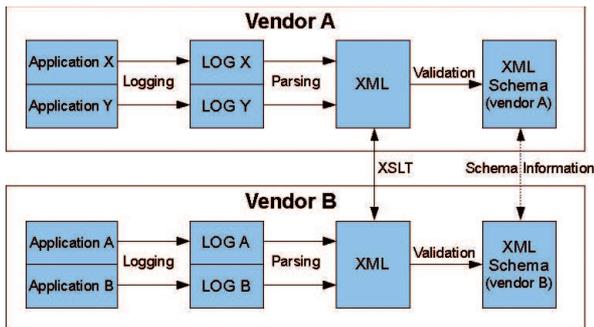
Austrian Grid, FH Vorarlberg, University of Vienna

Project period: 01.02.2008—31.12.2010

Abstract: Grid computing technology is becoming increasingly widespread in both the academic and the business world as an important part of research environments. Especially in medical research, grid computing is often utilized to conduct clinical studies by forming a virtual organization (VO) spanning multiple locally dispersed participants, which provides the possibility to share medical data within this VO. In addition to authentication and authorization, limiting access to legitimate persons only, tighter control over conducted workflows must also be kept in order to comply with laws such as HIPAA or GBL. Although several solutions for authentication and authorization are available, no tools or frameworks support the traceability of workflows.

To tackle this challenge, the implementation of audit trails within a distributed grid environment is needed, and it must be guaranteed that every interaction with data is comprehensible. Audit trails are realized by logging those interactions into a LOG file, but currently no standards for log file format or logging mechanisms exist. An additional problem is that several different LOG files with different formats need to be collected, transported, aggregated and evaluated, resulting in an enormous amount of LOG data. To solve these problems, we introduced a virtualized grid environment, guaranteeing freedom from any side access, which ensures that every data access is recorded into a LOG file. In the next phase of this project, a new logging format based on XML technology will be developed. Logging data will be recorded in XML format, conforming to a self-defined XML Schema. This concept provides several advantages:

- There is no need for one LOG file standard, every node can use its own format, and conversion between formats can be done automatically by XSLT.
- As an XML Schema has to be developed first, inconsistencies in LOG data will be eliminated.
- Validation: The XML LOG files can be validated against the schema (XML-S)
- Aggregation and correlation can be done automatically, which is the only feasible possibility because of the enormous amount of logging data.
- The structure and meaning of log files can be communicated easily by publishing the underlying XML Schema.
- Many tools for manipulation and evaluation are available, as all existing XML tools can be utilized.



The lack of a LOG standard is mitigated by parsing LOG information into a vendor specific XML format described by an XML schema, which makes them transformable from one format into other ones through XSLT.

Compared to existing solutions this introduces an advantageous concept, as no standard needs to be defined and followed by each vendor. Until now, existing solutions always tried to define a logging standard, but every attempt failed because vendors did not support them and followed their own logging strategy.

In our solution each vendor can structure logging information in a way that best suits their needs. This provides a lot of flexibility without interoperability problems because transformation from one XML log file into another can easily be done by XSLT transforming one schema to another. Additionally, automatic evaluation and aggregation is easy, as the existing XML tools can be utilized. This solution will support the vendor needs and simultaneously eliminates the drawbacks of existing solutions.

Publications:

- » Descher, M. & Masser, P & Feilhauer, T & Huemer, D. & Tjoa, A Min (2009), "Retaining Data Control to the Client in Infrastructure Clouds", Proceedings IEEE Computer Society Press
- » Descher, M. & Masser, P & Feilhauer, T & Huemer, D. & Tjoa, A Min & P. Brezany, I. & Elsayed & A. Woehrer (2009), "Position Paper: Submitted to the SAGC Workshop Program Committee"
- » Huemer, D. & Tjoa, A Min & Descher, M. & Masser, P & Feilhauer, T (2009), "Towards a Side Access Free Data Grid Resource by Means of Infrastructure Clouds", Submitted to ICPP conference

Results:

<http://grid.securityresearch.at>

- » Logging Framework
- » Logging Format concept
- » Secure Grid Computing architecture

People involved:

A Min Tjoa, David Huemer, Marco Descher

COMPLEX SYSTEMS Design & Engineering

Simulation Production automation

Project type:

Funded by the dean of the informatics faculty

Project partners:

ACIN Institute, ADS, JKU Linz, TU Prague/Rockwell Automation, Salzburg Research, RealSafe

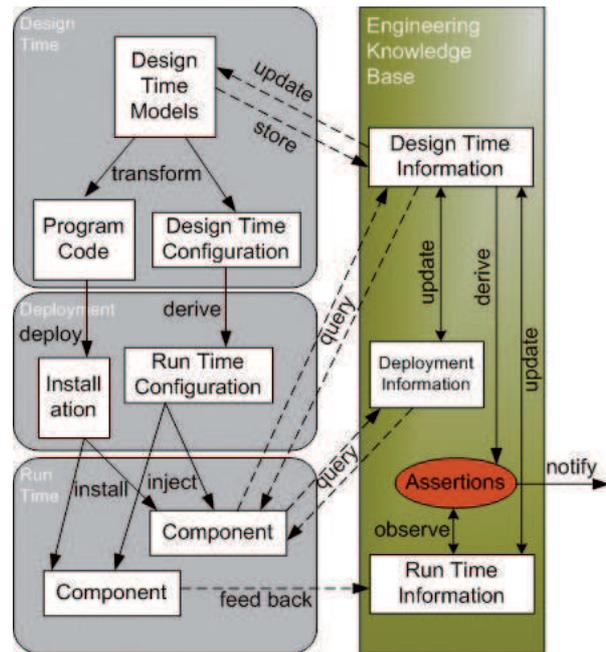
Project period: 1.2.2008—31.1.2010

Abstract: Information and communication technology (ICT) has been successfully used to control and manage complex systems in many domains. However, decision makers who deal with complex systems problems and are not ICT experts are often not aware of the range of contributions from informatics research that they could use to address their complex systems challenges effectively and efficiently. The Complex Systems Design & Engineering Lab (CSDE-Lab) is named after the Vienna University of Technology (TUW) Informatics faculty research focus “Complex Systems”. The objectives are to engineer and manage complex systems in concrete mission-critical applications in safety-critical domains, like mission coordination for emergencies, air traffic management or production automation. It is characteristic of complex systems that they are difficult to model, predict, and manage due to their variety, dynamics and emergent system properties. Additionally, the integration of heterogeneous systems is essential in order to achieve common goals more effectively, efficiently, and/or in a more failure-resistant way. Therefore, the CSDE-Lab develops, evaluates, and improves processes, methods, and tools for systems development, integration, and verification.

Particular research topics in the CSDE-Lab are: a) the use of ontologies as continuous software engineering model for the specification of technology capabilities and capacities, support of iterative system reconfiguration and optimization, b) optimization of coordination patterns with multi-criteria objectives using space-based computing for efficient production scheduling and backup solutions with minimal disruption, and c) formal specifications and strong QA for the verification of mission-critical elements, like test automations to lower the effort for re-testing software systems, the measurement of system performance, or the checking of assertions at run time to inform the responsible roles.

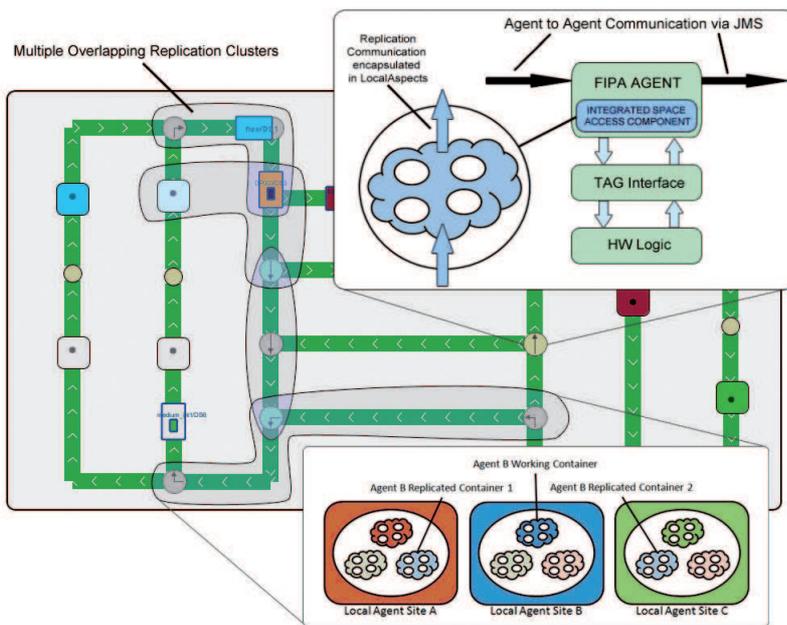
Publications:

- » Kühn, E., Mordinyi, R., Goiss, H.-D., Sandford, B., and Slobodanka, T. 2009. Using tuple-spaces to build a storage P2P system for structured and dynamic data. In Proc. of the 2nd International Workshop on Adaptive Systems in Heterogeneous Environments - ASHEs'09, CISIS 2009 Conference.



Support for complex system adaptations at run time with design-time engineering knowledge

- » Moser, T., Mordinyi, R., Mikula, A. & Biffli, S. (2009) Making Expert Knowledge Explicit to Facilitate Tool Support for Integrating Complex Information Systems in the ATM Domain. In Proc. of the Intl. Conf. on Complex, Intelligent and Software Intensive Systems (CISIS 2009), Fukuoka, Japan.
- » Kühn, E., Mordinyi, R., and Schreiber, C. 2008 “An Extensible Space-based Coordination Approach for Modeling Complex Patterns in Large Systems” Workshop on Formal Methods for Analysing and Verifying Very Large Systems, ISOLA 2008
- » Merdan, M., Moser, T., Wahyudin, D., Biffli, S. 2008 “Performance Evaluation of Workflow Scheduling Strategies Considering Transportation Times and Conveyor Failures” The International Conference on Industrial Engineering and Engineering Management (IEEM), Singapore
- » Merdan, M., Moser, T., Wahyudin, D., Biffli, S., Vrba, P. 2008 “Simulation of Workflow Scheduling Strategies Using the MAST Test Management System” In The 10th International Conference on Control, Automation, Robotics and Vision, Hanoi, Vietnam
- » Moser, T., Kunz, K., Matousek, K., Wahyudin, D. 2008 „Investigating UML- and Ontology-Based Approaches for Process Improvement in Developing Agile Multi-Agent Systems“ 34th EUROMICRO Conference on Software Engineering and Advanced Applications SEAA 2008
- » Moser, T., Roth H., Rozsnyai S., Biffli, S. 2008 “Semantic Event Correlation Using Ontologies” In the 3rd Central and East European Conference on Software Engineering Techniques (CEE-SET 2008), Brno, Czech Republic
- » Moser, T., Schimper, K., Mordinyi, R. & t, A. (2009)



Failure-tolerant agent coordination approach in a complex production automation system simulation

SAMOA - A Semi-automated Ontology Alignment Method for Systems Integration in Safety-critical Environments. In Proc. of the 2nd IEEE Intl. Wsh. on Ontology Alignment and Visualization, Fukuoka, Japan.

- » Moser, T., Mordinyi, R., Mikula, A., and Biffi, S.: 'Efficient System Integration Using Semantic Requirements and Capability Models: An approach for integrating heterogeneous Business Services'. Proc. 11th Int. Conf. on Enterprise Information Systems, 2009.
- » Moser, T., Ferstl, C., Höllwieser C., Biffi, S.: Evaluation of case tools methods and processes: A Case Study Analysis of eight Open Source CASE Tools'. Proc. 11th Int. Conf. on Enterprise Information Systems, 2009.
- » Kühn, E., Mordinyi, R., Keszthelyi, L., and Schreiber, C. (2009) Introducing the Concept of Customizable Structured Spaces for Agent Coordination in the Production Automation Domain. In Proceedings of the 8th international Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2009)

People involved:

Stefan Biffi, Thomas Moser, Richard Mordinyi, Eva Kühn, Alexander Schatten

Planned project results:

- » Paper Scientific American: Linking Contributions of Informatics Research to Complex Systems Challenges
- » Space & SAW - Project
- » PhD Thesis Thomas Moser: Semantic Integration of heterogeneous Engineering Systems
- » PhD Thesis Richard Mordinyi: Space-Based Coordination in mobile Environments
- » CSDE Webpage

Czech VMXT Project

Process Improvement for Dependable-Systems Research

Project type:

EU FP7 Marie Curie Transfer of Knowledge Project

Partner:

Department of Cybernetics Faculty of Electrical Engineering Czech Technical University in Prague; Czech Republic.

Project period: 01.10.2006—31.03.2009

Abstract: The Gerstner Laboratory (GL) at the Czech Technical University in Prague successfully conducts research in the area of artificial intelligence, with the focus on knowledge-based and information systems, knowledge discovery in databases, multi-agent systems, and software diagnostics. Until now, GL has gathered experience in the development of many IT systems in the above areas. Due to an extreme increase in the size and complexity of software development in research projects, the ad-hoc software process has already reached the limit of quality and economic efficiency. At this stage it becomes necessary for GL to build competence in the field of “software process improvement for dependable systems” in order to improve the research conducted in areas of dependable systems applications. This new competency will enable GL researchers to overcome the current challenges in IT project management (high risk of rework, risk of feasibility, quality and usability of end product and services) and to support GL researchers with the advanced methodologies addressing the quality assurance, quality management and standardization in software processes. The specific knowledge transfer objectives are formulated as follows:

- » To acquire a knowledge of formal methodology of software development processes, software engineering, and software process improvement,
- » to learn the concepts of V-Model XT framework and to tailor its process models to the needs of GL research projects and application domains in Czech practice (aimed at dependable system applications),
- » to integrate methods from requirements management and knowledge engineering to refine and improve software process models, and
- » to enable researchers to conduct empirical studies in the area of software engineering and quality management to improve processes and products.

The partner organization providing training for the outgoing researchers is TUW, the Institute of Software Technology and Interactive Systems (IFS). IFS has considerable experience in quality software engineering (QSE) research, teaching and training in the area

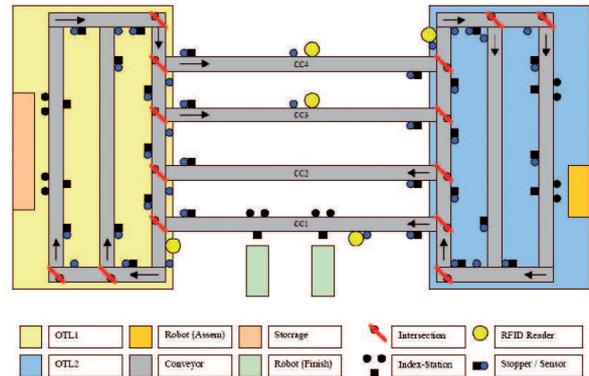


Fig 1.: Example of a multi-agent based production and transportation facility.

of software engineering, project management, quality management, and risk management. Additionally, IFS will provide the training in the V-Model XT framework for the GL researchers.

Project results:

- » Guest lectures in Software Engineering, Software Quality Assurance, Empirical Software Engineering.
- » Winkler D., Matousek K., Kubalik, J., Biffi S.: “Software Engineering Practices in Multi-Agent Software Development based on the V-Modell XT”, Czech Technical University, Prague, 2007.

People involved:

Stefan Biffi, Jiri Kubalik, Kamil Matousek, Alexander Schatten, Dietmar Winkler

System-Wide Information Sharing (SWIS)

Project type:

FFG - Österr. Forschungsförderungsgesellschaft mbH; Wien; Österreich

Project period: 01.07.2006—31.12.2008

Abstract: The research project System-wide Information Sharing (SWIS) is intended as an information sharing network within the air traffic management (ATM) domain, with very demanding safety and security requirements as well as the need for high availability. Today, companies and organizations operate in a highly complex environment requiring well-defined but flexible means of communication and cooperation that can be easily adapted to potentially frequently changing business processes.

Traditionally, most organizations have developed IT infrastructures consisting of numerous stand-alone applications, which are connected via point-to-point links and therefore lack flexibility. Over the last years, several approaches have been taken to solve this architecture problem, such as Enterprise Application Integration as a concept and service-oriented architecture. However, these approaches only provide mechanisms for a flexible connection of various business applications in one domain. In the case of ATM, many actors are involved, e.g., airports, airlines, military users, general aviation, air traffic service providers, and air traffic flow management instances, resulting in more or less de-coupled actions and decisions. However, due to the expected growth of air traffic in the next decades, all ATM actors will be forced to grow accustomed to the cooperative handling of virtually shared information during the entire life cycle of a flight.

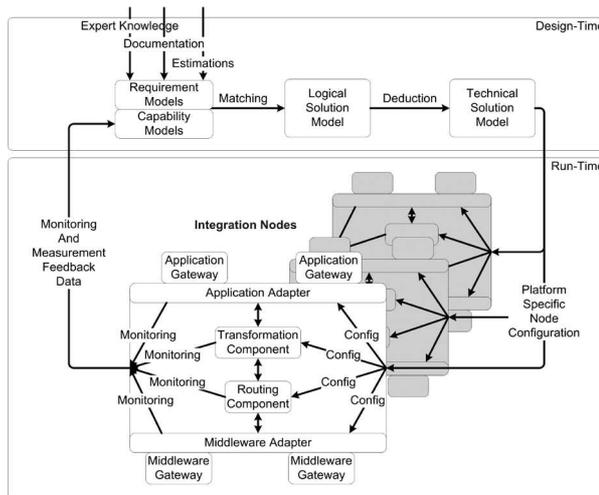
To support high-level cooperation, a low-level mechanism for information sharing needs to be established and the corresponding operational procedures and practices agreed upon and installed at all actors' premises. In the ATM environment, the degree of heterogeneity of existing legacy systems, solutions, actors, and their practices and preferences may well preclude any "end-to-end" interoperable solution. Therefore, it is essential to keep low-level information sharing mechanisms strictly de-coupled from high-level applications that rely upon these mechanisms.

The demand for an improved solution in the ATM domain generates a need for the development of a System-wide Information Sharing (SWIS) network based upon adequate and sound concepts. Major contributions are a) the description of the source and target systems in terms of data requirements and functional ranges as well as constraints of the infrastructure, b) algorithms deducing "intelligent plumbing" from semantic descriptions of the exchanged service messages and other non-functional service requirements, like QoS

requirements, c) the definition of an automated and verifiable way to acquire the canonical data exchange model as well as the resulting data flows and interface function calls with respect to an optimized usage of the underlying integration network infrastructure, d) the description of the solution architecture with all functional components, and e) the development of a prototype integration for example applications utilizing the results of the research project. SWIS enables the sharing of information in a highly distributed environment, taking demanding requirements regarding performance, scalability, maintainability, safety and security into account.

Project results:

- » MDA inspired process for transformation of integration requirements into deployable infrastructure configuration
- » Java integration node prototype using Space-based computing paradigms
- » Three-layer ontology-architecture for capturing domain knowledge, infrastructure capabilities, and integration requirements
- » EAI scenario based evaluation of the proposed SWIS approach
- » Industry expert integration effort estimation



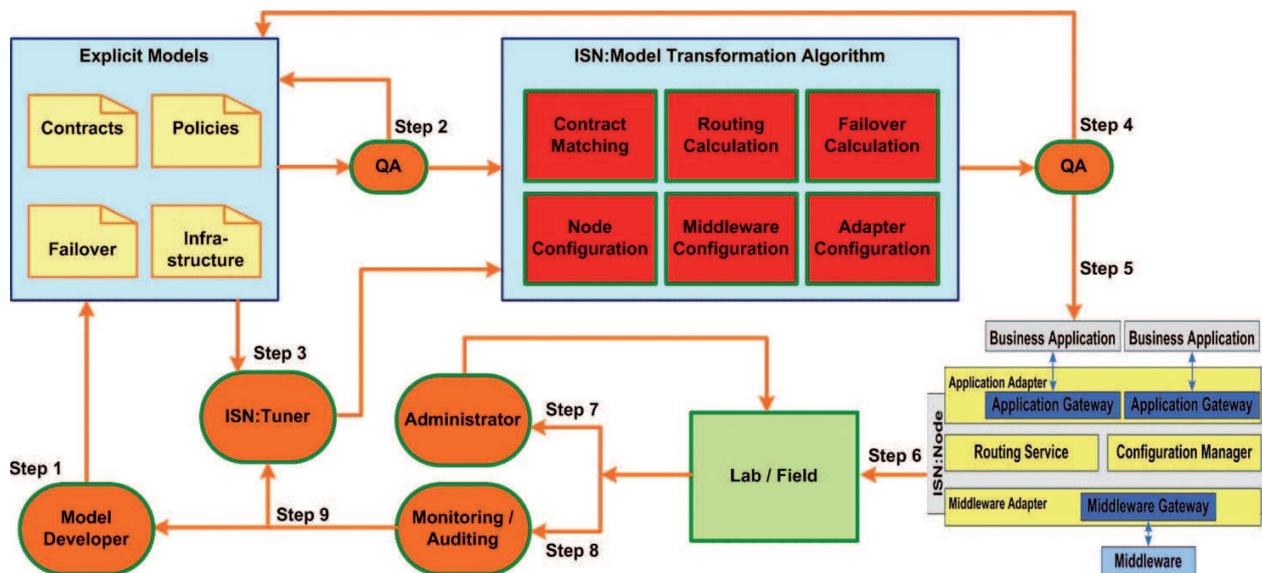
Model-driven configuration and optimization process for safety-critical networks in the Air Traffic Management domain

Project Website

csde.ifs.tuwien.ac.at/csde/csde/swis

Publications

- » Moser, T., Mordinyi, R., Mikula, A. & Biffel, S. (2008) Making Expert Knowledge Explicit to Facilitate Tool Support for Integrating Complex Information Systems in the ATM Domain. In Proc. of the Intl. Conf. on Complex, Intelligent and Software Intensive Systems (CISIS 2009), Fukuoka, Japan.
- » Moser, T., Schimper, K., Mordinyi, R. & Anjomshoaa, A. (2008) SAMOA - A Semi-automated Ontology Alignment Method for Systems Integration in Safety-



Derivation of technical configuration for safety-critical networks from the semantic description of system requirements and infrastructure capabilities

critical Environments. In Proc. of the 2nd IEEE Intl. Wsh. on Ontology Alignment and Visualization, Fukuoka, Japan.

- » Moser, T., Mordinyi, R., Mikula, A., and Biffi, S.: 'Efficient System Integration Using Semantic Requirements and Capability Models: An approach for integrating heterogeneous Business Services'. Proc. 11th Int. Conf. on Enterprise Information Systems, 2009.
- » Kubalik, J., Mordinyi, R., and Biffi S. 2008. Multiobjective Prototype Optimization with Evolved Improvement Steps. In Proceedings of the Eighth European Conference on Evolutionary Computation in Combinatorial Optimisation (March 26 - 28, 2008), pp. 218-229, Napoli, Italy, 2008.
- » Biffi, S., Mordinyi, R., and Schatten, A. 2007. A Model-Driven Architecture Approach Using Explicit Stakeholder Quality Requirement Models for Building Dependable Information Systems. In Proceedings of the 5th international Workshop on Software Quality (May 20 - 26, 2007). International Conference on Software Engineering. IEEE Computer Society, Washington, DC, 6.

People involved

Amin Anjomshoaa, **Stefan Biffi**, Eva Kühn, Marcus Mor, Richard Mordinyi, Thomas Moser

Ambulance Routing Fleet management for Emergency Service Vehicles

Project type:

Austrian Science Fund (FWF) national funding for translational research; academic partner University of Vienna

Project period: 01.01.2006—31.12.2008

Abstract: Many emergency service providers, especially ambulance departments and companies who provide non-public maintenance services, face the problem of providing different types of services with one fleet of vehicles:

- (1) Emergency coverage for a certain region to provide immediate emergency service,
- (2) Efficient regular service: scheduled pick-up and delivery of patients, predetermined service tasks, periodic pick-ups, etc.

This is also the current situation for the largest Austrian regional emergency service providers (e.g., the Austrian Red Cross), where the same fleet is used to provide both emergency and regular transport services. Dynamic emergency aspects thus directly influence the schedule for the regular service. When an emergency occurs and an ambulance is required, the vehicle with the shortest distance to the emergency is assigned to serve the emergency patient. Therefore, it often happens that an ambulance vehicle that has been scheduled for a transport order of a patient, but has not yet started, serves the emergency request. Thus, another vehicle has to be reassigned to the regular patient and the overall regular service schedule has to be re-optimized. Ambulances that carry out emergency transports become available at the hospital after the emergency service and can then be used to carry out

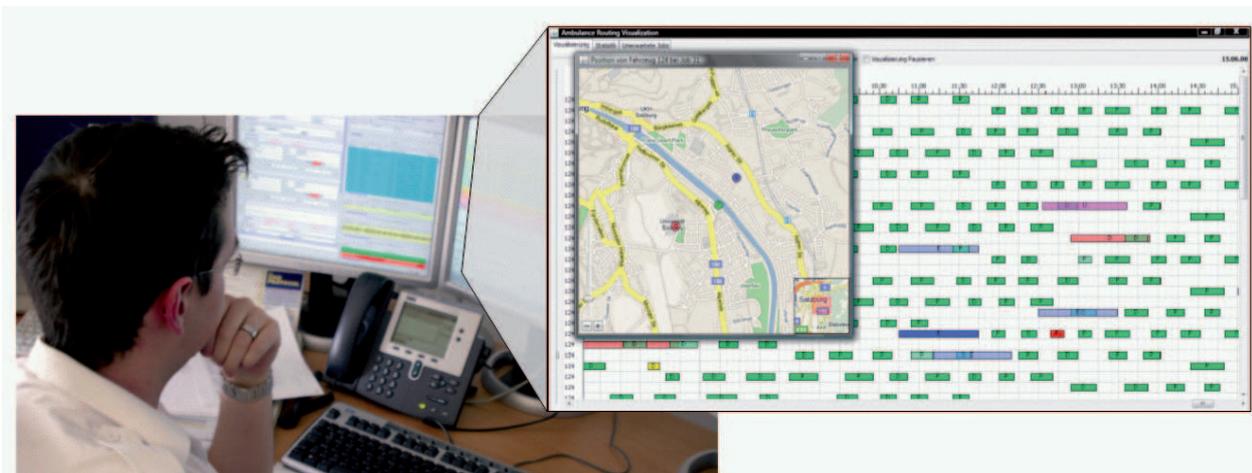
regular transportation orders. Again, the schedule for regular services has to be re-optimized.

Regular transportation services are offered for handicapped persons or patients with minor health problems who cannot use taxi services. When thinking of optimization for ambulance scheduling, we have to consider at least two perspectives. On the one hand, the objective from the perspective of a transportation provider is to minimize the cost of operations. On the other hand, maximizing quality of service is the objective from a patient's point of view. Although both objectives comprise a multitude of factors, we base our investigations on a simplified model of reality. Basically, we use the length of a tour in terms of driving time to model costs, and waiting time of patients to model transportation quality. A tour or route is defined as all the movements of a vehicle over a day of operation.

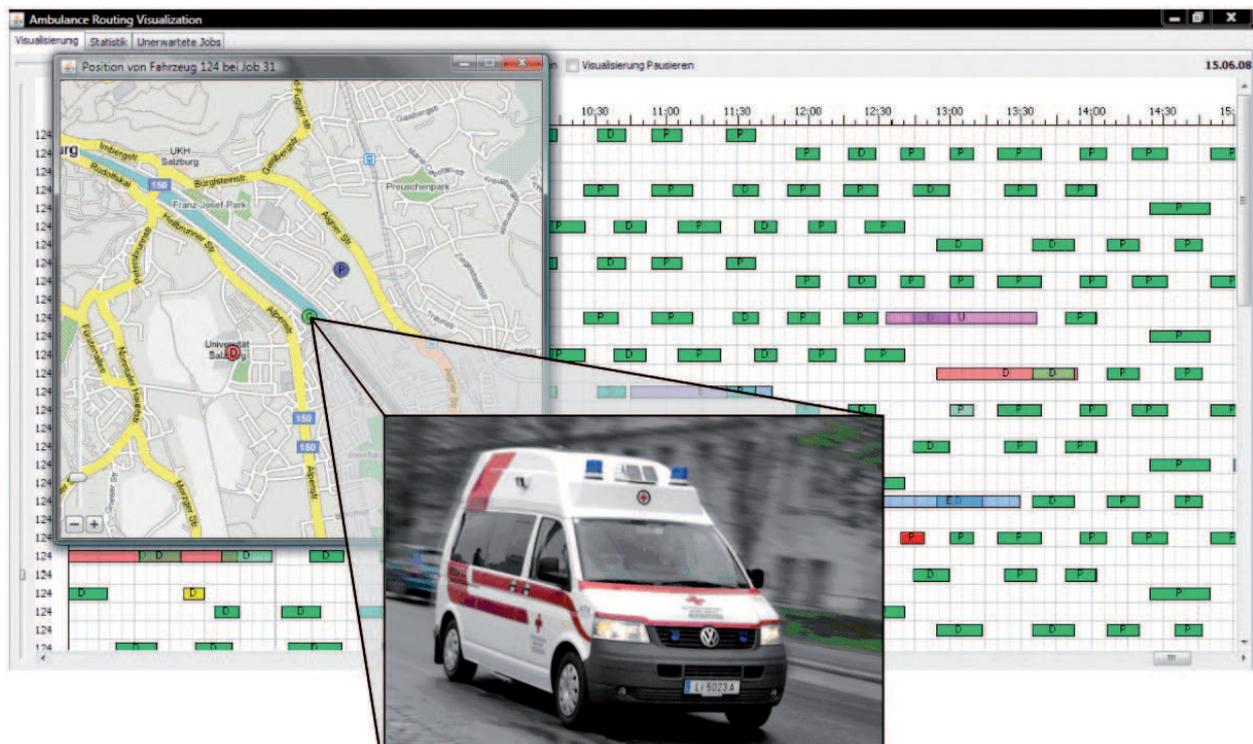
The project dealt with different perspectives on ambulance scheduling, e.g., consideration of expected transportation requests in vehicle scheduling determined from experiences in the past or waiting strategies for maximizing coverage to reduce response times for emergency services. In this contribution we will concentrate on regular transportation services, where a minor part of transportation requests arises dynamically and most of the requests are known beforehand. Emergency requests disturb regular operations, but may be modeled as dynamic requests with high priority.

In addition to the constraints of classic dial-a-ride problems, our problem has the following features:

- 1) Different (hard as well as soft) time constraint types; e.g., dialysis patients must arrive exactly on time because the dialysis machine is reserved.
- 2) Heterogeneous fleet - We deal with a heterogeneous fleet concerning capacities of the vehicles and the different equipment available in the vehicles.
- 3) Dynamic aspects - Some orders are known in ad-



Ambulance dispatcher user interface prototype: map with locations of ambulances and transport targets; bar chart of planned transports for a day



Ambulance route planning: combined optimization of availability for emergency cases and of efficiency for scheduled transports

vance. Additionally, the vehicle availability changes dynamically. The reason is the disappearance and reappearance of vehicles (emergency requests are serviced with the same fleet).

4) Stochastic aspects - Expected return transport orders (relatively long planning horizon), expected availability of vehicles, expected transport orders (relatively short planning horizon, in some cases emergencies occur and most probably additional vehicles are required).

A major goal of the Ambulance Routing project is to demonstrate potential advantages of optimization algorithms in a decision support pilot system for ambulance scheduling. Related work in the field of decision support systems has demonstrated the practical use of optimization for real-world vehicle routing problems. Providing dynamic routing services requires a certain information system infrastructure that integrates positioning systems, wireless communication, and geographic information systems to process necessary inputs for optimization and decision support, which in turn can provide business services useful for dispatchers.

The contributions of this project are twofold. On the one hand, we describe two promising and efficient solution procedures suitable for a bi-objective version of the dynamic "dial-a-ride problem" (DARP) and evaluate the efficiency of these procedures with real-world problem instances.

On the other hand, we review restrictions and constraints for the development of a decision support ex-

ension for ambulance scheduling and suggest a system architecture for integration of our solution procedures into an existing control center system to provide interfaces for future business services.

Project results:

<http://csde.ifs.tuwien.ac.at/csde/csde/ambulanceRoute>

Publications:

- » Kiechle, G. & Doerner, K. (2008). A decision support system for ambulance scheduling. In: Proceedings of the FH Science Day 2008, Linz, Austria.
- » Kiechle, G., Doerner, K. & Biffel, S. (2009). Strategies to support ambulance scheduling with efficient routing services. Proceedings of the 9th International Conference on Business Informatics. Vienna, Austria.
- » Kiechle, G., Doerner, K., Gendreau, M. & Hartl, R. (2009). Waiting strategies for regular and emergency patient transportation. Proceedings of the OR 2008 Conference, Augsburg, Germany.

Software Modules:

- Optimization algorithms library for Dial-a-Ride Problems (patient transportation)
- Demo application for visualization of vehicle schedules
- Data analysis framework for future integration with real-world emergency systems (follow-up project).

People involved:

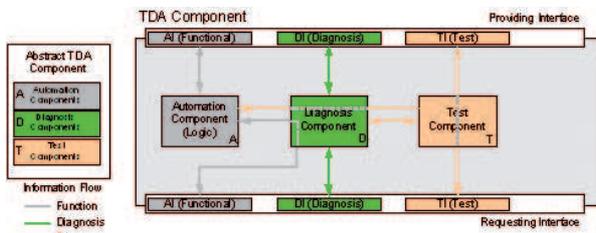
Stefan Biffel, **Günter Kiechle**

Test-Driven Automation in the logi.cals system environment automation

Project type: FFG bridge funding
Industry partners: logi.cals, Messfald

Project period: 01.09.2008—31.12.2010

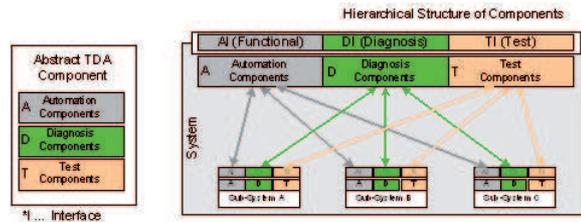
Abstract: „Test-Driven Automation“ is intended to support automation technicians with a new integrated development process that should help them to deal with the increasing complexity of extensive automation projects based on IEC 61131-3 and IEC 61499. During the whole lifetime of a plant, the engineer should be able to use a framework based on test-driven methods (of business IT state of the art), which raises the outcomes quality while concurrently decreasing the amount of work.



Test-Driven Automation Component.

Through adapted quality assurance methods such as unit and module tests based on new reference architecture in conjunction with requirements management, reusability and development of SW product lines are supported. The development process is stabilized for the implementation of later requirement changes as well. With the help of this architecture, a summable connection of automation and test functions with diagnosis and condition monitoring (CM) components is also possible. Plant monitoring is considered to be a largely observing test during the operation of the plant. For test evaluation (diagnosis and CM tasks), appropriate data analysis methods are developed, which are used by automation and service technicians as well as for processing on particular platforms. Test-Driven Automation should fulfill the following aims:

- » increased number of errors found during the engineering phase and, as a result, reduction of found errors in the integration phase by 30%
- » reduction of the start-up time by at least 10%
- » reduction of the diagnosis and CM creation time by at least 35%
- » reduction of errors caused by the change of requirements by 30%



Hierarchical Systems Design: Interaction of TDA Components.

Project results:

Expected project outcomes are SW prototypes as well as domain specific implementations in the area of roll mill technology.

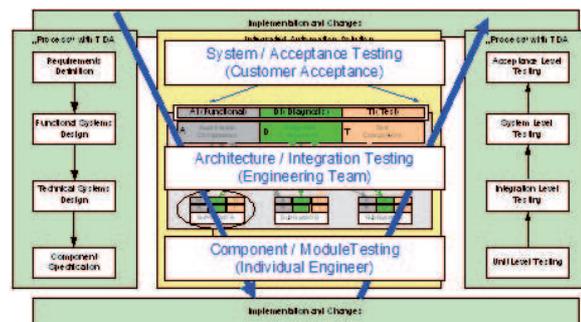
Project Website: www.logidiag.at

Results and publications:

- » Winkler D., Biffli S., Östreicher T.: „Test-Driven Automation – Adopting Test-First Development to Improve Automation Systems Engineering Processes“, Proc of the 16th EuroSPI Conference, Madrid, Spain, 2.–4.09.2009
- » Winkler D., Hametner R., Biffli S.: „Automation Component Aspects for Efficient Unit Testing“, Proc of the 14th IEEE International Conference on Emerging Technologies and Factory Automation, Mallorca, Spain, 22–26.09.2009 (to appear).

People involved:

Stefan Biffli, Dietmar Winkler, Alexander Schatten, Thomas Östreicher



Development Process for Automation Systems with TDA.

SkyDreamer - building simulation tool

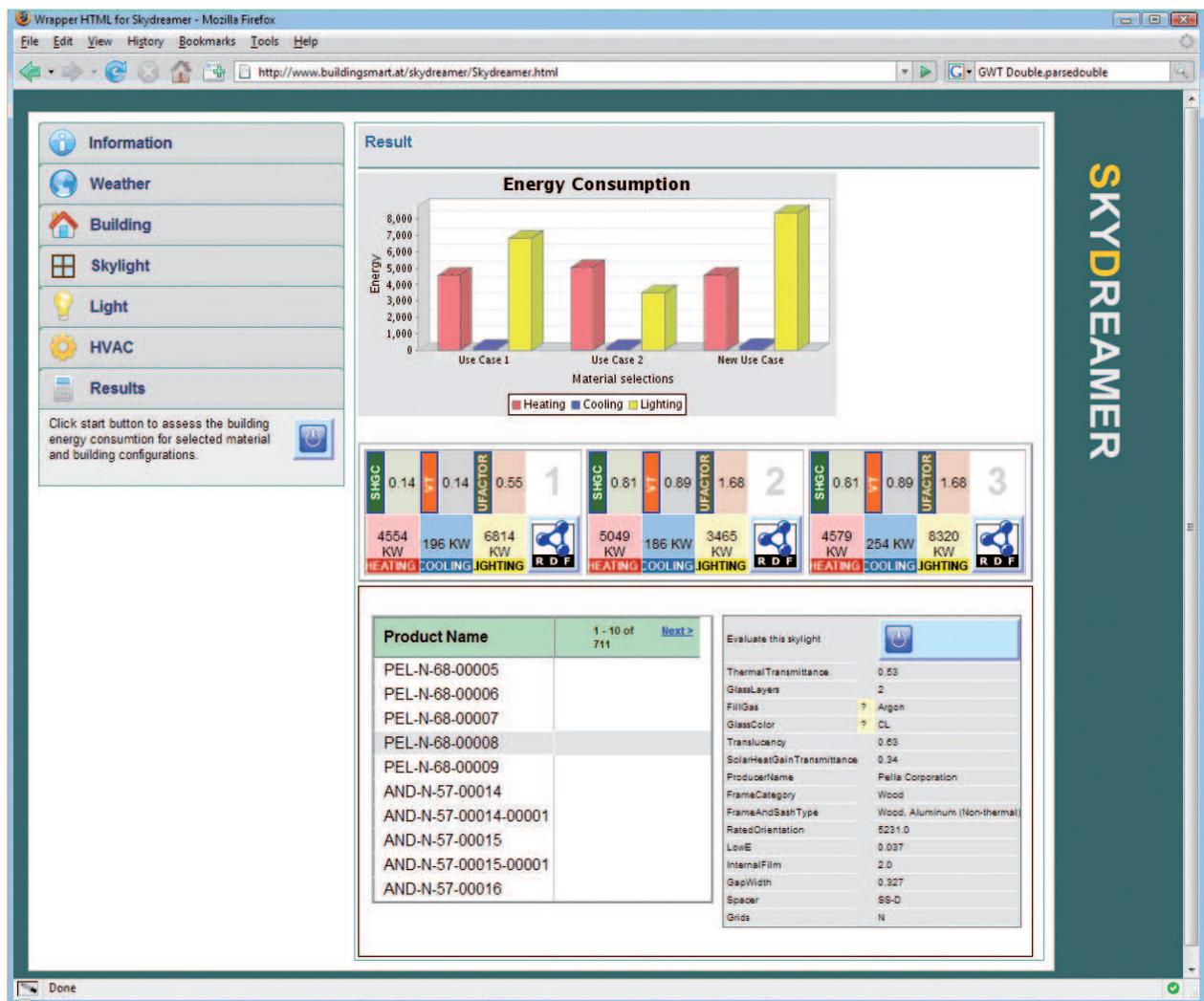
Project type: TU internal (project partner Department of Building Physics and Building Ecology)

Project period: 2008-2009

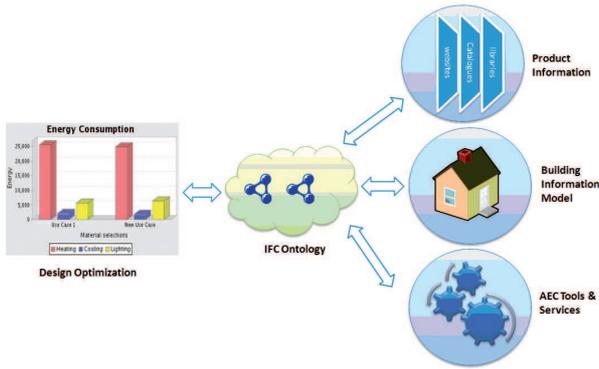
Abstract: The architecture, engineering and construction (AEC) industry is composed of multiple knowledge domains that are formed corresponding to the needed skills and professions. Sharing and exchanging knowledge is the key factor to success in such a collaborative environment; however, the distributed nature of AEC knowledge has led to knowledge gaps between AEC-related domains. Each domain has its own tools and applications and the data exchange between domain applications is not straightforward. In other words, although all the different models of a building are talking about the same object, inter-model communication is done only using the knowledge of expert building

constructors. Moreover, building code standards and regulations should be continuously tested and verified throughout the building design and construction life cycles.

Another important issue in building construction is the proper selection of the products and materials used in construction, which is a critical issue and should be seen from multiple perspectives. On the one hand, product attributes have a great effect on building performance and the comfort of its occupants, and on the other hand, their conformance with building code and regulations need to be considered. In other words, the selection process of a specific product crosses the borders of discrete knowledge domains, and domain expertise is needed to confirm the fitness of a selected product. Moreover, the criteria and conditions of business and economic processes need to be addressed. In order to bridge the communication gap between AEC tools, building regulations and building products, we would need an efficient and formal medium such as Semantic Web and ontologies.



The semantic web based prototype for energy efficient building design



Industry Foundation Classes Ontology bridges the information gap between Information resources and services of AEC (Architecture, Engineering, and Construction) industry

The design principle of the Semantic Web is to provide a collaborative working environment and knowledge exchange in a machine-understandable way. Ontologies that describe the domain concepts and the relationships among them will play a prominent role in the Semantic Web vision. Ontologies contribute to solving the problem of interoperability and shared understanding between software applications of different domains. In a Semantic Web-based AEC environment, the building models of two parties could interact with each other using the ontologies as a common tool to facilitate understanding.

Despite all the potential benefits and advantages of Semantic Web applications in the field of AEC, there are very few research works and prototypes available. In fact, the AEC community is quite conservative when it comes to adopting new technologies. The best proof of this statement is the transition phase from CAD drawings to smart building models, which is not yet completed. CAD drawings are still being used in many countries and accepted as de facto standard for AEC data exchange. The transition from existing building models to smarter building models that can be easily shared and processed between different domains is the next challenge that the AEC industry will be confronted with soon. Providing computational support for this decision making process would benefit the AEC stakeholders in terms of cost reduction, energy efficiency, and occupants' comfort and productivity.

In this research project, the role of the Semantic Web in the AEC industry is explored and a framework is proposed as a solid basis for a semantically-enabled working environment. The proposed framework can be used to overcome the problems stated above. The rich semantics associated with the domain knowledge together with the Semantic Web Services allow bridging the gap between discrete knowledge domains. As a proof of concept, a prototype for a specific skylight product has been presented.

Project results: <http://www.pixdeal.com/skydreamer>

» This project has tried to demonstrate the uniform integration of different resources in AEC/FM fields. More specifically, it shows how elaborate semantic technologies can be used to bridge the knowledge gap between manufacturers' data, building information models, and simulation web services. Semantically enriched process helps the designer to find the desired product through automatic access to the building product libraries.

Publications:

- » F. Shayeganfar, A. Mahdavi, G. Suter, A. Anjomshoaa (2008). Implementation of an IFD library using semantic web technologies: A case study, ECPPM 2008 eWork and eBusiness in Architecture, Engineering and Construction, p. 539 - 544
- » F. Shayeganfar, A. Anjomshoaa, A. Tjoa (2008). A Smart Indoor Navigation Solution based on Building Information Model and Google Android, Computer Helping People with Special Needs, Springer, p. 1050-1056

People involved:

Ferial Shayeganfar, Ardeshir Mahdavi,
Amin Anjomshoaa, A Min Tjoa

DPE: Digital Preservation Europe

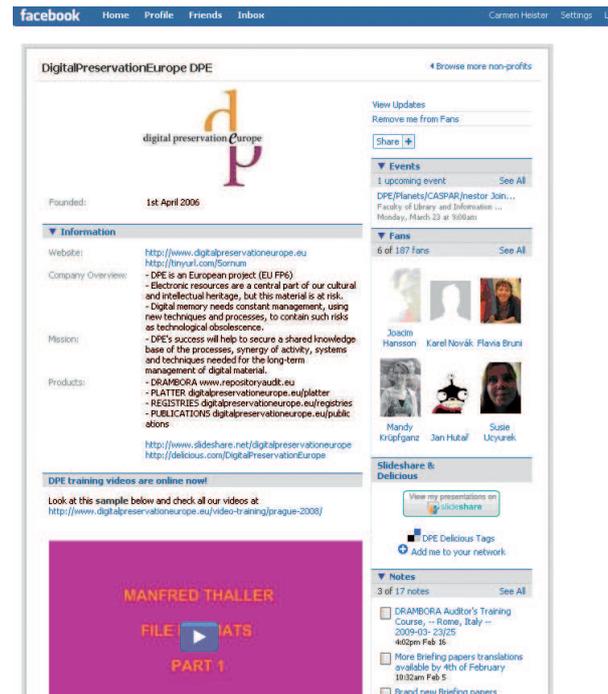
Project type: EU FP6 Coordination Action (C1)
European Commission Directorate-General Information Society Knowledge management and Content creation; Luxembourg; Luxembourg

Project period: 01.04.2006—31.03.2009

Abstract: Electronic resources are a central part of our cultural and intellectual heritage, but this material is at risk. Digital memory needs constant management, using new techniques and processes, to contain risks such as technological obsolescence. Risk begins before a digital record is created and continues for as long as the digital object needs to be retained. Digital preservation is too big an issue for individual institutions or even sectors to address independently. Concerted action at both national and international level is required. DigitalPreservationEurope (DPE) facilitates pooling of the complementary expertise that exists across the academic research, cultural, public administration, and industry sectors in Europe. DigitalPreservationEurope fosters collaboration and synergies between many existing national initiatives across the European Research Area. It addresses the need to improve coordination, cooperation and consistency in current activities to secure effective preservation of digital material.

DPE's project partners lead work to: (a) raise the profile of digital preservation, (b) promote the ability of Member States acting together to add value to digital preservation activities across Europe, (c) use cross-sectoral cooperation to avoid redundancy and duplication of effort, (d) ensure auditable and certified standards for digital preservation processes are selected and introduced, (e) facilitate skills development through training packages, (f) enable relevant research coordination and exchange, (g) develop and promote a research agenda roadmap, and (h) help both citizens and specialist professionals recognize the central role that digital preservation plays in their lives and work. DPE's success will help to secure a shared knowledge base of the processes, synergy of activity, systems and techniques needed for the long-term management of digital material.

DPE has created a research roadmap, which provides a concise reflection of the core research issues for digital preservation. Based on an analysis of ongoing activities and existing research agendas, DPE recommends digital preservation research into 10 focus areas. One of the primary targets of our research activities in DP will be a focus on the automation of processes at all levels, automating processes as well as creating a clear structure for their flexible management. Research into different DP techniques will continue even after the end of the project period, with a specific focus on their interoper-



ability, combining, e.g., virtualization approaches with migration approaches. In order to use cross-sectoral cooperation to avoid redundancy and duplication of effort, DPE created WePreserve, a platform to unite several high-profile research projects, specifically of DigitalPreservationEurope (DPE), Cultural, Artistic and Scientific knowledge for Preservation, Access and Retrieval (CASPAR), and Preservation and Long-term Access through NETworked Services (PLANETS). The three partners are working together to collaborate on the development of training and educational activities, events and programs in Europe, and to support the dissemination of publications and the mechanisms to ensure their visibility, etc.

The project has developed a range of services, the most prominent being PLATTER and DRAMBORA:

DRAMBORA: DPE and the Digital Curation Centre (DCC) developed the Drambora Toolkit, the Digital Repository Audit Method Based on Risk Assessment (DRAMBORA), which presents a methodology for self-assessment, encouraging organizations to establish a comprehensive self-awareness of their objectives, activities and assets before identifying, assessing and managing the risks implicit within their organization.

PLATTER is a Planning Tool for Trusted Electronic Repositories (PLATTER), which provides a basis for a digital repository to plan the development of its goals, objectives and performance targets over the course of its lifetime in a manner that will contribute to the repository establishing trusted status amongst its stakeholders. PLATTER is not in itself an audit or certification tool but is rather designed to complement existing audit

and certification tools by providing a framework that will allow new repositories to incorporate the goal of achieving trust into their planning from an early stage.

TUWIEN activities have been particularly focused on awareness raising and training activities as well as the Digital Preservation Research challenges. To this end, TUWIEN was deeply involved in the research and industrial exchange program (DPEX), which helped institutions to exchange knowledge, best practice and experiences in preservation endeavors. Furthermore, new practitioners in the field of digital preservation had the opportunity to apply their theoretical knowledge in practical settings, obtain specific knowledge from host institutions (e.g., risk assessment, Web archiving) and gain deep insights into other institutions and their work.

TUWIEN also organized the Preservation Challenge of DPE. In the Preservation Challenge, contestants are given access to three to five 'unknown objects' (e.g., a bit stream representing a program, a file, a group of files, or a large scientific dataset), with the task to render them and make them and their content known. In this task, TUWIEN is responsible for organizing the collection of content, the call to participate, the process of judging, and the delivery of the award. Two challenges have already been completed, and a third challenge is currently under way.

Project results:

- » DPE produces and disseminate a series of articles, briefing papers and small fact sheets about many aspects of digital preservation.
- » They are published on the DPE website:
www.digitalpreservationeurope.eu/publications/
The publications are translated into several languages.
- » Support the foundational work on a European-wide preservation masters programme
- » Research and industrial Exchange Programme
www.digitalpreservationeurope.eu/exchange/
- » European Digital Preservation Challenge
www.digitalpreservationeurope.eu/publications/challenge_reports/
- » WE PRESERVE **www.wepreserve.eu/**
- » The DPE Research Roadmap
- » DPE DRAMBORA Toolkit
- » Repository Planning Checklist and Guidance: PLATTER

Publications:

Robert Neumayer, Andreas Rauber, Seamus Ross, and Stephan Strodl. Fostering Collaboration with Digital-PreservationEurope. In Proceedings of the IST Africa Conference 2008, Windhoek, Namibia, May 6 - 9 2008.

People involved:

Christoph Becker, Mark Guttenbrunner, Carmen Heister, Robert Neumayer, **Andreas Rauber**, Stephan Strodl, Natascha Surnic

PLANETS: Permanent Long-Term Access through Networked Services

Project type:

EU FP6 Integrated Project (IP) · European Commission Directorate-General, Information Society, Knowledge management and Content creation; Luxembourg;

Project partners:

The British Library · The National Library of the Netherlands · Austrian National Library · The Royal Library of Denmark · State and University Library, Denmark · The National Archives of the Netherlands The National Archives of England, Wales and the United Kingdom · Swiss Federal Archives · University of Cologne · University of Freiburg · HATII at the University of Glasgow · Austrian Research Centers GmbH · IBM Netherlands · Microsoft Research Limited · Tessella Support Services Plc

Project period: 01.06.2006—31.05.2010

Abstract: The longevity of digital objects used to be taken for granted by many, until in the last decade several instances of spectacular data loss drew the public's attention to the fact that digital objects do not last forever. This awareness has led to the development of various approaches that deal with the question of preserving digital objects over long periods of time. The number of tools that are available for preserving standard types of objects such as images or electronic documents is steadily increasing. However, many of the fundamental issues underlying the longevity of digital content are yet unsolved. The questions of proving the authenticity of an object in a converted representation, of systematically choosing among different choices of actions for treating digital collections, and of automating these decisions, are yet unsolved. Our limited ability to ensure that today's digital information will be

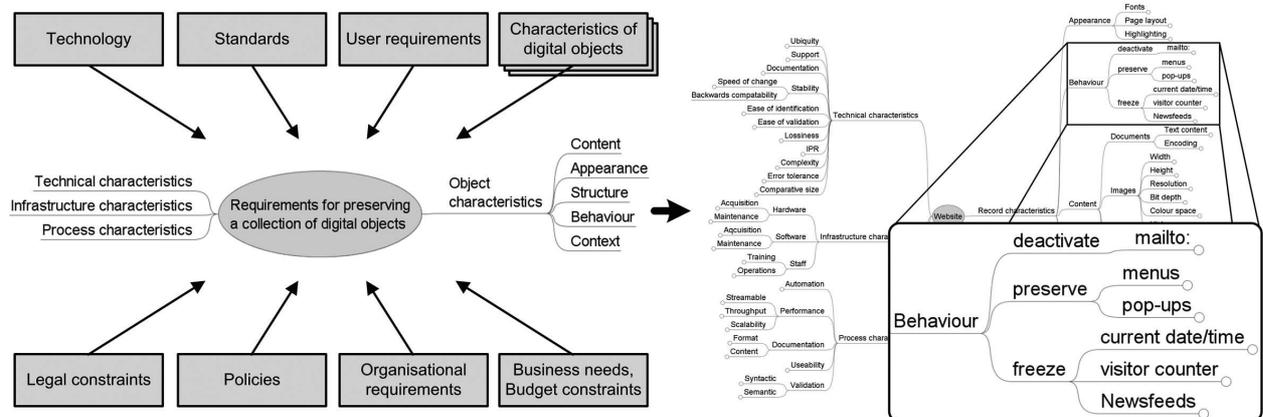
accessible for future generations means they will see a gaping hole in their cultural and scientific record unless we act now. However, meeting the challenge of preserving access goes beyond the capabilities of any single institution.

The objective of PLANETS is to advance the state of research in the field of digital preservation to enable future access to digital material. PLANETS is developing approaches to evaluate and benchmark state-of-the-art approaches for preserving digital content, content extraction and description mechanisms for analyzing the content to be preserved, and a consistent framework for interconnecting these components in a service-oriented architecture. PLANETS systems and tools will support the accessibility and use of digital cultural and scientific resources, specifically through the development of novel concepts, techniques and tools to preserve the availability of digital resources over time. PLANETS brings together complementary expertise: leaders in the practical application of digital preservation technology and the provision of preservation services, as well as leading research institutes and technology vendors.

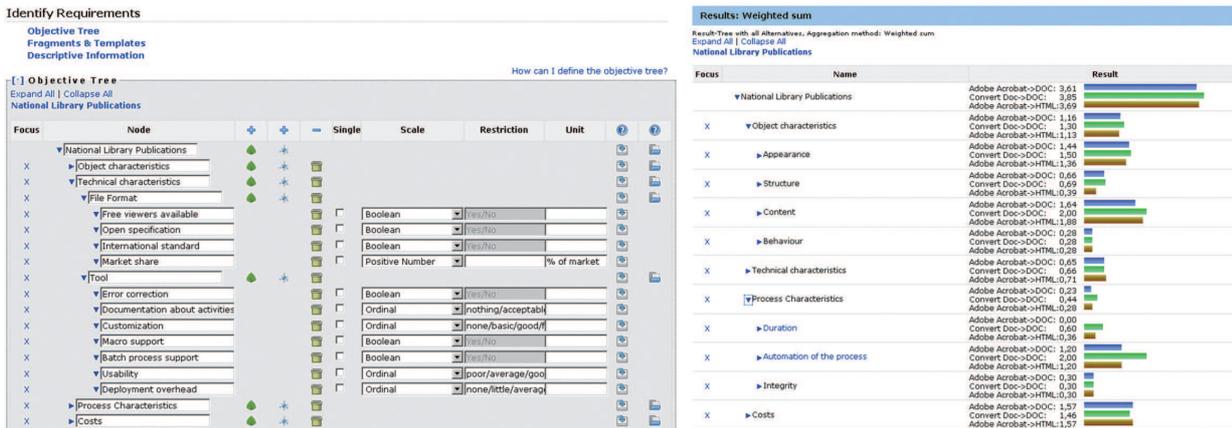
The project is developing

- » planning services to empower organizations to define, evaluate, and execute preservation plans
- » methodologies, tools and services for characterization of digital objects
- » innovative solutions for preservation actions
- » an interoperability framework to seamlessly integrate tools and services in a distributed service network
- » a testbed to provide a consistent and coherent evidence base for the objective evaluation of different protocols, tools, services and complete preservation plans.

The project's sustainable framework enables long-term preservation of digital content, increasing Europe's ability to ensure long-term access to its cultural and scientific heritage. The project enables organizations



From influence factors to requirements trees



Requirements definition and analysis in the planning tool Plato

to improve decision making about long-term preservation, to ensure long-term access to their valued digital content and to control the costs of preservation actions through increased automation and scalable infrastructure. Intensive dissemination and take-up activities ensure the widest possible adoption of results in the user community as well as enabling commercial tool and service providers to compete in a new market place for differentiated preservation services and tools. Many of the challenges of digital preservation derive from the variety of institutional needs, as well as variety and rapid change in the nature of digital content. To meet these challenges, PLANETS is developing a range of tools and services to identify what needs to be preserved, capture the information properties of the resources to be preserved, and handle their multiple digital formats and dynamic behavior. These tools and services will work together in an interoperable framework and be validated in a testbed.

The planning tool Plato is a decision support tool for evaluating potential preservation solutions against specific requirements. It implements a solid preservation planning process and integrates services for content characterization, preservation action and automatic object comparison in a service-oriented architecture to provide maximum support for preservation planning endeavors.

The evaluation of different tools for digital preservation has to rely on validating converted objects and thus on an analysis of the logical structure and the content of documents. The eXtensible Characterisation Languages (XCL) support the automatic validation of object conversions and the evaluation of migration quality by hierarchically decomposing a document and representing documents from different sources in an abstract XML language.

Disaster recovery investigates semantic technologies for content and structure characterization and meta-data extraction. The focus of our current work is the analysis of semantic and organizational relationships between objects to create alternative structured views

of large repositories.

While most of the current work in digital preservation is geared towards large institutions, personal collections are gaining in importance. Based on an analysis of requirements in personal and small-enterprise environments, and supported by available tools and services, we are developing concepts for a future home archiving system to provide digital preservation solutions specifically for digital holdings in the small office and home environment. The system combines bitstream preservation and logical preservation strategies to avoid loss of data and the ability to access and use them. Results of the PLANETS project have been used and had an impact on other related projects, especially in domain-specific case studies such as digital preservation of born-digital photographs, but also in recent projects such as the Research Studio Digital Memory Engineering.

Project results 2007-2008:

The planning tool Plato is freely available at www.ifs.tuwien.ac.at/dp/plato and in use by almost 200 registered users all over the world. It received the “Best demonstration award” at the European Conference on Digital Libraries (ECDL) 2008. Preservation planning tutorials and demonstrations were held at JCDL 2008, ECDL 2008, RCDL 2008, ICADL 2008, IPRES 2008, and other events. Upcoming events include DigCCurr 2009, JCDL 2009, IST Africa 2009, and ECDL 2009. www.PLANETS-project.eu

Publications

» Christoph Becker, Andreas Rauber. Requirements modelling and evaluation for digital preservation: A COTS selection method based on controlled experimentation. In: Proceedings of the ACM Symposium on Applied Computing (SAC'09), Track 'Requirements Engineering'. Honolulu, Hawaii, USA, March 9-12, 2009.

» Stephan Strodl, Christoph Becker, Andreas Rauber. Digital preservation. Yin-Leng Theng, Schubert Foo, Dion Goh, Jin-Cheno Na (eds.): Handbook of Research on Digital Libraries: Design, Development, and Impact. Information Science Reference, February 2009.

» Christoph Becker, Andreas Rauber, Volker Heydegger, Jan Schnasse, Manfred Thaller. Systematic Characterisation of Objects in Digital Preservation: The eXtensible Characterisation Languages. Journal of Universal Computer Science (JUICS), vol 14(18), pp 2936-2952, 2008.

» Mark Guttenbrunner, Christoph Becker, Andreas Rauber. Evaluating Strategies for the Preservation of Console Video Games In: Proceedings of the Fifth international Conference on Preservation of Digital Objects (iPRES 2008). London, UK, September 29-30, 2008.

» Christoph Becker, Miguel Ferreira, Michael Kraxner, Andreas Rauber, Ana Alice Baptista, José Carlos Ramalho. Distributed Preservation Services: Integrating Planning and Actions. In: Research and Advanced Technology for Digital Libraries. Proceedings of the 12th European Conference on Digital Libraries (ECDL'08). Springer Lecture Notes in Computer Science 5173, pp 25-36. Springer Berlin/Heidelberg, 2008.

» Christoph Becker, Hannes Kulovits, Andreas Rauber, Hans Hofman. Plato: a service-oriented decision support system for preservation planning. In: Proceedings of the ACM/IEEE Joint Conference on Digital Libraries (JCDL'08), pp 367-370 Pittsburgh, Pennsylvania, June 16-20, 2008.

» Stephan Strodl, Florian Motlik, Kevin Stadler, Andreas Rauber. Personal & SOHO Archiving Proceedings of the ACM/IEEE Joint Conference on Digital Libraries (JCDL 2008), pp 115-123 Pittsburgh, Pennsylvania, USA, June 16-20, 2008.

» Christoph Becker, Andreas Rauber, Volker Heydegger, Jan Schnasse, Manfred Thaller. A Generic XML Language for Characterising Objects to Support Digital Preservation. In: Proceedings of the ACM Symposium on Applied Computing (SAC'08), Track 'Document Engineering'. Fortaleza, Brazil, March 16-20, 2008.

» Christoph Becker, Günther Kolar, Josef Küng, Andreas Rauber. Preserving Interactive Multimedia Art: A Case Study in Preservation Planning. In: Asian Digital Libraries. Looking Back 10 Years and Forging New Frontiers. Proceedings of the Tenth Conference on Asian Digital Libraries (ICADL'07). Springer Lecture Notes in Computer Science 4822, p. 257-266. Springer Berlin / Heidelberg, 2007.

» Stephan Strodl, Christoph Becker, Robert Neumayer, Andreas Rauber. How to Choose a Digital Preservation Strategy: Evaluating a Preservation Planning Procedure. In: Proceedings of the ACM/IEEE Joint Conference on Digital Libraries (JCDL'07). Vancouver, British Columbia, Canada, June 2007.

People involved:

Christoph Becker, Riccardo Gottardi, Mark Guttenbrunner, Carmen Heister, Michael Kraxner, Hannes Kulovits, Thomas Lidy, Rudolf Mayer, Florian Motlik, Robert Neumayer, Georg Pözlbauer, **Andreas Rauber**, Kevin Stadler, Stephan Strodl, Natascha Surnic

DaVis – Data mining and visualisation

Project type:

Third-party funds

Project period: 01.01.2004–31.10.2008

Abstract: The DaVis project was a joint project with a company active in the oil field exploration business. The main goal was to provide consulting on the feasibility of several techniques from the domains of data mining, machine learning, and information visualization, which were then employed to support the user in analyzing large amounts of data, the majority stemming from sensors. Assistance and consulting with implementing these methods in a software product for clients was an integral part of the project as well.

The methods chosen were, among others, clustering-based approaches such as the self-organizing map (SOM), complemented with other techniques to facilitate the explanation of the generated mapping, such as Ward's clustering and decision trees. Additionally, concepts for combining supervised with unsupervised techniques were designed, e.g., the combination of self-organizing maps with Bayesian networks.

Several new visualization techniques for self-organizing maps were developed, targeted in particular at users from engineering domains using concepts familiar to them.

Publications:

- » Georg Pözlbauer, Michael Dittenbach, Andreas Rauber. Advanced visualization of Self-Organizing Maps with vector fields. *Neural Networks*, 19(6-7): 911-922, July-August 2006
- » Georg Pözlbauer, Michael Dittenbach, and Andreas Rauber. Gradient visualization of grouped component planes on the som lattice In Marie Cottrell, editor, *Proceedings of the Fifth Workshop on Self-Organizing Maps (WSOM'05)*, pages 331-338, Paris, France, September 5-8 2005.
- » Georg Pözlbauer, Michael Dittenbach, and Andreas Rauber. A visualization technique for self-organizing maps with vector fields to obtain the cluster structure at desired levels of detail In *Proceedings of the International Joint Conference on Neural Networks (IJCNN'05)*, pages 1558-1563, Montreal, Canada, July 31 - August 5 2005. IEEE Computer Society.
- » Georg Pözlbauer, Andreas Rauber, and Michael Dittenbach. A SOM-view of oilfield data: A novel vector field visualization for self-organizing maps and its applications in the petroleum industry In Klaus Tochtermann and Hermann Maurer, editors, *Proceedings of the Fifth International Conference on Knowledge Management (I-KNOW'05)*, pages 502-509, Graz, Austria, June 29 - July 1 2005. J.UCS - Journal of Universal Computer Science.
- » Georg Pözlbauer, Andreas Rauber, and Michael Dittenbach. Graph projection techniques for self-organizing maps In Michel Verleysen, editor, *Proceedings of the European Symposium on Artificial Neural Networks (ESANN'05)*, pages 533-538, Bruges, Belgium, April 27-29 2005. d-side publications.

People involved:

Rudolf Mayer, Georg Pözlbauer, **Andreas Rauber**

FODOK Austria: Austrian Research Documentation

Project period: 01.07.2006–30.06.2009

Abstract: FODOK Austria integrates the common parts of the Austrian Research Documentation systems of Austrian universities and academies of arts into one central portal. In this way, it facilitates the search for publications, projects, presentations, and other scientific research outcomes on a country-wide scale. The search portal goes beyond being a simple search engine by providing a rich metadata structure that allows searching for different criteria, such as authors, departments and universities, or scientific research areas. To support this, an interface for periodic data export in a standardized format has been implemented. Additionally, an automatically created knowledge map gives a visual interface for exploring the documents. This map makes it possible to easily find documents that are related to each other, even if they do not share the same common key terms users might use for a standard search. The map can also be utilized to display the results of a common keyword-based search, and thus show the relations and structures in the search results.

The knowledge maps are based on self-organizing maps (SOMs). This has the advantage that the map can automatically be re-created at periodic intervals, even if the set of documents in the collection changes significantly.

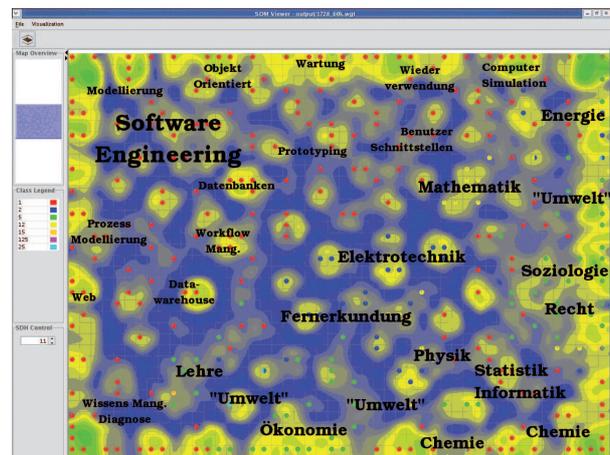
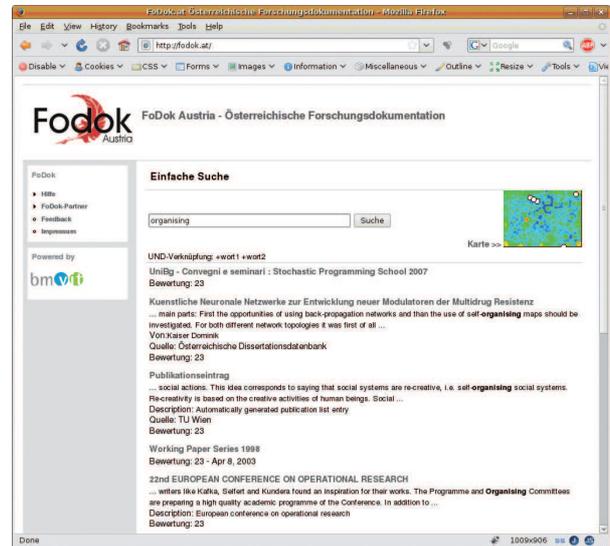
The system can be accessed at www.fodok.at

Publications:

- » Rudolf Mayer and Andreas Rauber. Adding SOMLib capabilities to the Greenstone Digital Library System. Proceedings of the 9th International Conference on Asian Digital Libraries, Kyoto, Japan, November 27-30, 2006. LNCS 4312, pp 486-489, Springer.
- » Rudolf Mayer, Angela Roiger, and Andreas Rauber. Map-based Interfaces for Information Management in Large Text Collections. Journal of Digital Information Management, 6 (2008), 4, pp 294-302.

People involved:

Rudolf Mayer, **Andreas Rauber**



Delos

Project type:

European Commission Directorate-General Information Society Knowledge management and Content creation; Luxembourg; Luxemburg, FP6 Network of Excellence (NoE)

Partners: 47 partners all over Europe

Project period: 01.01.2004—31.12.2007

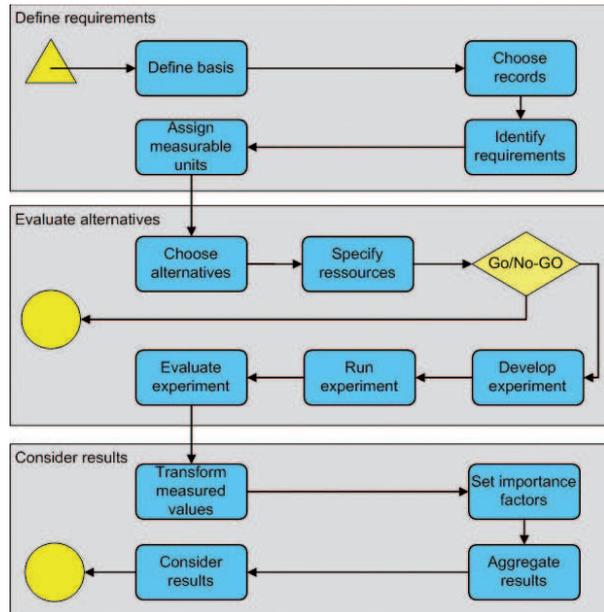
Abstract: EU FP6 Network of Excellence on Digital Libraries: The DELOS network, started in January 2004, conducted a joint program of activities aimed at integrating and coordinating the ongoing research activities of the major European teams working in Digital Library-related areas with the goal of developing the next generation of Digital Library technologies. The focus of our contributions was on work package 3: “Audio/Visual and Non-Traditional Objects”, and on work package 6: “Digital Preservation”.

In work package 1 “Digital Library Architecture”, we contributed with the integration of music feature extraction algorithms and Web services into the DELOS Digital Library Management System, and a Web interface for the training and creation of music maps for access to music collections over the Web.

In work package 2 “Information Access and Personalization”, we implemented the export of the music features into an (MPEG7-like) XML description format for integration into the CNR MILOS Multimedia Digital Library system. MILOS stores the descriptors in an XML database and is able to index the data and provide it via an XML service to Digital Library Applications.

In work package 3 “Audio/Visual and Non-traditional Objects”, work focused on providing modules for the CoCoMA (Content and Context Aware Multimedia Content Retrieval, Delivery and Presentation) framework, such as content-based audio, video, and image features (MPEG7, etc.), a feature extraction engine, and search services. Most of these services were also provided as Web services, to be used from within other frameworks.

Work package 6 “Digital Preservation” (www.dpc.delos.info) focused on research on the methodological framework and theory in order to ensure that digital libraries research addresses preservation issues, and that digital libraries incorporate preservation elements in their designs. TUWIEN developed the DELOS Digital Preservation Testbed for testing and validating digital preservation strategies. It is based on utility analysis to evaluate the performance of various solutions against well-defined objectives, and facilitates repeatable experiments in a standardized laboratory setting.



Project results:

DELOS Digital Preservation Testbed
www.ifs.tuwien.ac.at/dp/testbed.html
 Report on a framework for documenting the behaviour and functionality of digital objects and preservation strategies. DELOS Summer Schools on Preservation 2005, 2006, 2007

People involved: Christoph Becker, Doris Divotkey, Jakob Frank, Thomas Lidy, Rudolf Mayer, Dalibor Mitrovic, Robert Neumayer, Georg Pözlbauer, Carl Rauch, Stephan Strodl, **A Min Tjoa**, Matthias Zeppelzauer, **Andreas Rauber**

MUSCLE

Multimedia

Understanding through Semantics, Computation and Learning

Project type:

EU FP6 Network of Excellence (NoE)

Project period: 01.01.2004—29.2.2008

Abstract: MUSCLE was a Network of Excellence on multimedia understanding through semantics, computation and learning, partially funded by the European Commission under the 6th Framework Programme from 2004 to 2008. The main objective of the MUSCLE Network of Excellence was to conduct a joint program of research activities in order to foster close collaboration and integration between research groups in the field of multimedia data mining on the one hand and machine learning on the other, thus creating a network of different research communities at a European level.

The MUSCLE Network of Excellence had actively brought together 45 leading research teams in the field of multimedia analysis. It aimed at making breakthrough progress towards the following objectives:

Harnessing the full potential of machine learning and cross-modal interaction for the (semi-) automatic generation of robust metadata with high semantic value for multimedia documents.

Applying machine learning for the creation of expressive, context-aware, self-learning, and human-centered interfaces that will be able to effectively assist users in the exploration of complex and rich multimedia content.

Improving interoperability and exchangeability of heterogeneous and distributed (meta)data by enabling data descriptions of high semantic content (e.g., ontologies, MPEG7 and XML schemata) and inference schemes that can reason about these at the appropriate levels.

To stimulate cohesion, the Network set itself two grand challenges. These were ambitious research projects that involve the whole spectrum of expertise represented within the consortium.

Grand Challenge 1: Natural high-level interaction with multimedia databases. In this vision it was possible to query a multimedia database at a high semantic level. This challenging problem involved a wide range of techniques: natural language processing, interfacing technology, learning and inferencing, merging of different modalities, federation of complex metadata, appropriate representation and interfaces, etc.

Grand Challenge 2: Detecting and interpreting humans and human behavior in videos. Many important applications of multimedia data mining revolved around the detection and interpretation of human behavior. Applications were legion: surveillance and intrusion detection, face recognition and registration of emotion or affect, automatic analysis of sports videos and films, etc. A major challenge was the integration and interpretation of various modalities such as vision, audio and speech.

The focus of the contribution of TU Vienna laid particularly in the field of single modality processing, especially in the fields of text and audio analysis, with the aim of integration of these modalities and evaluation of multimodal approaches. In particular, research at TU Vienna centered on the detection of high-level semantics from audio tracks, in particular music, using a range of machine learning techniques, and the cross-modal integration of textual analysis and image analysis. These techniques were integral to multimodal recognition and retrieval applications for multimedia databases and also play an integral part in the analysis of video content.

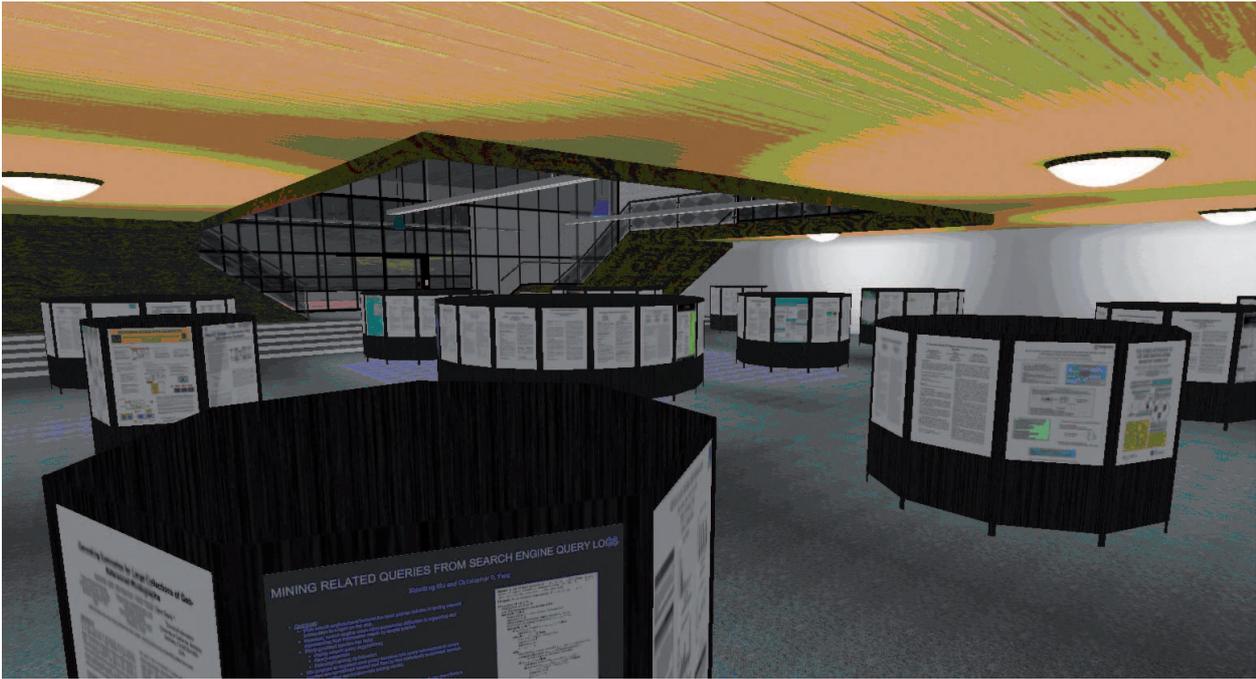
The project's results were disseminated in numerous publications and books as well as at a range of public events: workshops, summer schools, the MUSCLE Conference, as well as exhibitions and industrial fairs (CeBIT, CeBIT Eurasia, IBC, Intersec). TU Vienna, together with the E-Commerce Competence Center EC3, initiated "Beyond MUSCLE", a virtual reality world in which MUSCLE project results were sustained and presented to the public.

Project results:

www.muscle-noe.org

Publications:

- » Georg Pözlbauer, Thomas Lidy and Andreas Rauber: Decision Manifolds - A supervised learning algorithm based on Self-Organization. In: IEEE Transactions on Neural Networks, Volume 19, Issue 9, September 2008
- » Sanni Siltanen, Charles Woodward, Seppo Valli, Petri Honkamaa, Andreas Rauber, Jakob Frank, Thomas Lidy and Robert Neumayer: Natural / Novel User Interfaces for Mobile Devices (Book Chapter). In: Multimodal Processing and Interaction: Audio, Video, Text, Series "Multimedia Systems and Applications", Springer, August 2008
- » Ronald Genswaidner, Helmut Berger, Michael Dittenbach, Andreas Pesenhofer, Dieter Merkl, Andreas Rauber and Thomas Lidy: A Synthetic 3D Multimedia Environment (Book Chapter). In: Computational Intelligence in Multimedia Processing: Recent Advances, Series "Studies in Computational



MUSCLE Scientific Showroom in SecondLife

Intelligence”, Springer, April 2008.

- » Thomas Lidy and Andreas Rauber: Classification and Clustering of Music for Novel Music Access Applications (Book Chapter). In: Machine Learning Techniques for Multimedia, Springer, February 2008.
- » Veronika Zenz and Andreas Rauber Automatic Chord Detection Incorporating Beat and Key Detection Proceedings of the 2007 IEEE International Conference on Signal Processing and Communications (ICSPC 2007)
- » Thomas Lidy, Andreas Rauber, Antonio Pertusa and José Manuel Ñesta Improving Genre Classification by Combination of Audio and Symbolic Descriptors Using a Transcription System Proceedings of the 8th International Conference on Music Information Retrieval (ISMIR 2007)
- » Robert Neumayer and Andreas Rauber. Multi-modal music information retrieval - visualisation and evaluation of clusterings by both audio and lyrics. In Proceedings of the 8th Conference Recherche d'Information Assistée par Ordinateur (RIAO'07), Pittsburgh, PA, USA, May 29th - June 1 2007
- » Robert Neumayer and Andreas Rauber. Integration of text and audio features for genre classification in music information retrieval. In Proceedings of the 29th European Conference on Information Retrieval (ECIR'07), pages 724-727, Rome, Italy, April 2-5 2007.

All MUSCLE publications available from:

www.muscle-noe.org/component/option,com_preprints/Itemid,121/

List of MUSCLE Books:

www.muscle-noe.org/content/view/41/49/

Text Analysis Tools:

www.ifs.tuwien.ac.at/mir/muscle/del/text_analysis_tools.html

Audio Description and Recognition Tools:

www.ifs.tuwien.ac.at/mir/muscle/del/audio_tools.html

MUSCLE Data and Software Repository:

muscle.prip.tuwien.ac.at/download_upload.php

VideOlympics:

www.videolympics.org

Movie Summarisation and Skimming:

www.muscle-noe.org/content/blogcategory/19/64/

Real-Time Audio-Visual Automatic Speech Recognition:

<http://www.muscle-noe.org/content/view/143/64/>

MUSCLE Virtual Showrooms (in SecondLife):

www.muscle-noe.org/content/view/142/64/

Further Showcases are available on:

<http://www.muscle-noe.org/content/blogcategory/19/64/>

People involved:

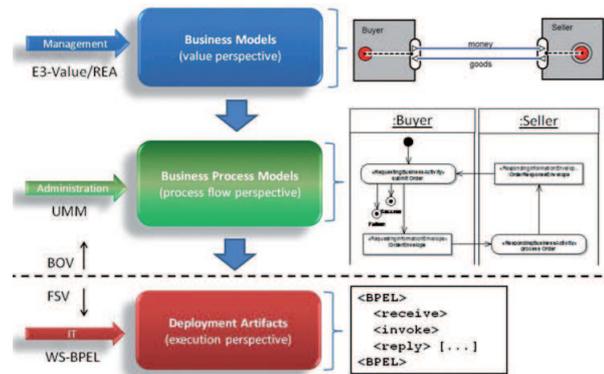
Jakob Frank, Thomas Lidy, Rudolf Mayer, Robert Neumayer, Georg Pözlbauer, **A Min Tjoa, Andreas Rauber**



The **Electronic Commerce** Group follows two research streams:

In the B2B domain, business (process) modeling and, consequently, the definition, specification and implementation of e-business systems are at the focus of our research. Here we combine Semantic Web research with service-oriented architectures (SOA); especially the derivation of Web services from business process models, with a major emphasis on collaborative business processes. A further focus of research is on workflow management and the transformation of process flows to workflow descriptions. Finally, in the domain of Semantic Web, we look at ontology engineering and information integration.

In the B2C domain, the group looks at new interaction paradigms using 3D collaborative environments as well as mobile applications. Here special emphasis is given to application domains such as e-tourism and cultural heritage.



Business Semantics on Top of Process Technologies

PCP – Personal Competence Profiles

Project type:
TU internal

Project period: start (2007) ongoing

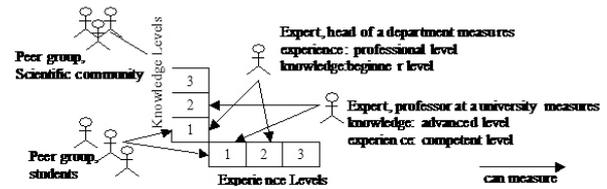
Abstract: Competence management is an approach for managing staff based on their capabilities (theoretical knowledge, practical experience and mental abilities). Companies typically distinguish four functions in human resource management: requirements planning (derived from strategic decisions), recruiting of personnel (derived from requirements planning), development of human resources (planning the education of staff members to satisfy requirements) and allocation of personnel to jobs or projects. Since in our society people frequently change their company and/or do projects for different customers, these people have to offer their skills in a flexible and trustworthy way. It is not sufficient to indicate these skills in social networks such as XING, because not only is it difficult to evaluate one's own abilities objectively, but some people may also exaggerate their skills in order to get a certain job offer. Students acquire different competences at university, and after finishing their studies they start looking for positions in companies that are perhaps searching for new staff with these competences. This process could be supported by personal competence profiles where the university, personnel consultants or previous employers can certify that the person in question has the competences indicated, either because they were acquired there or because these organizations have been able to verify or measure them in some way.

Target audience of the project contributions

The first target audience are students who plan which competencies they should acquire in order to get certain positions in the industry. With verified competences, students have better opportunities on the labor market. However, the solution is also intended to support lifelong learning so that people can also get information about new trends and competencies that they should develop further in order to remain up to date in their field. Therefore, in general, the target audience of the project are people working in knowledge-intensive domains.

Scientific and practical goals to reach/challenges to overcome

The main challenge of the project is to obtain a language for expressing competences in a way that is understandable by different parties and to measure competencies in an objective, transparent, valid and reliable manner. Additionally, learning objects (i.e., educational offers) must be described in such a way that those at whom an offer is targeted can see whether they have the required competences to be able to use



Measuring competences on three levels

this offer and whether they will obtain competences they are interested in. This is supported by consistency mechanisms (relations between different competences, a temporal model of competence aging, and an evidence model).

Expected improvements with measurable criteria for improvement (e.g., new capabilities; more accurate methods; faster, more effective or efficient process)

We expect that a more accurate model of the competence of students can be given to potential employers and that better goal-oriented learning will be possible for students. Moreover, criteria for the measurement of soft skills will be developed.

3 to 5 most important expected scientific contributions (e.g., contributions to analysis, modeling, visualization)

A coherent semantic modeling approach for competences with relations between competences and other concepts such as learning objects (course, book, e-learning unit, project, ...), proof of acquired skills (measurement, examination, project, ...), job descriptions, etc., is to be developed. A focus will be on a competence algebra enabling the computation of competences from different proofs. Furthermore, algorithms for combining certificates (evidence of the presence of a certain competence) from different issuers are expected.

Expected practical (long-term) benefits for target audience and scientific communities

In the long run, the proposed approach may be applied to lifelong learning and the curricula at universities may also be defined in a more flexible way, because the formal degree becomes less important with a competence-based approach to learning, recruitment and staffing. A further expectation is that educational organizations will offer courses and other learning objects from which people may select in a semi-automated way.

Project results by end of 2008

A competence model was defined to support different functional requirements and a first prototype was developed showing the derivation of competencies from passed courses in the information system study and the measurement of soft skills. An ontology was developed defining competences and related concepts. An exchange of competence profiles is implemented with HR-XML, an international standard for exchanging personal data.

<http://dbai.tuwien.ac.at/cms>

Publications:

- » Dorn, J. and M. Pichlmair and K. Schimper and H. Tellioglu (2008) Supporting Competence Management in Software Projects, in Proceedings of International Conference on Concurrent Enterprising, Lisboa, pp. 451 - 458
- » Dorn, J. and T. Naz (2008) Structuring Meta-search Research by Design Patterns, in Proceedings of International Computer Science and Technology Conference, San Diego
- » Pichlmair, M. and J. Dorn (2008) Evaluation of Competence Management at Universities, in Proceedings of International Conference on Knowledge Management (ICKM 2008), Columbus, Ohio
- » Nirschl, F. and M. Fuchs and J. Dorn (2008) A Quantitative Competence Model for e-Recruiting and Team Building in Safety Critical Domains, in Proceedings of International Conference on Concurrent Enterprising, Lisboa, pp. 459-466
- » Dorn, J. and Naz, T. (2007) Integration of Job Portals by Meta-search, in Proceedings of 3rd International Conference on Interoperability for Enterprise Software and Applications Funchal, Portugal
- » Dorn, J. and Pichlmair, M. (2007) A Competence Management System for Universities, in Proceedings of European Conference on Information Systems St. Gallen, pp. 759-770
- » Dorn, J., Naz, T. and Pichlmair, M. (2007) Ontology Development for Human Resource Management, in Proceedings of International Conference on Knowledge Management Vienna, pp. 109-120
- » Dorn, J. and Naz, T. (2006) Meta-search in Human Resource Management, International Journal on Social Science, 1(2), pp. 105-110

People involved:

Jürgen Dorn, Markus Pichlmair, Tabbasum Naz, Hilda Tellioglu

TechScreen Knowledge Sharing in Social Networks

Project type:

partly funded by Hochschuljubiläumsfond, TU internal

Project period: start (2008/5)

Abstract: Technological knowledge on Internet and related technologies is rapidly growing. New standards by W3C and other standardization bodies are published regularly, new open source components of frameworks are continuously developed by the Apache Software Foundation and others, and many software artifacts are provided in repositories such as the Free Software Directory of Free Software Foundation (<http://directory.fsf.org/>) or Sourceforge (<http://sourceforge.net/>). New releases of standard software by large software vendors are also offered at short intervals. Many small companies and organizations struggle to be able to adequately use the latest technologies demanded by their customers. Open source content management systems, AJAX (Asynchronous JavaScript and XML), Web services or technologies for accessible Web page design are recent challenges for developers. Although there is considerable knowledge on the Internet, there is usually not enough manpower to evaluate the different technologies and to decide which one to use in a certain environment. TechScreen is a publicly funded project that tries to develop a community that supports sharing of knowledge (especially experience) about Internet technology. The provided portal enables the finding of explicit knowledge expressed in users' submissions, but focuses more on the implicit knowledge of its users. Using mining techniques, a competence profile is derived from the submissions that supports the finding of people who are capable of solving certain problems.

Target audience of the project contributions

In the first phase, the system is used by students working on practical problems related to Internet technologies. Especially for students writing their master's thesis, the system makes it possible to find other students working on a related topic and, in this way, supports active knowledge sharing. The system could also be applied in a company working in a similar domain. In a second phase, the sharing of knowledge between organizations is addressed, where mechanisms to protect certain knowledge are required.

Scientific and practical goals to reach/challenges to overcome

The main challenge is to provide services to users that convince users to supply their submissions to the system. From a technological point of view, the efficient indexing and the mining of competences from submissions are the greatest challenges. These challenges will be solved by text mining, social tagging and ontologies.

Semantic knowledge is used to structure the knowledge elicitation (semantic concepts describing problem, solution, and other meta-concepts) and to structure the domain knowledge of the users (Internet technology-related concepts). Further technologies are applied to extract existing knowledge from the Internet to obtain a rich body of explicit knowledge.

Expected improvements with measurable criteria

The system propagates a model of knowledge sharing between users. It should be a goal of university training to teach knowledge sharing. To achieve this goal, users must be satisfied with the provided services and therefore, the most important criterion to be evaluated is user satisfaction.

3 to 5 most important expected scientific contributions

The most innovative scientific contribution of the project is mining of competences from user submissions. Further scientific contributions are in knowledge extraction from the Internet and modeling of user competences.

Expected practical (long-term) benefits for target audience and scientific communities

In the long term, it is expected that a culture of knowledge sharing can be reached for students and that with this cultural change more innovative solutions are created by students as well as by knowledge workers who also change their attitude.

Project results by end of 2008

A first prototype was finished in late 2008 that is used to share knowledge in the knowledge management course. The system is based on a small ontology, open source text mining algorithms, the Drupal content management system and the authorization server of Vienna University of Technology.

<https://techscreen.tuwien.ac.at>.

Publications:

- » Dorn, J. (2008) Social Software (and Web 2.0), in Encyclopedia Of Multimedia Technology and Networking pp. 1327
- » Dorn, J. (2008) Social Tagging, in Web 2.0 in der Unternehmenspraxis, pp. 39-50
- » Dorn, J., Herzog, Ch. and Werthner, H. (2008) TechScreen: Networked Knowledge Management, in Proceedings of Smart Business Networks Initiative Workshop Beijing
- » Dorn, J. and Hochmeister, M. (2009) TechScreen: Mining Competencies in Social Software, in Proceedings of The 3rd International Conference on Knowledge Generation, KGCM 2009, Orlando

People involved

Jürgen Dorn, Martin Hochmeister, **Hannes Werthner**

SemProM

Semantic based Project Management

Project type:

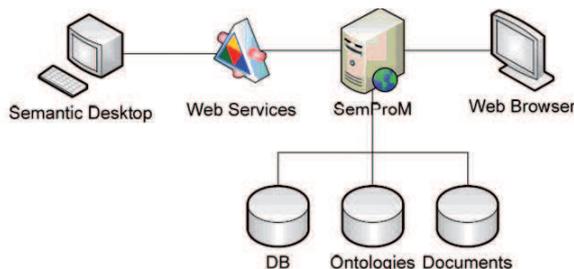
FIT-IT, nur TU Wien

Project period: 01.09.2008—31.08.2011

Abstract: The main goal of SemProM is to enhance Project Management (PM) with semantic technologies and further, to enable an interchange of information between a Semantic Desktop and a Project Management System. Thus, it tackles problems in today's project management systems where information very often gets lost, e.g. nobody knows where to find the needed piece of information or how to find it. One reason is that documents and project data are spread across several systems and computers; another reason is that the search in today's PM systems is either simple keyword or full-text search where you have to know what you are searching for and in addition the relation between various project documents is not recorded in machine accessible form. In consequence, the most important problem in current project management is that many IT projects fail because of bad execution of the project and of neglecting the "rules" of proper project management, even though everyone knows them.

By combining semantic technologies and PM, a reduction of the administration effort and an improved control of the progress of a project are possible. Introducing semantic technologies such as ontologies, semantic annotation of content and semantic search addresses the problems outlined above and opens up new ways of delivering the needed insight and experience of past projects. Relevant information of former projects is consolidated in a knowledge base. With the use of ontologies project members can search for concepts and do not have to search for exact keywords. Furthermore, different information items are set in relationship which simplifies and optimises the search process. All information items for a project are on one platform or at least a relationship exists between the project data on a desktop and on the platform related to a project. With the availability of the knowledge of already finished, running and planned projects the probability to deliver a project in time, in budget and with the specified capabilities is improved.

In addition, an interface between a Semantic Desktop system and the PM system shall be built, thus enabling an up-to-date access to the relevant information of a project. With this interface, relationships between data and information items of projects on multiple systems and information items on a desktop are established. Hence, also the desktop can be searched for project relevant information.



Draft Architecture of SemProM

To enhance an existing PM system with semantic technologies the following sub-goals are relevant.

Definition of a Project Management Domain Ontology and PM related Ontologies

In order to reach the goal of this project, a project management domain ontology and other related ontologies have to be developed. These ontologies concern project related issues (e.g., milestones, tasks), project documents, temporal issues, or project members and their capabilities. All these ontologies are not on the same level, but they support and complement each other. In this context, it must be clearly defined which parts of a PM system will be considered within SemProM. This will be done by use cases and requirement analysis. Starting point is an evaluation of existing ontologies which can be taken, modified or further developed.

Combining Ontologies: Relevant ontologies have to be analyzed if they have to be changed or adapted or if there are any difficulties for combining to due ill-defined interfaces. As a starting point we assume that these ontologies will not be merged, but properly interlinked. They have to be modular, for the sake of a flexible architecture and the extensibility of the system. Consistency: Modified and new ontologies will be designed for extensibility in order to plug in industry specific domain ontologies. Regarding the ontologies in the PM and in the Semantic Desktop system, the consistency between them must be given by adaptation of the Semantic Desktop ontology with the relevant parts of the PM ontologies. Moreover, a general consistency of the system must be given.

Interface Semantic Desktop – Semantic PM

Another very important goal of SemProM is to implement an interface between the client, a Semantic Desktop system and the semantic PM system. The Semantic Desktop system must be extended with a fat-client with the functionalities to search and to set links to PM information as well as editing them. The ontology of the Semantic Desktop must be adapted with parts of the project management ontologies.

Flexible Architecture of the System

To guarantee the success of the project SemProM a detailed architecture of the system has to be designed. This architecture has to be built in a modular and flexible way to allow future extensions. Also all interfaces of this system must adhere to open standards.

Proof of Concept of the PM System

The proof of concept of the PM system includes a prototype of the system with the following parts: ontologies, databases, semantic technologies (metadata, tagging ...), interface to the Semantic Desktop, adaptation of the Semantic Desktop and the functionalities of PM. It also includes the evaluation of SemProM. This project deals with project management in general. But to receive useful test results, SemProM directs its attention to project management for IT projects and in greater depth to the tourism (industry) domain.

Software Modules:

Ontology
Interface Semantic Desktop and Project Management
Design of Architecture
Proof of concept: implementation of the prototype
(Project Management System, Semantic Desktop)

People involved:

Birgit Dippelreiter, **Hannes Werthner**

Semantic Market Monitoring - SEMAMO

Project type: FIT-IT

Project Partners:

electronic commerce group - Vienna University of Technology · e-commerce competence center · liXto

Project period: 15.02 2008—14.02.2010

Abstract: SEMAMO aims at building a technological framework that allows the automatic capturing of market information and the semi-automatic analysis of these data for market research and benchmarking. To automate this process, online data harvesting, semantic domain modeling, and semantically guided (i.e., domain-specific) analysis and reporting technologies are integrated. This framework will be tested in the area of tourism, but can be easily transferred to other sectors due to the underlying domain model.

More specifically, SEMAMO aims at:

- » Building a metadata model that captures the required semantics to enable the interpretation of the market data according to application needs,
- » Sampling of data from Web sources: this will include the learning of properties of the data sources (such as data change frequency) in order to guide the sampling process as well as to update the domain model, making the entire system adaptive,
- » Developing an ontology-driven strategy for cleansing of data, and
- » Developing semantic annotation and analysis methods for product as well as market data.

On a methodological level, SEMAMO will use a semantic approach to adapt practices of market research to the specific requirements of online markets. This includes the important question of how to gather relevant empirical market data from online sources. In this respect, two main problem dimensions have to be addressed, viz.

The assignment of “harvested” product (and attached price) information to identified products, or markets in the narrow sense, for the purpose of direct price comparison (formally, i.e., a classification task assigning collected data to product classes based on product descriptions wrapped from the Web sources), and The (adaptive) decision on how often individual online sources (expressed as URLs) have to be sampled in order to optimize the data collection effort (i.e., to keep the price forecast intervals balanced) by adaptive sampling schemes.

Starting with the assumption that the Web has grown into a faithful mirror of the (economic) world, and that, hence, decision-relevant market information can indeed

be gathered from the Web and analyzed automatically, SEMAMO is an interdisciplinary research effort integrating Semantic Web technologies and statistical methodologies: the customization and automation of the empirical analysis process will be facilitated by explicit application domain models expressed in a suitable formalism comprising the respective subject matter (domain) ontologies. This engenders not only a plain combination, but rather fresh research into the effective integration of both parts. In order to obtain reasonable flexibility of the approach, SEMAMO distinguishes clearly between generic function components independent of specific market analysis tasks, and a configuration component stating the “semantics” of individual analysis domains (such as, e.g., travel package offers). In brief, the specific technological and scientific aims tackled in the project are as follows:

Developing an ontology-driven strategy for data cleansing and rectification assuring that only comparable products and market offers are pooled for comparative analysis.

Learning of sampling strategies of data from Web sources: SEMAMO addresses the need to determine sampling strategies adaptively to generate results with a required confidence value.

Learning of empirical properties of the data sources (e.g., data change frequencies) as well as new structural characteristics (e.g., relationships, new product [descriptions]). This will lead to an update of the semantic domain model, making the system adaptive to changing markets.

Devising a data aggregation model according to interesting aggregation hierarchies, i.e., geographic regions, product categories, bundles, etc., given a specific domain model.

Developing semantic annotation and analysis of product as well as market data, e.g., distribution of offers over a certain time period or over geographic regions.

Developing and implementing semi-automatic analyses – again based on semantically controlled application of statistical analysis functions – of the harvested data.

Building a metadata model that captures the required semantics to enable the interpretation or analysis of the market data according to application needs. The focus will be on a generic framework that can be applied to a number of domains.

Identification of business-critical decisions and how the decision making process can be supported by analysis and reporting tools.

In all this, the essential core of SEMAMO consists in automating the market data analysis process flow, starting

from harvesting online sources through data rectification up to analysis so that both the data harvesting process and the data analysis/reporting stages are directly driven by the subject matter relations defining markets, products, and relevant decision criteria encoded in the semantic domain model of an application. In particular, SEMAMO embodies an adaptive approach to empirical Web data analysis by feeding back derived information (product occurrences, description elements, price variation) into the harvesting and reporting processes, respectively, based on constantly updated domain representations.

In order to achieve its ambitious goals, SEMAMO is based on a range of fields such as Web data extraction, data cleansing and record linkage, (statistical) data analysis and reporting, as well as semantic domain modeling, and market research. The objective is to develop a self-contained framework that allows better understanding, analyzing, and reporting on developments in e-markets. For turning the research effort of SEMAMO, in the longer run, into a marketable tool matching the needs of a wide variety of application domains, e.g., travel industry, electronic consumer goods, fast moving consumer goods, etc., a flexible and scalable component architecture is envisaged. Eventually, as many industry sectors and application scenarios as possible should be covered. Within the SEMAMO project, the domain of e-tourism will be used as a test case, based on the rationale that this market area definitely poses a non-trivial challenge due to its complexity.

Economic Relevance and Potential

In the Internet-based economy, traditional market research methods, including methods of market segmentation and price discrimination, no longer work the way they used to. In particular, the transparency of e-markets and the speed of market changes call for an increasingly comprehensive and quicker monitoring of markets and competition. A natural response to this overall development, advanced information technology – and particularly semantic technologies – provide a means to expand the range of and to accelerate market observation (on both global and local business levels) by reducing the cost of information procurement and, thus, speeding up competitive decision making. In this respect, SEMAMO arguably extends the scope of current business intelligence methodologies and solutions, exploiting the vast potential of semantic technologies to solve a problem of tremendous practical economic relevance unsolved as yet. We expect that the SEMAMO partners will be in an excellent position to leverage project outcomes both scientifically and economically. The economic advantages for potential customers will clearly result from the improved visibility of the electronic distribution channels and the online markets as a whole. According to a 2006 Gartner Research report, on average, a 1% improvement in price translated to an 11% increase in profitability. By contrast, according to the same report, a 1% improvement in fixed costs or in

variable costs only increases profitability by 3% and 7%, respectively. SEMAMO will gather market data required to calculate optimal prices, often leading to substantial price improvements.

The sheer extent of the online market channels no longer allows for a manual observation and analytical activities based on cut-and-paste. In contrast, a systematic approach is required to deliver reliable and predictable results that can be used on a daily basis. Complete market coverage is required to meet the needs of involved product managers/pricing experts. SEMAMO will provide this coverage with a systematic approach towards market intelligence applications. Moreover, the near real-time quality of SEMAMO responds to the fast moving online markets such as travel, perishable goods, and consumer goods. Customers of the envisioned solution will be able to react faster and with improved accuracy to market movements, and will therefore be at the forefront of a more competitive market appearance. The target market for online market monitoring is defined as all companies who intend to or already play significant roles in the relevant online and also offline markets. Other important criteria for segmenting those companies are their current skills in online marketing and their willingness or market pressure to further develop this ability. Specifically large online vendors will be the most likely targets for the potential product. From experience with related systems we can already forecast that the companies with the largest number of business processes to handle and a high degree of organization are usually the first to understand the benefits of SEMAMO.

Industry sectors that will adopt such a solution are characterized by their affinity to online market channels. As of today, the travel industry shows the highest degree of online business. Other industries are electronic consumer products, computer parts, cars and car parts, furniture, fashion, etc. The US e-commerce retail market value is USD 220 billion in total (Forrester Research Inc., 2007). Regionally, among the segments targeted, the German-speaking market ranks first, followed by the French and UK markets. The US market is of course very interesting due to its e-commerce maturity, however, significant investment is needed, too.

Project results by end of 2008

- » Hands-on Prototype
- » Sampling Process
- » Harvest Heuristic
- » Mapping and Cleansing
- » Semantic Domain Model
- » Report Generation
- » Record Linkage and Re-Identification

People involved:

Birgit Dippelreiter, **Hannes Werthner**, Michael Pöttler, Vienna University of Technology. Norbert Walchhofer, EC3.

OnTourism Ontology-based Online Tourism Offer Integration

Project type:
FFG Bridge2

Project partners:
Forschungsverein E-Commerce Competence Center (EC3), Leopold-Franzens-Universität Innsbruck (DERI), austria.info systems GmbH, Lixto Software GmbH

Project period: 01.08.2006–31.03.2008

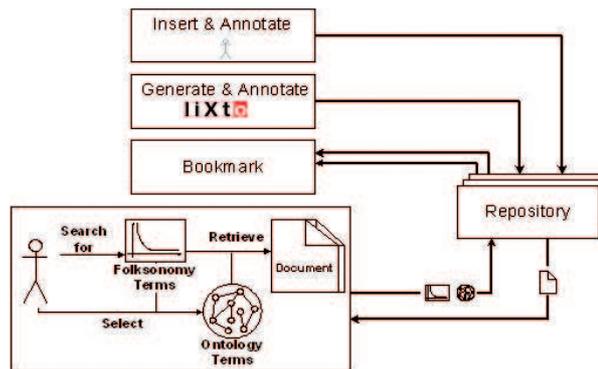
Abstract: The goal of the OnTourism project is to improve information creation, maintenance and delivery in the tourism industry by introducing semantic technologies to this domain. OnTourism follows an evolutionary approach towards technology adoption, extension and benchmarking, since it bases these information-rich processes on principles, concepts and tools of the Semantic Web, and more specifically Semantic Web Services (SWS). All content-related activities such as creation, aggregation and delivery as well as sequences of activities (processes) are seen as services; these services are provided and requested respectively. Describing, publishing, invoking and coordinating these services can be founded on Semantic Web Services technology. In that sense, we bring content-related activities, and with them content management to a higher semantic level. It is a prerequisite for automating content exchange processes and realizing new, intelligent applications.

The OnTourism approach enforces explicit semantic descriptions of content resources, content providers and content requesters by referring to underlying ontologies. However, machine-to-machine communication – as it is envisioned by Web services and Semantic Web Services – is not the only way of communication, especially in e-tourism where content creation and aggregation often require manual tasks (i.e., content editing). The reason is that tourism content delivery on a regional or even national level hardly fits into the picture of integrated, highly automated information supply chains. Therefore, content editing as well as semi-automated and manual content annotation are key elements of content processes.

The main working fields of OnTourism are:

Ontology Management

Since ontologies are the cornerstone of semantic technologies and Semantic Web Services, we will analyze, evaluate and choose means for ontology management in general and specifically for integrating and further developing ontologies for e-tourism (domain ontologies).



System Overview Search

Semantic Content Management

We propose Semantic Content Management as an extension of content management with Semantic Web Services technology; therefore, we employ frameworks, languages and tools of SWS for describing and realizing content management processes.

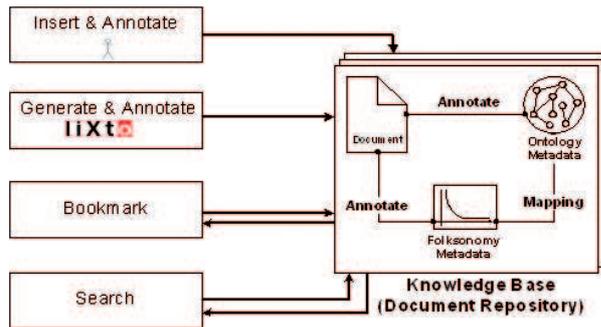
Semantic End-User Applications

Based on ontologies, content delivery services and annotated content, we model, design and implement semantically enriched applications for end-users.

These vertical fields are complemented horizontally by setting up a use case for evaluating all concepts and solutions that will be developed. The reason is that bringing information creation, maintenance and delivery in the tourism industry to the semantic level, thus “ontologizing” the respective information delivery processes, requires substantial modifications to existing process organization and its respective infrastructure. In addition, the development of domain ontologies for tourism is costly and time-consuming due to the number of concepts and relations as well as to the diverse and distributed structure that hinders content integration. Therefore, the evaluation essentially covers both technical and organizational aspects.

In more detail, in the OnTourism project we improve the information aggregation process of Österreich Werbung’s call center by categorizing the customer requests that have to be answered through on-demand online searches and analyzing which information sources are queried in order to provide the caller with the required information. These processes are then automated, using advanced Web extraction techniques to aggregate the information from the identified Web sources. These data are further compiled into comprehensible PDF documents, which can be sent to the customer by e-mail. Information about upcoming events (e.g., cultural or sports events) has been selected as a use case for our approach.

Furthermore, the call center agents need to be able to quickly access the compiled information documents. They have a document repository available for storing



Systemdesign - Metadata

pre-researched information, which supports a semantic search functionality for more precise information retrieval. The automatically generated documents are stored within that document repository and are also automatically annotated with a description of the documents' contents in terms of a formal ontology. This enables a more precise search result with better recall through semantic reasoning.

Project results:

Prototype (see Pictures)

Publications:

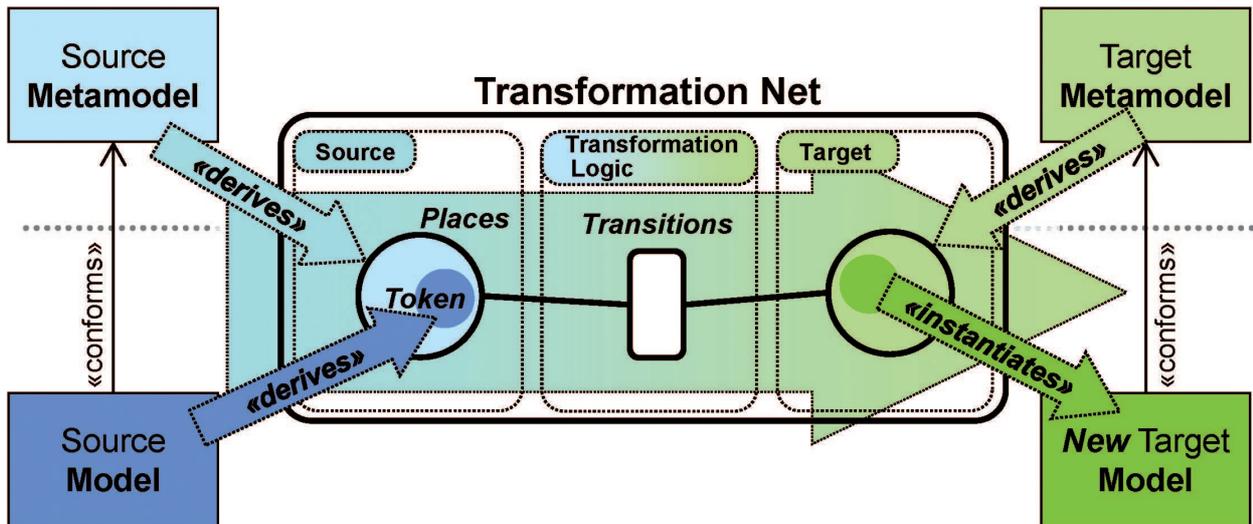
- » C. Herzog, M. Bauer, K. Prantner, H. Werthner, B. Dippelreiter: A Case Study on Automating Information Aggregation Processes in Information Centres"; Information and Communication Technologies in Tourism 2008 Proceedings of the International Conference in Innsbruck, Austria, 2008, W. Höpken, U. Gretzel, P. O'Connor (Hrg.); Springer Vienna, (2008), ISBN: 978-3-211-77279-9; S. 407 - 417.

Software Modules:

- » Ontology Management
- » Semantic Content Management Processes
- » Content Classification and Annotations
- » Tourism Meta Portal

People involved:

Hannes Werthner, Birgit Dippelreiter, Christoph Herzog



Transformation Model with Colored Petri Net

In the reporting period the research areas of the **Business Informatics Group** were investigated along the following lines:

Model-driven engineering is a systematic approach that considers models as first class entities that are created and transformed during a software engineering life cycle. The group has considerable experience in the model-driven development of applications in various fields, and all other research areas of BIG are strongly interlinked with the concepts of model-driven engineering.

Data engineering targets the role of data in the design, development, management and utilization of information systems. Consequently, BIG is interested in using model-driven approaches towards the structural aspects of information systems.

The data-oriented focus on developing information systems is usually accompanied by the concepts of **process engineering**. BIG applies model-driven approaches to the modeling of both intra- and inter-organizational business processes. At BIG, the process engineering aspects are always considered as part of a more holistic business process management approach aligning business strategy and corresponding IT solutions.

Furthermore, BIG promotes a model-driven approach to **Web engineering**, resulting in a systematic development of high-quality Web-based systems and applications.

Finally, BIG is interested in methods, modeling languages and tool support for identifying, defining, and developing services and service applications. BIG believes that a systematic model-driven approach to **services engineering** will overcome the current reality of uncoordinated services in order to realize the full potential of service-oriented architectures.

BSopt - Business Semantics on Top of Process Technologies

Project type:

FIT-IT Semantic Systems (Best Project Proposal 2007)

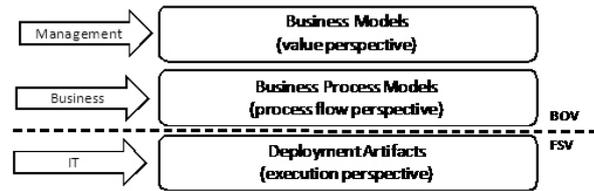
Project partners:

BIG, EC, MediaPrint, BOC Unternehmensberatung GmbH, Thomas Gerhardt, PARADIGMA Unternehmensberatung GmbH

Project period: 01.04.2008—31.03.2010

Abstract: The BSopt project will deliver an integrated methodology for inter-organizational systems ranging from business models and business process models to their execution in a service-oriented architecture (SOA). Integrating business processes into an SOA is certainly a hot topic. However, most current approaches are limited to the technical process aspects, disregarding the economic drivers of the information society. In contrast, BSopt will consider the formalization of the semantics of new business models due to faster changing business environments, their support with appropriate business processes and their implementation in flexible architectures. We will incorporate state-of-the-art approaches to describe business models, business process models and deployment artifacts in SOAs. However, we will go beyond the state of the art by connecting the dots between these approaches, allowing for a semi-automatic mapping between them. This will result in an integrated methodology spanning all layers that is based on a metamodel incorporating the semantics of the assimilated approaches. Furthermore, we demonstrate the customization of the BSopt approach by integrating a domain (= industry) specific ontology on the example of the print media industry. A critical point in reaching user acceptance is tool support for the BSopt methodology. Following advanced software engineering concepts, we will implement the integrated BSopt approach as a software factory based on a so-called domain-specific language (DSL). For this purpose we have to use a meta-modeling tool that allows us to specify the BSopt metamodel within this tool. Furthermore, the software factory will guide a modeler in a wizard-driven style through the BSopt methodology, requiring not as much modeling know-how as in traditional modeling languages such as UML. The meta-modeling tools being used in BSopt are the Microsoft DSL tools for Visual Studio and ADONIS. The goal of a software factory-based approach is to create high-quality code in a shorter time. Code created by the BSopt tools are deployment artifacts (BPEL, WSDL, XAML, etc.) to be consumed by existing software environments - in our case the Oracle SOA Suite and the Microsoft Workflow Foundation. The BSopt approach will be validated by case studies in the print media industry.

Project results: <http://www.bsopt.at>



3 Layers for inter-organizational systems

- » Integrated approach for the definition of business semantics in business models, global choreographies, local choreographies, internal processes and business documents
- » Formalization for semantic dependencies between business models and global choreographies
- » Print media domain analysis
- » Domain specific language (DSL) for the business model and business process model layer based on Visual Studio and Microsoft DSL
- » Software factory for the BSopt project based on the DSL, customized wizards, ...

Publications:

- » C. Huemer , P. Liegl , R. Schuster, and M. Zapletal, B2B Services: Worksheet-Driven Development of Modeling Artifacts and Code, Computer Journal, vol. 52, n° 1, 09
- » P. Liegl , Conceptual Business Document Modeling using UN/CEFACT's Core Components , in Proceedings of the Sixth Asia-Pacific Conference on Conceptual Modelling (APCCM2009), Wellington, New Zealand, 01, 2009
- » C. Huemer , P. Liegl , T. Motal, R. Schuster, and M. Zapletal, The Development Process of the UN/CEFACT Modeling Methodology, in Proceedings of the Tenth International Conference on Electronic Commerce, 2008.
- » C. Huemer , P. Liegl , R. Schuster, H. Werthner, and M. Zapletal, Inter-organizational Systems: From Business Values over Business Processes to Deployment, in Proceedings of the 2nd International IEEE Conference on Digital Ecosystems and Technologies (DEST2008).
- » C. Huemer , P. Liegl , R. Schuster, and M. Zapletal, A 3-level e-Business Registry Meta Model, in Proceedings of the 2008 IEEE International Conf. on Services Computing, 2008, pp. 441-450.
- » P. Liegl , Business documents in a service oriented context , Poster presentation for: Tenth International Conference on Electronic Commerce (ICEC08), Innsbruck; 19.08.2008.
- » P. Liegl , T. Motal, and R. Schuster, An Add-In for UN/CEFACT's Modeling Methodology 2.0, Poster presentation for: Tenth International Conference on Electronic Commerce (ICEC08), Innsbruck; 19.08.2008.

People involved: Christian Huemer, Philipp Liegl, Thomas Motal, Gerhard Preisinger, Rainer Schuster, Hannes Werthner, Marco Zapletal

Public Private Interoperability (PPI)

Project type:

FFG Programm: Research Studios Austria

Project partner:

Research Studio Austria Forschungsgesellschaft mbH

Project period: 01.10.2008—30.09.2011

Abstract: The research studio Public Private Interoperability (PPI) develops methods and tools targeting the inter-organizational integration of enterprises and organizations of the public sector. Service-oriented architectures and their implementation by Web services are the current state-of-the-art technologies for this kind of integration problems. However, Web services are agnostic to the structure of the information/documents being exchanged. The studio PPI focuses on the exchanged business documents and considers a model-driven approach for the definition of the interfaces. The resulting method and a corresponding toolset have to provide a mix between re-usable document building blocks and business context-specific adaptation of business documents. The method must not be limited to a single business document standard language or business document ontology. PPI delivers concepts for the platform-independent definition of business documents as well as for the transformation between different business document standards/ontologies. PPI integrates existing, well accepted business document standards, such as UBL 2.0, into its prototypical implementation of a toolset. The re-engineering of existing business document standards will reduce time and costs in the development of new business interoperability interfaces and will allow the platform-specific transformation between business document standards. Project results:

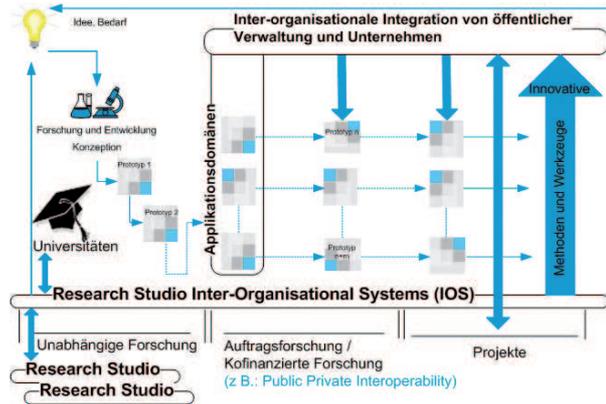
HYPERLINK "https://webmail.isis.tuwien.ac.at/exch-web/bin/redirect.asp?URL=https://tuwis.tuwien.ac.at/ora/tuwis/bokudok/search_project.show_project?project_id_in=7083"
 An analysis of five major business document industry standards (ebInterface, Unified Business Language, Health Level 7, Core Components Technical Specification, ISO 20022

Project Results: <http://ios.researchstudio.at>

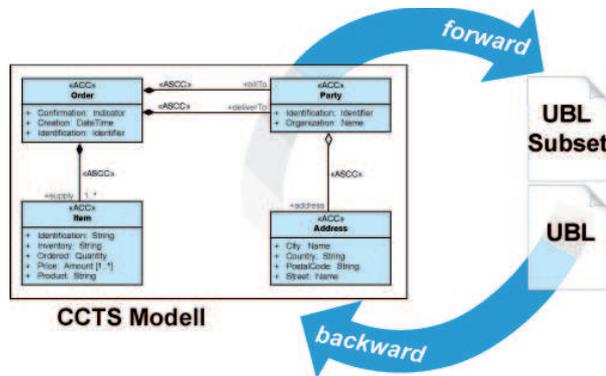
Publications:

P. Liegl, Conceptual Business Document Modeling using UN/CEFACT's Core Components, in Proceedings of the Sixth Asia-Pacific Conference on Conceptual Modeling (APCCM2009), Wellington, New Zealand, January 2009

People involved: Christian Huemer, Philipp Liegl



Innovation Pipelines from University to Market



Round-trip engineering of business document types

ModelCVS: A Semantic Infrastructure for Model-based Tool Integration

Project type:

FIT-IT Semantic Systems, Österreichische Forschungsförderungsgesellschaft (FFG)

Project Partners:

Arikan Ges.m.b.H, Bundesministerium für Landesverteidigung, Johannes Kepler Universität Linz

Project period: 01.01.2006—31.12.2007

Abstract: With the rise of model-driven software development, more and more development tasks are being performed on models. A rich variety of modeling tools is available supporting different tasks, such as model creation, model simulation, model checking, and code generation. Seamless exchange of models among different modeling tools increasingly becomes a crucial prerequisite for effective software development processes. Due to lack of interoperability, however, it is often difficult to use tools in combination, and therefore the potential of model-driven software development cannot be fully utilized, unless we find some scalable way of integration.

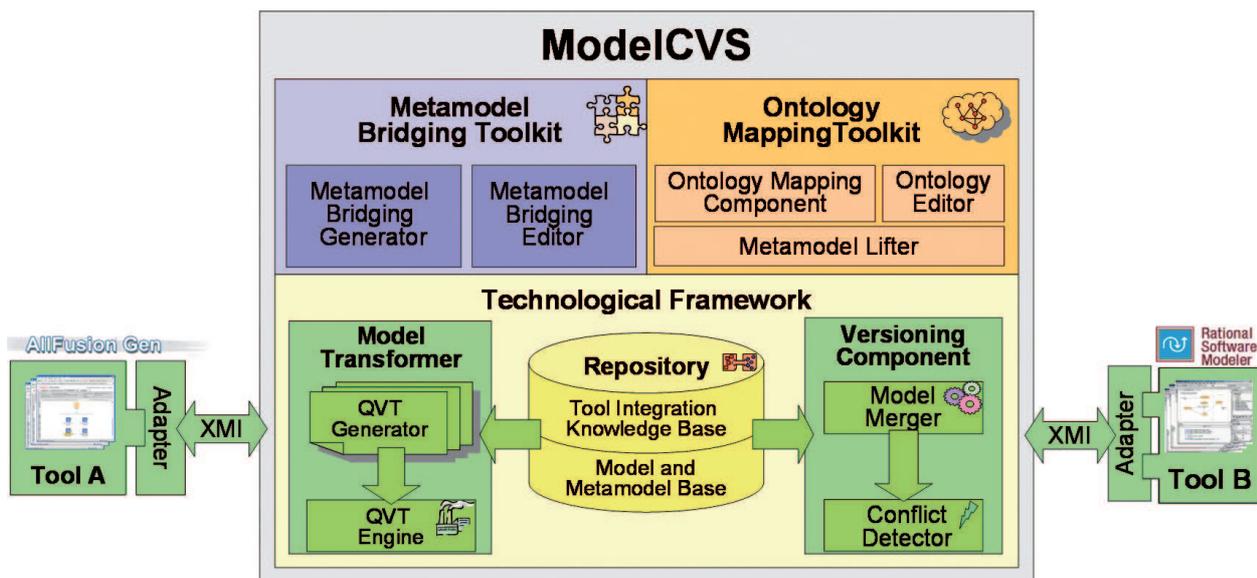
The aim of this project is to provide a semantic infrastructure for model-based tool integration, enabling the facilitation of any tool appropriate for the modeling task at hand. The key innovations provided are a set of scalable architectural model integration patterns supported by a high-level metamodel integration language, thus going beyond existing low-level model transformation approaches. Ontology-based metamodel integration considerably lowers the manual effort required for tool integration, enabling a novel synergic use of technologies from the model engineering and ontology engineering domains. An open knowledge base for tool integration captures essential knowledge about modeling languages and tools in terms of ontologies, fostering reuse within and beyond the scope of this project.

These innovations have been realized within the ModelCVS prototype and case study. The core of the system is based on a versioning system such as CVS, thus providing a loosely-coupled and well-proven integration architecture. Transparent transformation of models between different tools, languages and exchange formats, as well as versioning capabilities exploiting the rich syntax and semantics of models represent the key functionalities of ModelCVS. In this way, ModelCVS serves as both a research vehicle and testbed for exploring applications of semantic technologies in model-based tool integration.

Project results: <http://www.modelcvs.org>

Publications:

- » M. Wimmer, G. Kramler, Bridging Grammarware and Modelware, Proc. of the 4th Workshop in Software Model Engineering (WiSME 2005), in conj. with MoDELS/UML 2005 Conference, Montego Bay, Jamaica, 2005.
- » J. Oetsch, M. Seidl, H. Tompits, S. Woltran, A Tool for Advanced Correspondence Checking in Answer-Set Programming: Preliminary Results , 20th Workshop on Logic Programming, Vienna, 2006
- » G. Kappel, E. Kapsammer, H. Kargl, G. Kramler, T. Reiter, W. Retschitzegger, W. Schwinger, M. Wimmer, On Models and Ontologies - A Layered Approach for Model-based Tool Integration, Proc. of the Modellierung 2006 (MOD2006), Innsbruck, Austria, 2006.
- » G. Kramler, G. Kappel, T. Reiter, E. Kapsammer, W. Retschitzegger, W. Schwinger, Towards a Semantic Infrastructure Supporting Model-based Tool Integration, Proc. of the 1st Int. Workshop on Global Integrated Model Management (GaMMa2006), Shanghai, 2006.
- » J. Oetsch, M. Seidl, H. Tompits, S. Woltran, A Tool for Advanced Correspondence Checking in Answer-Set Programming , 11nd International Workshop on Non-Monotonic Reasoning at the KR 2006, Lake District, UK, 2006
- » M. Seidl, A Solver for QBFs in Nonprenex Form , Poster at the Doctoral Consortium at the KR 2006, Lake District, UK, 2006
- » T. Reiter, W. Retschitzegger, A. Schauerhuber, W. Schwinger, E. Kapsammer, Enabling API-based Tool Integration through Aspect-Oriented, Proc. of the 2nd Workshop on Models and Aspects, in conj. with ECOOP'06, Nantes, France, 2006.
- » Schauerhuber, M. Wimmer, E. Kapsammer, Bridging existing Web Modeling Languages to Model-Driven Engineering: A Metamodel for WebML, Proc. of the 2nd Int. Workshop on Model-Driven Web Engineering (MDWE'06), Palo Alto, California, 2006.
- » J. Oetsch, M. Seidl, H. Tompits, S. Woltran, ccT: A Tool for Checking Advanced Correspondence Problems in Answer-Set Programming, LaSh'06 Workshop, Seattle, 2006
- » J. Oetsch, M. Seidl, H. Tompits, S. Woltran, ccT: A Correspondence-Checking Tool For Logic Programs Under The Answer-Set Semantics (System Description), Proceedings of the 10th European Conference on Logics in Artificial Intelligence, Liverpool, 2006
- » U. Egly, M. Seidl, S. Woltran, A Solver for QBFs in Nonprenex Form, Proceedings of the 17th European



ModelCVS architecture

Conference on Artificial Intelligence, Riva del Garda, Italy, 2006

- » T. Reiter, K. Altmanninger, W. Retschitzegger, Think Global, Act Local: Implementing Model Management with Domain-Specific Integration Languages, Models in Software Engineering, Workshops and Symposia at MoDELS/UML 2006, Genoa, Italy, 2006.
- » G. Kappel, E. Kapsammer, H. Kargl, G. Kramler, T. Reiter, W. Retschitzegger, W. Schwinger, M. Wimmer, Lifting Metamodels to Ontologies: A Step to the Semantic Integration of Modeling Languages, Proc. of the ACM/IEEE 9th Int. Conference on Model Driven Engineering Languages and Systems (MoDELS/UML 2006), Genoa, Italy, 2006.
- » H. Kargl, M. Strommer, M. Wimmer, Measuring the Explicitness of Modeling Concepts in Metamodels, Proc. of the Workshop on Model Size Metrics, in conj. with MoDELS/UML 2006, Genoa, Italy, 2006.
- » K. Altmanninger, G. Kappel, E. Kapsammer, H. Kargl, G. Kotsis, G. Kramler, T. Reiter, W. Retschitzegger, W. Schwinger, M. Seidl, M. Strommer, M. Wimmer, From Models to Ontologies and Back Again: The ModelCVS Approach for Integrating Modeling Tools, Poster at the ACM/IEEE 9th International Conference On Model Driven Engineering Languages and Systems (MoDELS/UML 2006), Genoa, Italy, 2006
- » J. Oetsch, M. Seidl, H. Tompits, S. Woltran, ccT: A Tool for Checking Advanced Correspondence Problems in Answer-Set Programming, Proceedings of the 15th International Conference on Computing CIC-2006, Mexico City, 2006

E. Kapsammer, T. Reiter, W. Schwinger, Model-Based Tool Integration - State of the Art and Future Perspectives, Proceedings of the 3rd International Conference on Cybernetics and Information Technologies, Systems and Applications, Orlando, USA, 2006.

- » M. Wimmer, M. Strommer, H. Kargl, G. Kramler, Towards Model Transformation Generation By-Example, Proc. of the Hawaii Int. Conference on System Sciences (HICSS-40), Hawaii, USA, 2007.
- » G. Kappel, H. Kargl, G. Kramler, A. Schauerhuber, M. Seidl, M. Strommer, M. Wimmer, Matching Metamodels with Semantic Systems - An Experience Report, Proc. of the Workshop on Model Management und Metadaten-Verwaltung (BTW 2007), Aachen, 2007.
- » M. Wimmer, H. Kargl, M. Seidl, M. Strommer, T. Reiter, Integrating Ontologies with CAR-Mappings, Proc. of the 1st Int. Workshop on Semantic Technology Adoption in Business (STAB'07), Vienna, 2007.
- » M. Wimmer, A. Schauerhuber, W. Schwinger, H. Kargl, On the Integration of Web Modeling Languages: Preliminary Results and Future Challenges, 3rd International Workshop on Model-Driven Web Engineering, (MDWE'07), Como, Italy, July 2007.
- » T. Reiter, M. Wimmer, H. Kargl, Towards a runtime model based on colored Petri-nets for the execution of model transformations, Accepted at: 3rd Workshop on Models and Aspects - Handling Crosscutting Concerns in MDSD, Berlin, Germany, 2007.

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- » K. Altmanninger, Models in Conflict – Towards a Semantically Enhanced Version Control System for Models, Proceedings of the Doctoral Symposium at the ACM/IEEE 10th International Conference On Model Driven Engineering Languages And Systems, Nashville, TN, 2007
 - » Schauerhuber, M. Wimmer, E. Kapsammer, W. Schwinger, W. Retschitzegger, Bridging WebML to Model-Driven Engineering: From DTDs to MOF, IET SOFTWARE Journal, The Institution of Engineering and Technology, 2007.
 - » K. Altmanninger, A. Bergmayr, W. Schwinger, G. Kotsis, Semantically Enhanced Conflict Detection between Model Versions in SMOVer by Example, In Proceedings of the International Workshop on Semantic-Based Software Development in conjunction with OOPSLA, Montreal, Canada, 2007.
 - » T. Reiter, K. Altmanninger, A. Bergmayr, W. Schwinger, G. Kotsis, Models in Conflict - Detection of Semantic Conflicts in Model-based Development, 3rd International Workshop on Model-Driven Enterprise Information Systems (MDEIS-2007), 2007.
 - » M. Strommer, M. Murzek, M. Wimmer, Applying Model Transformation By-Example on Business Process Modeling Languages, 3rd International Workshop on Foundations and Practices of UML (ER 2007), Auckland, New Zealand, 2007.
 - » J. Oetsch, M. Seidl, H. Tompits, S. Woltran, Testing Relativised Uniform Equivalence under Answer-Set Projection in the System ccT, 4th Workshop in Software Model Engineering (WLP 2007), 2007.
 - » K. Altmanninger, G. Kotsis, W. Retschitzegger, W. Schwinger, Models in Conflict – A Semantically Enhanced Version Control System for Models (Poster), Poster at the ACM/IEEE 10th International Conference on Model Driven Engineering Languages and Systems (Models07), 2007.
 - » H. Kargl, M. Wimmer, SmartMatcher – How Examples and a Dedicated Mapping Language Can Improve the Quality of Automatic Matching Approaches , International Workshop on Ontology Alignment and Visualization (OnAV'08) , Barcelona, Spain 2008
 - » M. Wimmer, A. Schauerhuber, M. Strommer, W. Schwinger, G. Kappel, A Semi-automatic Approach for bridging DSLs with UML , Proceedings of the 7th OOPSLA Workshop on Domain-Specific Modeling, Montréal, Canada, October 2007.
 - » M. Strommer, M. Wimmer, A Framework for Model Transformation By-Example: Concepts and Tool Support, 46th Int. Conference on Objects, Components, Models and Patterns (TOOLS-EUROPE 2008), 2008.
 - » G. Kappel, H. Kargl, T. Reiter, W. Retschitzegger, W. Schwinger, M. Wimmer, M. Strommer, A Framework for Building Mapping Operators Resolving Structural Heterogeneities., 7th International Conference on Information Systems Technology and its Applications, Klagenfurt, Austria, 2008.
- Software Modules:**
- » Metamodel Bridging Toolkit for integrating heterogeneous modeling languages
 - » Model Repository for optimistic versioning of software models
 - » Metamodel2Ontology Transformation Component for bridging the model technical space and the ontology technical space
 - » Model Transformation Framework based on Coloured Petri Nets for debugging model transformations
 - » UML Profile Generator for semi-automatically extending UML with domain-specific modeling concepts
- People involved:**
- Gerti Kappel**, Horst Kargl, Gerhard Kramler, Martina Seidl, Michael Strommer, Manuel Wimmer

TRACK and TRADE: Creating a Data Mart for Floating Car Data

Project type:

EU FP6 co-operative research project

Project partners:

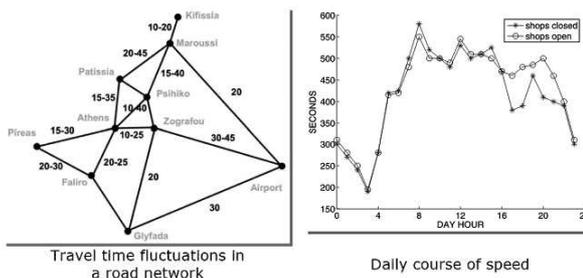
Deutsches Zentrum für Luft- und Raumfahrt, Emphasis Telematics, Geomatics, GreenWay Systeme, Research Academic Computer Technology Institute, Talent S. A., WIGeoGIS

Project period: 01.10.2006—30.09.2008

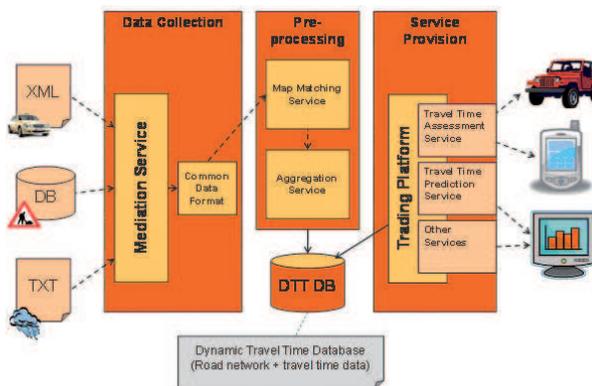
Abstract: With the number of vehicles, both private and commercial, in urban areas steadily increasing, accurate traffic information becomes an increasingly important commodity. A change in transport policy, e.g., increased use of public transport and efficient inter-modal transport, will only have a medium to long-term effect on improving the traffic situations in inner-city areas. To create high-quality content for traffic management applications and mobility services, reliable and inexpensive real-time traffic data is essential. The TRACK&TRADE project relies on floating car data (FCD) to solve a number of well-known problems in generating traffic content. While conventional traffic data collection systems have a high infrastructure maintenance and communication expense, this project exploits the FCD approach synergies with existing GPS-based fleet disposition systems. The scope of the project is to develop an FCD data mart that allows for the collection and integration of FCD data from as many data suppliers as possible. In turn, the data mart will supply aggregated datasets as well as valued-added services. Services include the provision of maps visually illustrating travel times and the provision of current and predicted travel times for parts of the road network. These services will be provided using XML and Web services and should simplify the creation of more complex services such as routing and navigation as well as traffic forecasts. Trading FCD data and the provision of related services would serve two main purposes. (i) It creates an additional income stream for the data producers from an otherwise worthless resource and (ii) given that such data becomes generally available, it allows for the provision of improved traffic information services through a series of more or less technological means. With an increasing number of commercial vehicles (e.g., taxi fleets) being equipped with GPS, a successful business case for the FCD technology can be demonstrated.

Project results:

<http://www.trackandtrade.org/>



Dynamic travel times



Track&Trade architecture

Publications:

P. Brosch (2008). "A Service Oriented Approach to Traffic Dependent Navigation Systems," in 2008 IEEE Congress on Services 2008 - Part 1, pp. 269-272.

D. Pfoser, S. Brakatsoulas, P. Brosch, M. Umlauf, N. Tryfona, and G. Tsironis (2008). "Dynamic Travel Time Provision for Road Networks," in GIS '08: Proceedings of the 16th ACM SIGSPATIAL international conference on Advances in geographic information systems, pp. 475-478.

Software Modules:

- » Configurable data collection and mediation component
- » Travel Time Assessment Service
- » Web based visualization of traffic conditions
- » Dedicated client for dynamic routing based on estimated travel times (Crouser Platform)

People Involved:

Petra Brosch, Gerti Kappel, Martina Umlauf

In the reporting period **Interactive Media Systems** research areas were investigated in the following projects:

The project Digital Formalism - The Vienna Vertov Collection is an interdisciplinary research project that focuses on the content-based analysis of artistic documentaries of the Soviet filmmaker Dziga Vertov from the early 20th century. The project aims at the development of computer-based media tools for the digital analysis of archive films and at a description of the function of the cinematic elements in Vertov's work in relation to film form as well as to the perception of the cinematic medium: what specific cinematic elements play on the auditory, visual, haptic, synaesthetic aspects of perception and how can innovative high-level media analysis help identify, describe and analyze (contextualize) them? In contrast to similar projects, the research ideas are not generated by computer scientists but defined by film analysis experts and fertilized by the specific formal structure of Vertov's work. Experts from different domains work hand in hand, learn from each other and adapt their vocabulary and methodology according to the project experiences. The film material is well-suited for multimodal analysis. Since Vertov's work is available in Vienna in an outstanding quality and due to the fact that the Austrian Film Museum is able to provide the media content in highest resolution and enriched by a variety of additional modalities (e.g., visually digitized sound), completely novel paths of multimodal analysis and retrieval can be researched. The interactive media systems group analyzes and retrieves basic and aesthetic patterns contained in the films, such as shot boundaries, object and camera movements, montage patterns, and image composition.

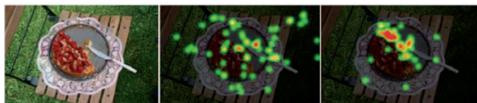
The project Evaluation and Design of Energy Functions for Global Stereo Matching deals with the development of improved modeling techniques for stereo matching algorithms in order to achieve high-accuracy 3D scene reconstruction from stereo images and videos. The project Alpha Matting from Single and Multiple Images concentrates on the development of precise image segmentation/matting techniques and the set-up of a web-based benchmark test for evaluation of matting results. In the recently granted project Temporal-consistent Stereo Matting for High-quality Novel View Synthesis and Visual Effects (in collaboration with Microsoft Research Cambridge), we seek to combine stereo and image matting techniques in a joint framework to improve algorithms for scene visualization from novel viewpoints, augmented reality and 3D video/TV scenarios. The project VENDOR (Video Engine Design Methodology Rules) explores the optimized distribution of video coding algorithms on multi-core hardware for system-on-chip implementations.

The EU project VISION aims to specify and develop key interface features in fundamental cornerstones of VR technology, namely in immersive visualization and interaction, so as to improve the flexibility, performance and cost efficiency of human-oriented life cycle procedures in critical aircraft-related virtual products (e.g., virtual cockpit, virtual cabin, etc.). The upstream research roadmap of VISION will involve a) specific human-oriented developments in simulation features, such as visual perception, real-time rendering, markerless body tracking, smart objects interaction, and interaction metaphors, b) an integration of the features in a common IT platform, and c) a validation based on test cases focused on specific aircraft-related virtual products. The achievements of VISION will enhance the credibility of human-in-the-loop aircraft-related VR simulations. They will further enhance the engineering context of aircraft-related virtual products by enabling their increased use for activities, such as design verification, ergonomics validation, specifications of equipment displays, operational and situational training. The VISION project aims to develop new technology in support of the design and virtual prototyping of critical aircraft-related products. It will improve the human-oriented functionality and usage of these virtual products along their life cycle. Thus, it addresses the "Design Systems & Tools" and "Human Factors" call topics. The consortium of VISION includes representatives of all major stakeholders, including end users, research partners and VR IT vendors. VISION is supported by the European Aeronautics Science Network (EASN).

Infrastructure

The Interactive Media Systems group operates three laboratories distributed over several rooms of the building. The media laboratory is equipped with a state-of-the-art video and audio studio including D1 video cabling, high-performance switching components, an Ultimatte keyer and several workstations for media capturing, processing and storage. The computer vision laboratory holds equipment for stereo vision and video analysis, including the Tobii x50 eye tracker and the MotionPro 2000 high-speed camera described below. Finally, the augmented and virtual reality laboratory contains equipment for accurate object tracking and the visualization of virtual content, including head-mounted displays, infrared cameras and a Barco 3D table. Below, three selected components from the IMS laboratories are described.

The Tobii x50 eye tracker enables us to accurately track and analyze the gaze of the human eye. The Tobii x50 eye tracker provides very high quality tracking without interfering with the user environment of the test subject. At the same time, it is easy to use and fully automatic, which allows for time-efficient eye tracking without compromising tracking quality. This enables us to use the eye tracker in many research projects, for both analysis and interaction purposes. For instance, the eye tracker is used in the "Alpha Matting from Single and Multiple Images" project, which is funded by Microsoft Research Cambridge. Here we used the eye tracker to analyze the influence of different artifacts that occur in photomontages. An example of a result is depicted below. It shows the eye fixations of two different people (rightmost images) that occurred when they looked at the photomontage shown on the left side.



Human gaze recorded by eye tracking

Furthermore, the institute owns a Redlake MotionPro 2000 high-speed video camera for use in teaching, research and industrial collaborations. The camera system operates at frame rates up to 2000 frames/sec at a full resolution of 1280 x 1024 pixels. The high temporal resolution gives new insight into dynamic processes that could not be observed with sufficient quality by conventional video analysis. A memory extension of 6 GB is available for longer recording times. The camera is equipped with a FlexPAC Power Portable to facilitate mobile and outdoor video capture.

For the purpose of 3D vision the IMS group has purchased a Philips WOWvx 42-inch display. The important feature of this display is that it enables 3D viewing of video content without the need for special glasses. This novel display is capable of delivering a quality of 3D impression that considerably outperforms previous autostereoscopic displays. In addition to a color image, the Philips WOWvx screen requires a corresponding depth map of the scene for enabling 3D viewing. These depth maps are used to synthesize arbitrary stereo views as they would appear from different viewing angles (i.e., novel viewpoint generation). The user can therefore walk in front of the display and get a perspective correct 3D impression of the scene from its current viewing point. One major problem that currently hinders the spread of autostereoscopic displays is the difficulty of content creation. While for artificial content (e.g., animation movies) depth maps can easily be made



Highspeed ballet jump

available as a byproduct of the production process, this is clearly more challenging for videos of real scenes. The necessity to generate depth maps of real scenes represents the link to the stereo processing work at the IMS group. Apart from representing an excellent application example, the screen serves to visualize the output of our 3D computations and therefore allows us to judge the quality of produced depth maps.

Digital Formalism - The Vienna Vertov Collection

Project type:

WWTF

Project partners:

Austrian Film Museum
Department for Theatre, Film and Media Studies (TFM),
Vienna University.

Project period: 2007–2010

Abstract: The project Digital Formalism - The Vienna Vertov Collection is an interdisciplinary research project that focuses on the content-based analysis of artistic documentaries of the Soviet filmmaker Dziga Vertov from the early 20th century. The Interactive Media Systems group analyzes and retrieves basic and aesthetic patterns contained in the films, such as shot boundaries, object and camera movements, montage patterns, and image composition.

Project results:

www.digitalformalism.org

Publications:

Zeppelzauer, M., Mitrovic, D. and Breiteneder, C. 2008. Analysis of Historical Artistic Documentaries. Proceedings of the 9th International Workshop on Image Analysis for Multimedia Interactive Services, May 7-9, 2008, Klagenfurt, Austria.

Kropf, V., Zeppelzauer, M., Hahn, S., and Mitrovic, D. First Steps Towards Digital Formalism: The Vienna Vertov Collection. To appear in Proceedings of the International Workshop on Digital Tools in Film Studies. June 2007, Siegen, Germany.

People involved:

Christian Breiteneder, Matthias Zeppelzauer



Extraction of temporal features from video content

Temporal-Consistent Stereo Matting for High-Quality Novel View Synthesis and Visual Effects [3D-TV]

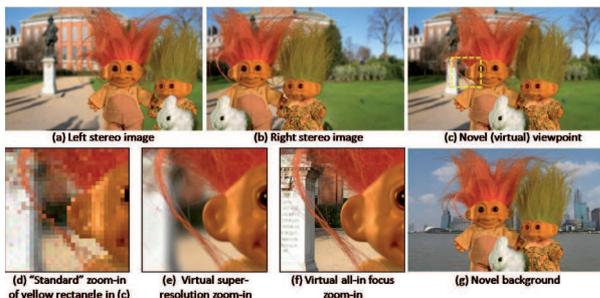
Project type:
WWTF-ICT

Project partners:
Microsoft Research Cambridge, UK

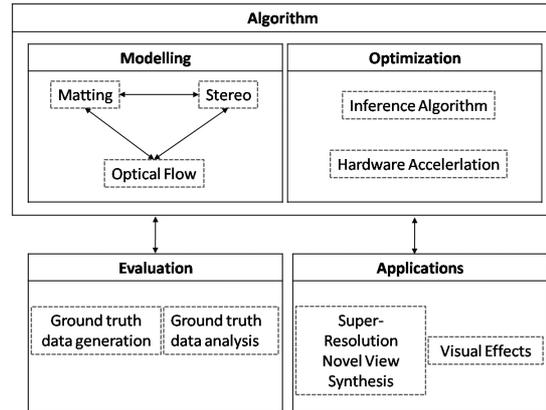
Project period: 01.4.2009—31.3.2012

Abstract: This project develops new image processing techniques for the emerging field of 3D television. Given two videos that are recorded by slightly displaced cameras, we aim to extract (1) the opacity values of individual pixels (“matting”), (2) a depth reconstruction of the scene (“stereo”), and (3) the temporal relationship between the images of a sequence (“optical flow”). Whereas traditional approaches have addressed tasks (1), (2), and (3) separately, we propose to fuse the three problems into a single problem formulation. This combined solution strategy is motivated by the similarity that these problems share and by a high amount of interconnections and dependencies between them. Through our joint approach we seek to overcome shortcomings of current 3D scene analysis and modeling techniques that manifest themselves, for example, in undesired artifacts along object boundaries and flickering effects between depth maps computed from individual frame pairs of a stereo video sequence.

Our results offer the exciting possibility of free-viewpoint video where the user has control over a virtual camera and can select the preferred viewpoint. Moreover, the computed depth map can serve as input for multi-view autostereoscopic displays that exploit our results to provide the user with a temporal-smooth depth impression, without the need for stereo glasses. To suit the requirements of these applications, our focus lies on generating results of high quality that outperform the current state of the art. Due to address-



3D TV media construction example



Design of stereo matting algorithm and applications.

ing the image matting problem, we will also be able to handle fuzzy and hairy objects that are traditionally difficult in image processing. Moreover, our results offer the possibility of new exciting visualization effects such as super-resolution zooming, focus and background manipulations as well as video object cut & paste.

In addition, we will generate ground truth data for the “stereo matting” problem. Such currently inexistent data will consist of ground truth disparities plus corresponding opacity values. We are planning to open a web-based evaluation system where researchers can download our test sets and submit their results. We believe that such an evaluation website is of high value for the computer vision community and will strengthen the visibility of our group among the international competition.

We expect our research results to have significant potential for commercialization in the economically important fields of the film and entertainment industry and the home multimedia market. Our results will simplify the seamless integration of virtual objects into video sequences, which opens new fields in the area of image and video manipulation.

Project results:

The project was granted in fall 2008 and will start in April 2009.

People Involved:

Margrit Gelautz, Michael Bleyer, Christoph Rhemann

Alpha Matting from Single and Multiple Images [VIDEOMAT]

Project type:

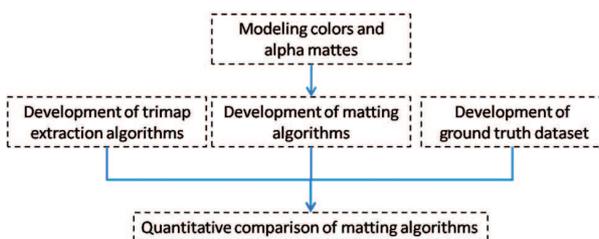
Microsoft Research European PhD Scholarship Program (MRL-2007-003)

Project partner:

Microsoft Research Cambridge, UK

Project period: 01.10.2006—30.9.2009

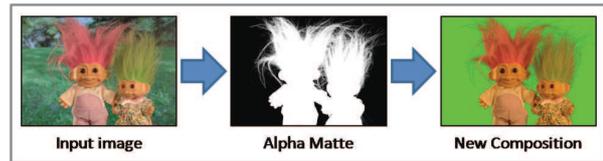
Abstract: Image/video matting is the problem of extracting a foreground object from its background by correctly recovering its foreground and background colors as well as an opacity factor for every pixel in an image sequence. Object segmentation and matting are fundamentally important operations in many image/video editing and compositing tasks, with a number of applications for instance in the entertainment industry. Once an object has been extracted successfully from its background, it may be inserted into another scene and/or visualized together with artificial objects to create mixed reality applications that merge the aspect of real with computer-generated worlds. In collaboration with Microsoft Research Cambridge, we develop novel algorithms to push forward the state of the art in image/video matting. As part of the project, we implement a ground truth database and a web-based benchmark test which allows a quantitative analysis of matting results.



Conceptual overview of the project

From a mathematical viewpoint, matting is a severely ill-posed problem and therefore user interaction is vital for solving it. The most common form of user interaction is the so-called trimap, where the user partitions the image into regions that belong solely to the foreground or background as well as an unknown region, where transparencies may occur.

Manually specifying such a trimap can be a tedious process. To alleviate the user interaction, we have developed an approach for single image matting that splits the task of extracting a foreground object from a single background into two steps: Interactive trimap extrac-



The alpha matting process. Given a natural input image, an alpha matte is computed and defines the fore- and background regions. Using the alpha matte a new composition can be generated by replacing the background with, e.g., green color.

tion from very coarse user input, which is then followed by trimap-based alpha matting. By doing this we also gain considerably in terms of speed and quality and in contrast to previous work are able to deal with high resolution images.

In this project we contributed to improving the matting side in several ways. First, we incorporated prior knowledge from a model of the imaging process, where the observed opacities are the result of defocus blur. We showed that using this prior knowledge improves the quality of matting results. We also improved on modeling the foreground and background colors in an image, which is of high importance for correctly recovering the opacity factors.

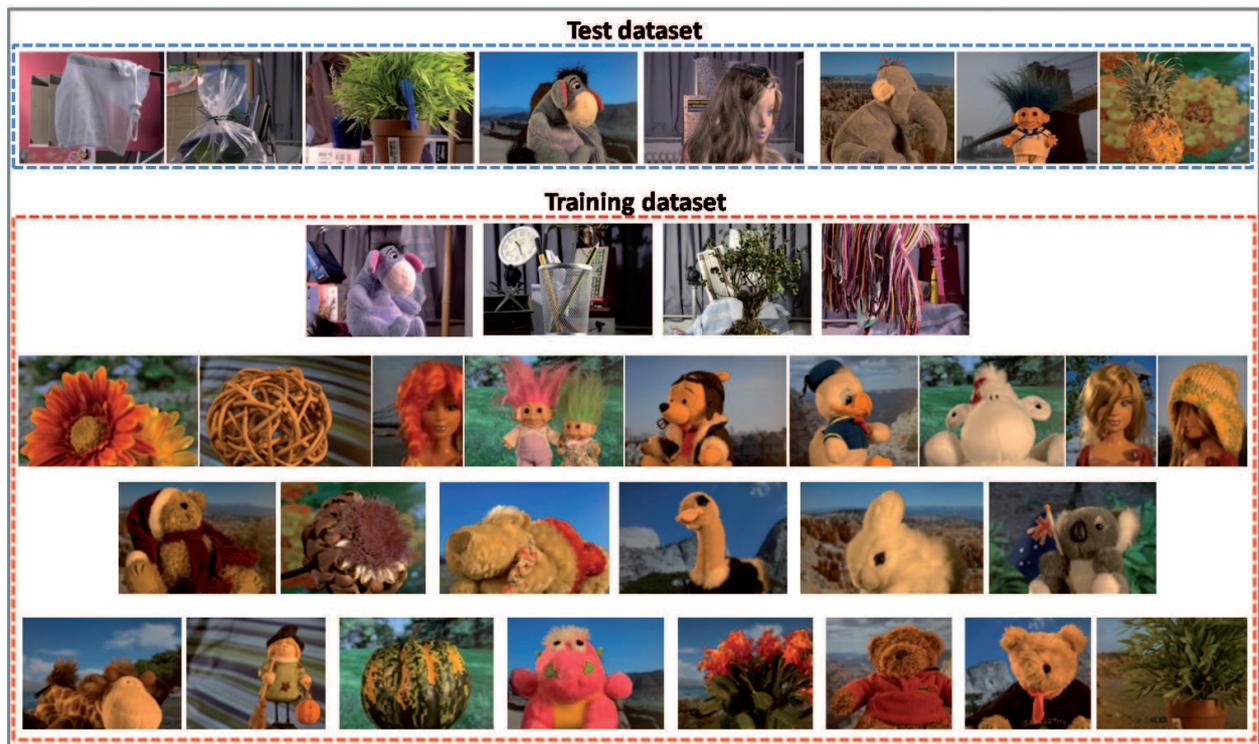
Another important part of the project was devoted to allowing for quantitative comparisons of matting results. We observed that the introduction of online benchmarks for other low-level vision tasks such as stereo and optical flow has led to significant progress in the respective fields. Thus we also strove to introduce such a benchmark for image matting. We identified two key factors for a successful benchmarking system:

- » A challenging, high-quality ground truth test set
- » An online evaluation repository that is dynamically updated with new results
- » Perceptually motivated error functions

Throughout this project we developed a benchmark that meets all three criteria. We generated a large ground truth dataset of 35 images that reflects the challenges inherent in real images and provides a good basis for the comparison of matting algorithms.

We have also established a dynamic online benchmark that provides all data and scripts that enable the research community to complement our evaluation with new results. This will place the scientific community in the favorable position to interactively analyze recent results that are visualized in the online benchmark.

We further contributed to improving on the evaluation methodology for image matting, which has been previously tied to simple pixel-wise error measures that do



Overview of our ground truth dataset developed throughout this project

not always correlate to the visual quality as perceived by humans. Thus we went beyond these evaluation methodologies and developed quantitative error measures that are based on subjective human perception. More specifically, we concentrated on two properties of alpha mattes that considerably affect the visual quality of matting results, namely the connectivity of the foreground object and the preservation of gradients in the alpha matte. We developed error functions that estimate the compliance of these properties and validated that our measures are correlated to human perception in a user study.

Finally, we analyzed the performance of several matting methods with our benchmark and showed that their performance varied depending on the error function. Also, our challenging test set revealed problems of existing algorithms not reflected in previously reported results.

Project results:

www.ims.tuwien.ac.at/research_detail.php?ims_id=MSR06

Alpha matting evaluation web page:

www.alphamatting.com

Publications:

- » C. Rhemann, C. Rother, J. Wang, M. Gelautz, P. Kohli, P. Rott, A Perceptually Motivated Online Benchmark for Image Matting, CVPR 2009, Miami, Florida (2009)
- » D. Singaraju, C. Rother, C. Rhemann, New Appearance Models for Natural Image Matting, accepted for CVPR 2009, Miami, Florida (2009)
- » M. Bleyer, M. Gelautz, C. Rhemann, C. Rother, A Stereo Approach that Handles the Matting Problem via Image Warping, CVPR 2009, Miami, Florida (2009) (oral)
- » C. Rhemann, M. Gelautz, B. Fölsner, An Evaluation of Interactive Image Matting Techniques Supported by Eye-Tracking, SPIE Electronic Imaging 2009, San Jose, California (2009) (oral)
- » C. Rhemann, C. Rother, M. Gelautz, Improving Color Modeling for Alpha Matting, BMVC 2008, Leeds, UK (2008) (oral)
- » C. Rhemann, C. Rother, A. Rav-Acha, T. Sharp, High Resolution Matting via Interactive Trimap Segmentation, CVPR 2008, Alaska (2008).

People Involved:

Christoph Rhemann, **Margrit Gelautz**

Evaluation and Design of Energy Functions for Global Stereo Matching

Project type:

Austrian Science Fund (FWF)

Project period: 01.06.2007–31.05.2010

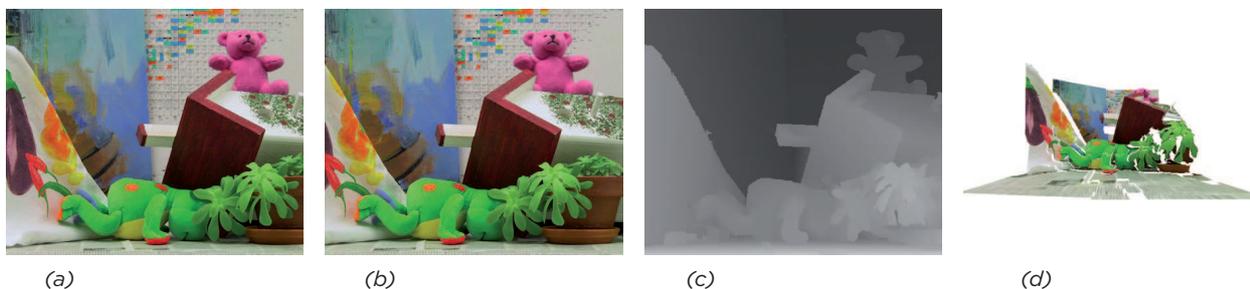
Abstract: The project “Evaluation and Design of Energy Functions for Global Stereo Matching” focuses on one of the most challenging research topics in computer vision, namely stereo vision. Stereo vision approaches imitate the ability of the human visual system to infer depth from the surrounding environment via the use of two eyes. In analogy to human depth perception, two slightly displaced cameras record the same scene. Roughly speaking, the left and right images are then “overlaid” to determine depth information. The problem of “overlapping” the two input images to obtain the result of Figure 1(c) is known as the stereo matching problem.

Being able to solve the stereo matching problem is important in two respects. First, it sheds light on the way human depth perception might work. Second, there are numerous applications in computer vision. For example, automated 3D visualization of terrain and cities has recently gained popularity. In this context, stereo-derived 3D models could be integrated into Google Earth to allow the user to take a walk in a 3D computer reconstruction of Vienna. In medical imaging, 3D reconstructions of organs created from multiple 2D (MRI) images can aid in diagnosis. Apart from visualization, stereo reconstructions can be applied for robot navigation (autonomously driving car), but also to assist handicapped (blind) people to navigate in their environment. Without being exhaustive, other applications include 3D tracking (surveillance, pose estimation, human-computer interaction), depth segmentation (z-keying), industrial applications (quality assurance) and novel view

generation (free viewpoint video), to name just a few. Generally speaking, whenever one needs to infer geometric information from the surrounding world, stereo vision presents a low-cost and non-intrusive alternative to active devices, such as range finders.

During the last few years, stereo matching has experienced a significant advance with the introduction of new optimization algorithms. Energy minimization methods based on these optimization schemes currently show the best performance in stereo computation. However, while a lot of research effort has been put into the optimization problem of the energy minimization approach, the fact that the energy functions under consideration might represent an unsatisfactory model for the stereo problem has often been ignored. In the proposed project, we aim at pushing the state of the art in stereo vision by investigating and improving the modeling component of energy minimization techniques. The project consists of two parts, namely an evaluation part and a design part. Although the project is currently in its middle stage, we have already accomplished several publications for both parts.

In the first part, a benchmark test among existing energy functions is performed. We have started our benchmark by focusing on the color component of modern stereo algorithms [1]. This is motivated by the observation that many stereo researchers still simply convert the stereo pairs to grey-scale images, although color is typically available. Since it is unclear whether color shows positive effects when using global methods, the color information is often discarded deliberately. Therefore, we have concentrated on the question: “Does color help to improve the performance of modern stereo matching approaches?”. To answer this question we have tested approximately 20 different color-based energy functions on 30 ground truth image pairs. We have found a relatively large improvement when using color in stereo matching. The best-performing color space gives 25% less disparity errors in comparison to grey-scale matching according to our benchmark.



The principle of 3D reconstruction via stereo vision. Left (a) and right (b) views of a stereo pair. Due to the different viewpoints, corresponding points in the two images are displaced in horizontal direction. (c) Amount of horizontal pixel displacement between the input views. (Large displacements are represented by bright pixels.) The amount of displacement is inversely proportional to a pixel's depth in the scene. The image (c) is therefore sufficient for generating the 3D scene reconstruction of (d).

In the second part of the project, we focus on the design of new energy functions. These energy functions are designed to provide a better model of the stereo problem, and therefore improved stereo matching results are expected from their application.

In [2], we have focused on the matting problem in stereo matching. At disparity borders, optical blur and image sampling generate pixels whose color is the composite of foreground and background surfaces. The problem in stereo is that this composition is different across stereo input views, and almost all stereo algorithms make a systematic mistake by assuming color consistency in these regions. We have proposed an energy function that overcomes this problem by explicitly modeling pixel mattes. Handling mattes does not only lead to an improved stereo model, but is also important for applications such as novel view generation.

In [3], we have worked on improving the data term of energy functions by proposing a new aggregation scheme for window-based matching. Our idea is to use the geodesic distance transform in the support aggregation step. Although we have only applied local optimization, our method achieves the 10th rank in the Middlebury Benchmark (<http://vision.middlebury.edu/stereo/>). Our method is the top performer among local methods in the Middlebury Online Table.

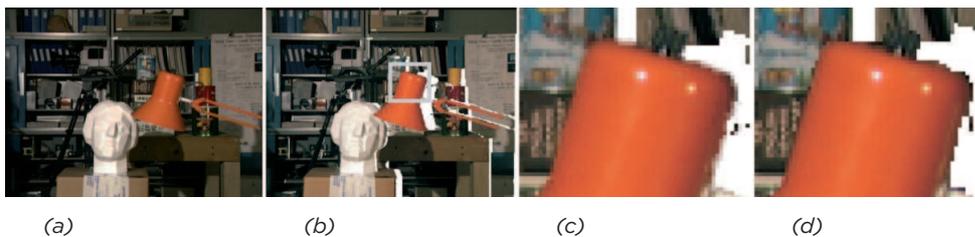
Finally, we have proposed a stereo algorithm that achieves results comparable to computationally expensive methods such as graph cuts at greatly reduced processing time [4]. Our idea is to apply dynamic programming on special purpose tree structures.

Project results (Publications):

- » [1] M. Bleyer, S. Chambon, U. Poppe and Margrit Gelautz. Evaluation of Different Methods for Using Colour Information in Global Stereo Matching. In the International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, volume XXXVII, part B3a, pages 415-422, 2008. (Oral presentation)
- » [2] M. Bleyer, M. Gelautz, C. Rhemann and C. Rother. A Stereo Approach that Handles the Matting Problem via Image Warping. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2009. (Oral presentation; Acceptance rate for oral presentations: 4.1%)
- » [3] A. Hosni, M. Bleyer, M. Gelautz and C. Rhemann. Local Stereo Matching Using Geodesic Support Weights. Accepted for IEEE International Conference on Image Processing (ICIP), 2009.
- » [4] M. Bleyer and M. Gelautz. Simple but Effective Tree Structures for Dynamic Programming-based Stereo Matching. In International Conference on Computer Vision Theory and Applications (VISAPP), volume 2, pages 415-422, 2008. (Oral presentation)

People involved:

Michael Bleyer, **Margrit Gelautz**, Asmaa Hosni



Novel view generation with pixel mattes. (a) Original image. (b) The image in (a) is transformed into a new perspective using the computed depth information. (c) Zoomed view. Due to using matting information, the lamp naturally blends in with its new background. (d) The same result without handling the pixel mattes. Disturbing artifacts occur around the lamp's border.

PLAYMANCER

Project type:
EU FP7 ICT

Project partners:

Systema Teknolotzis anonymi etaireia efarmogon ilektronikis kai pliروفrikis · Netunion s.a.r.l.
University of Patras · Technische Universitaet Wien
Fundació privada institut d'investigacio biomedica de bellvitge · Universite de Geneve · Serious Games Interactive · Roessingh Research and Development BV

Project period: 1.11.2007–31.10.2010

Abstract: PlayMancer will implement a new Serious Game environment by augmenting existing 3D gaming engines with new possibilities. The objectives of the project are

- » to construct a next generation gaming environment, mainly augmenting the gaming experience with innovative ICT modes of interaction between the player and the game world,
- » to evolve the principles of Universally Accessible Games for application into 3D-based games, following a design for all philosophy, with the ultimate goal of designing games to be equally challenging to players of different abilities,
- » to evaluate the proposed framework and gaming infrastructure by developing and testing a series of serious games modules as applied to two application domains: pain rehabilitation, and therapeutic support and lifestyle management programs for people with behavioral and addictive disorders.

Project results:

www.playmancer.com

Kalapanidas E., Wanatabe H., Davarakis C., Kaufmann H., Fernandez Aranda F., Lam T., Ganchev T., Konstantas D.
Playmancer: A European Serious Gaming 3D Environment
Proceedings of the 2nd International Workshop on e-health Services and Terchnologies - EHST 2008 in conjunction with ICISOFT 2008, Porto, Portugal, pp. 51-59, ISBN 978-989-8111-56-2, 2008.

Alex Conconi, Todor Ganchev, Otilia Kocsis, George Papadopoulos, Fernando Fernández-Aranda, and Susana Jiménez-Murcia: PlayMancer: A Serious Gaming 3D Environment. In Proceedings of the 4th AXMEDIS International Conference on Automated Solutions for Cross Media Content and Multi-channel Distribution (Florence, Italy, 17-19 November 2008).

Pintaric, T., Kment, T., and Spreicer, W. 2007. Squeeze-Orb: A Low-Cost Pressure-Sensitive User Input Device. In Proceedings of the 2008 ACM Symposium on Virtual



Motion tracking model

Reality Software and Technology (Bordeaux, France, October 27 - 29, 2008).

Thomas Pintaric, Hannes Kaufmann: A Rigid-Body Target Design Methodology for Optical Pose-Tracking Systems. In Proceedings of the 15th ACM Symposium on Virtual Reality Software and Technology (VRST), October 27-29, 2008, Bordeaux, France.

Todor Ganchev, Alexandros Lazaridis, Iosif Mporas and Nikos Fakotakis: Performance Evaluation for Voice Conversion Systems. In Proceedings of the 11th International Conference, TSD 2008, Brno, Czech Republic, September 8-12, 2008.

Theodoros Kostoulas, Todor Ganchev, Iosif Mporas, Nikos Fakotakis: A Real-World Emotional Speech Corpus for Modern Greek. In Proceedings of the Sixth International Language Resources and Evaluation (LREC'08), Marrakech, Morocco, May 28-30 2008

L. Forcano, F. Fernandez-Aranda, E.M. Alvarez-Moya, C.M. Bulik, A. Carracedo, R. Granero, M. Gratacos, S. Jimenez-Murcia, I. Krug, J.M. Mercader, E. Saus, J. Santamaria and X. Estivil: Suicide attempts in bulimia nervosa: Personality, Psychopathological and Genetic correlates. In European Psychiatry 16th AEP Congress - Abstract book Volume 23, Supplement 2, April 2008, Page S181

Fernando Fernández-Aranda, Araceli Núñez, Cristina Martínez, Isabel Krug, Mikael Cappozzo, Isabelle Carrard, Patrick Rouget, Susana Jiménez-Murcia, Roser Granero, Eva Penelo, Tony Lam (2008). Internet based cognitive-behavioral therapy for bulimia nervosa: A controlled study. Ponencia presentada en el Simposium (chair: S. Bauer) Technology enhanced interventions for the prevention, treatment support, and relapse prevention of eating disorders and obesity. 39th Annual Meeting Society for Psychotherapy Research, June 18-21, 2008, Barcelona, Spain

People involved:

Hannes Kaufmann, Christian Breiteneder, Thomas Pintaric, Christian Schönauer

Immersive interface technologies for life-cycle human-oriented activities in interactive aircraft-related virtual products (VISION)

Project type:

EU FP7, Thematic area: Transport (incl. aeronautics)

Project partners:

University of Patras / Laboratory for Manufacturing Systems & Automation (Coordinator), EADS Deutschland GmbH, EADS France (Innovation Works department), Universität des Saarlandes, VTT Technical Research Centre of Finland

Project period: 01.11.2008—30.04.2011

Abstract: Although Virtual Reality (VR) has demonstrated a significant potential for interactive applications in product and process development, the proven quality of the underlying technologies is still far from satisfying the real-life needs of aerospace industrial practice. VISION aims to specify and develop key interface features in fundamental cornerstones of VR technology, namely in immersive visualization and interaction, so as to improve the flexibility, performance and cost efficiency of human-oriented life cycle procedures in critical aircraft-related virtual products (e.g., virtual cockpit, virtual cabin etc.). The upstream research roadmap of VISION will involve a) specific human-oriented developments in simulation features, such as visual perception, real-time rendering, markerless body tracking, smart objects interaction, and interaction metaphors, b) an integration of the features in a common IT platform, and c) a validation based on test cases focused on specific aircraft-related virtual products. The achievements of VISION will enhance the credibility of human-in-the-loop aircraft-related VR simulations. They will further enhance the engineering context of aircraft-related virtual products by enabling their increased use for activities, such as design verification, ergonomics validation, specifications of equipment displays, operational and situational training. The VISION project aims to develop new technology in support of the design and virtual prototyping of critical aircraft-related products. It will improve the human-oriented functionality and usage of these virtual products along their life cycle. Thus, it addresses the “Design Systems & Tools” and “Human Factors” call topics. The consortium of VISION includes representatives of all major stakeholders, including end users, research partners and VR IT vendors. VISION is supported by the European Aeronautics Science Network (EASN).



Virtual reality research process

Project results:

Publications expected for VR/AR as well as 3D User Interface conferences, www.project-vision.eu

People Involved:

Christian Breiteneder, Hannes Kaufmann, Mathis Csisinko

Development of an Augmented-Reality Dynamic Spatial Test (ARST)

Project type:

FWF; WIEN; Österreich

Project partners:

Interactive Media Systems Group (IMS)
Technische Universität Wien, Österreich
Abteilung für Entwicklungs- und pädagogische Psychologie
Alpen-Adria Universität Klagenfurt, Österreich

Project period: 01.11.2006—31.10.2009

Abstract: In the proposed project we intend to develop a new type of test for the assessment of spatial abilities that differs from conventional spatial ability tests in several aspects. First, traditional spatial ability tests (paper-pencil as well as on-screen computer versions) assess 3-dimensional spatial abilities with 2-dimensional means. The new test will measure the ability to visualize and mentally manipulate 3-dimensional objects in actual 3-dimensional space, and should thus have a higher ecological validity than previous spatial ability tests. This will be possible through use of the augmented reality tool Construct3D, which allows the projecting of virtual 3-dimensional objects into real space where they can be seen and manipulated by means of special glasses and input devices. Furthermore, the planned test will be a dynamic learning test; i.e., in contrast to conventional tests, it not only measures a person's current status, but also their learning potential. Performance in conventional tests is generally, and particularly where spatial abilities are concerned, significantly dependent on factors such as test experience or experience with similar tasks and materials. Gender differences, which are still frequently found in spatial tests, can partly be attributed to these experience-based factors. Often, such differences can be reduced or eliminated through a relatively short training, sometimes even through a simple re-taking of the test. With a dynamic learning test (usually consisting of a pre-test, a training phase, and a post-test), the influence of short-term learning experiences on test performance can be assessed, which may yield higher internal consistency and predictive power of the test scores. The new item material will assess the mental manipulation (rotation, combination, intersection, etc.) of 3-dimensional objects. Stimuli and instructions are presented sequentially. Hence, in contrast to most other tests, participants need to actually encode and manipulate mental representations of the spatial objects. Thereby, the range of possible strategies (e.g., comparison of single features and elimination of possible answers) is reduced. In order to guarantee homogeneity of the testing material and to avoid problems such as ceiling effects, item response models will



Augmented reality application example

be employed for the development of test items as well as for the measurement of change in performance.

Project results:

KAUFMANN, H., CSISINKO, M., STRASSER, I., STRAUSS, S., KOLLER, I. & GLÜCK, J., Design of a Virtual Reality Supported Test for Spatial Abilities in Proceedings of the International Conference on Geometry and Graphics, August 4th - 8th, Dresden, Germany, 2008.
STRAUSS, S., STRASSER, I., CSISINKO, M. & KAUFMANN, H., Entwicklung eines 3D-Raumvorstellungs-Lerntests mit Augmented Reality in Poster presented at the 9. Arbeitstagung der Fachgruppe für Differentielle Psychologie, Persönlichkeitspsychologie und Psychologische Diagnostik, September 24-26, Vienna, Austria, 2007.

People Involved:

Mathis Csisinko, Hannes Kaufmann, Michael Mehling, Annette Mossel

VENDOR - Video Engine Design Methodology Rules

Project type: FFG (FIT-IT)

Project partners:

JKU Linz, Institute for Integrated Circuits
ON DEMAND Microelectronics · DICE GmbH

Project period: 01.08.2006—31.7.2009

Abstract: State-of-the-art video standards such as H.264 and VC-1 are currently used in a wide range of video-related areas such as video content distribution and television broadcasting. Compared to preceding standards such as MPEG-2 and MPEG-4 SP/ASP, improved coding efficiency could be reached by introducing more advanced pixel processing algorithms (e.g., quarter-pixel motion estimation) as well as by the use of more sophisticated algorithms for predicting syntax elements from neighboring macroblocks (e.g., context-adaptive VLC). These new coding tools result in significantly increased CPU and memory loads required for decoding a video stream. In environments of limited processing power such as embedded systems, the high computational demands pose a challenge for practical implementations. Multi-core systems provide an elegant and power-efficient solution to overcome these performance limitations.

However, the actual design methodologies for building such a video architecture possess two principal shortcomings. First, the partitioning of the system to a set of processing units by investigating the whole video processing system and evaluating whether the architecture mapping task has been successful are not addressed in a suitable way by available methodologies. Second, synergies between the separate video processing modules of such a video platform are not exploited, although it is obvious that they do exist. For example, depending on the current video application (e.g., encoding, decoding), the individual processing resources support the execution of an application task with different efficiency. An efficient design methodology must support the finding of synergies and optimizing of shared resources. Within this project, a new design methodology, which takes advantages of such synergies, is developed.

The advantages of the developed design methodology are twofold. On the one hand, evaluations and design space explorations for a “virtual” architecture can be done before the architecture is effectively built. We can simulate the video algorithms’ runtime behavior and analyze the architecture regarding its bottlenecks. This results in a labor and cost-optimized design process for video processing architectures and avoids an underperforming system design. The labor-intensive process of partitioning a video application can be done after this partitioning has been simulated and analyzed.

On the other hand, we can evaluate the potential for synergies by exploring various algorithms and partitionings running on a virtual architecture. Performance bot-

tlenecks can be detected at an early stage of the design process. We can adapt the architecture in such a way that all targeted applications can use the architecture’s resources most efficiently.

The developed methodology has been verified by a simulator implementation, namely the Partition Assessment Tool (PAT). This tool can model complex multi-core architectures and the partitioned video coding software running on this parallel system. The tool simulates the runtime behavior of this architecture and solves parallel issues such as data dependencies between the processing units, write stalls due to buffer limitations and concurrency issues automatically. It provides detailed information about the runtime complexity, the bus transfer volume and the buffer requirements. This information is of prime importance to a system designer when developing such a video coding architecture. The outcome of this project is intended to lead to the development of efficient multi-core video processing architectures.

Project results: www.ims.tuwien.ac.at/vendor

Publications:

- » Seitner F. H., Schreier R. M., Bleyer M., Gelautz M.; A macroblock-level analysis on the dynamic behavior of an H.264 decoder, IEEE ISCE, 2007.
- » Seitner F. H., Schreier R. M., Bleyer M., Gelautz M.; A high-level simulator for the H.264/AVC decoding process in multi-core systems, SPIE, 2008.
- » Schreier R., Seitner F. H.; Method and apparatus for encoding and decoding of video streams, US patent application, filed 2008/01.
- » Seitner F., Meser J., Schedelberger G., Wasserbauer A., Bleyer M., Gelautz M., Schutti M., Schreier R., Vaclavik P., Krottendorfer G., Truhlar G., Bauernfeind T., Beham P.; Design Methodology for the SVENm Multimedia Engine, Austrochip, 2008.
- » Seitner F., Bleyer M., Gelautz M.; Development of multi-core video decoding platforms based on high-level architecture simulations, JSC, 2008.
- » Seitner F. H., Bleyer M., Gelautz M., Schreier R. M.; Evaluation of data-parallel splitting approaches for H.264 decoding, MoMM, 2008.
- » Seitner F. H., Bleyer M., Schreier R. M., Gelautz M.; Development of a multi-core HD decoder using a high-level simulation approach, accepted for IEEE Trans. Of Circuits and Systems for Video Technology, 2009
- » Seitner F. H., Bleyer M., Gelautz M., Schreier R. M.; Evaluation of data-parallel H.264 decoding approaches for strongly resource-restricted architectures, accepted for Multimedia Tools and Applications (MTAP), 2009.

Software Modules:

- » Tool for high-level modeling of multi-core architectures
- » Framework for parsing runtime profiles and syntax information profiles for PAT compatible input format

People Involved: Margrit Gelautz, Florian Seitner, Ralf Schreier, Michael Bleyer

International Research Network

Europe

STI2 - Semantic technologies institute international,
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Johannes Kepler University, Linz, Austria

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University of Konstanz, Germany
Fraunhofer, Augsburg, Germany
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Technická Univerzita v Košiciach, Slovakia

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University of Toronto, Canada

Business Partners

Arbeiterkammer Wien, Vienna, Austria
<http://wien.arbeiterkammer.at>

A-SIT, Austria
<http://www.a-sit.at/>

Austrian Computer Society (OCG), Austria
<http://www.ocg.at/>

Avedos, Austria
<http://www.avedos.com/>

BOC Unternehmensberatung GmbH, Vienna, Austria
<http://www.boc-group.com/>

Braincon, Austria
<http://www.bct.co.at/>

Bravestone, Austria
<http://www.bravestone.at>

DICE GmbH, Linz, Austria,
www.dice.at

Door2solution software gmbH, Vienna, Austria
<http://www.element4solution.org/>

Factline, Austria
<http://www.factline.com>

Frequentis Nachrichten AG, Vienna, Austria
www.frequentis.at

Geodata Ziviltechniker GesmbH, Austria
www.geodata.at

Gesundheit Österreich, Austria
<http://www.goeg.at/>

Ikarus, Austria
<http://www.ikarus.at/>

Imagination GesmbH, Austria
<http://www.imagination.at>

ISIS Papyrus
<http://www.isis-papyrus.com/>

KMU Research, Austria
<http://www.kmuforschung.ac.at/>

logi.cals Kirchner Soft GmbH
<http://www.logicals.com/>

Mediaprint, Vienna, Austria
<http://www.mediaprint.at/>

Metadata, Austria

Parsgroup
<http://www.parsgroup.at>

Porsche Informatik GmbH, Austria
<http://www.porscheinformatik.at>

ProCom Strasser, Austria
<http://www.procom-strasser.com/>

Qualysoft, Austria
<http://www.qualysoft.at>

Raiffeisen Informatik, Austria
<http://www.raiffeiseninformatik.at/>

Siemens Austria (PSE)
<http://www.pse.siemens.at/>

Social Insurance (SVA), Austria
<http://esv-sva.sozvers.at/>

Theobroma, Austria
<http://www.theobroma-systems.com/>

T-Mobile, Austria
<http://www.t-mobile.at>

Webges
<http://www.webges.com/>

MobilTel Bulgaria, Sophia, Bulgaria
<http://www.mtel.bg/>

Finnish Tourist Board, Finland
<http://www.mek.fi>

Spin offs

SpectralMind (Music analysis)
<http://www.spectralmind.com/>

Senactive (Real-time monitoring and event data warehouse)
<http://www.senactive.com/>

EC3Networks GmbH (e-commerce tourist platform)
<http://www.ec3networks.at/>

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- » A. Schatten, M. Epheser, D. Pölz: "Instant Collaboration: Developing a Framework to Support new Patterns of Team-Cooperation"; the International Conference on Web Information Systems and Technologies (WEBIST), Barcelona; (2007), pp. 21-28.
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- » R. M. Schreier, A. Rothermel: "A Latency Analysis on H.264 Video Transmission Systems"; IEEE Conference on Consumer Electronics (ICCE); (2008), pp. 1-2.
- » A. Scutelnicu, F. Lin, Kinshuk, T.-C. Liu, S. Graf, R. McGreal: "Integrating JADE Agents into Moodle"; in: "(Workshops/Doctoral Student Consortium) of the International Conference on Computers in Education"; APSCE; 2007, ISBN: 978-4-924861-19-0, pp. 215-220.
- » M. Seidl: "A Solver for Quantified Boolean Formulas in Negation Normal Form"; Ausgezeichnete Informatikdissertationen 2007, Bonn; (2008), pp. 271-280.
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- » F. Seitner, R. M. Schreier, M. Bleyer, M. Gelautz: "A high-level simulator for the H.264/AVC decoding process in multi-core systems"; SPIE IS&T Electronic Imaging Conference, San Jose; 27.01.2008 - 31.01.2008; (2008), pp. 5-16.
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- » M. Wimmer, A. Schauerhuber, W. Schwinger, H. Kargl: "On the Integration of Web Modeling Languages: Preliminary Results and Future Challenges"; 7th International Conference on Web Engineering, Workshop Proceedings; (2007), pp. 255-269.
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» **Dissertations (30)**

- » S. Fenz: "Ontology- and Bayesian-based information security risk management"; Supervisors: A. M. Tjoa and M. Hudec; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 14.10.2008.
- » M. Fuchs: "Management von Kompetenzen für Personalauswahl und Teambildung in sicherheitskritischen Bereichen"; Supervisors: J. Dorn and H. Tellioglu; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 17.06.2008.
- » M. Heindl: "Managing Dependencies in Complex Global Software Development Projects"; Supervisors: S. Biffi and P. Grünbacher; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 05.05.2008.
- » A. Hinum: "Gravi++ Interactive Information Visualization for High Dimensional, Temporal Data"; Supervisors: S. Miksch and C. Popow; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 16.01.2007.
- » H. H. Hoang: "Semantic Web Information Retrieval: A Semantic Web Based Virtual Query System for Supporting User Query Formulation and Information Retrieval in The SemanticLIFE Personal Digital Memory Framework"; Supervisors: A. M. Tjoa and R. Wagner; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 20.03.2007.
- » H. Kargl: "Smart Matching - An Approach for the Automatic Generation of Executable Schema Mappings"; Supervisors: G. Kappel and C. Huemer; Institut für Softwaretechnik und Interaktive Systeme, 2008.
- » S. Karim: "The Concept of Connecting Ontology using the Semantic Web Technology, and its Exploitation for Knowledge and Information Presentation for People with Special Needs"; Supervisors: A. M. Tjoa and K. Miesenberger; Institut für Softwaretechnik und Interaktive Systeme, 2007.
- » S. Khusro: "User and Context Modeling on the Desktop - A Scalable Approach for Lifetime Information"; Supervisors: A. M. Tjoa and J. Küng; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 26.11.2007.
- » M. Kind: "Analyse, Struktur, Management und Kernrisiken von State of Art ID Projekten mit gesamtstaatlichem Charakter"; Supervisors: W. Merkl and T. Grechenig; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 09.10.2007.
- » B. Korherr: "Business Process Modelling - Languages, Goals and Variabilities"; Supervisors: G. Kappel and C. Huemer; Institut für Softwaretechnik und Interaktive Systeme, 2007.
- » K. Latif: "Shared Semantic Context in Lifetime Knowledge Archive"; Supervisors: A. M. Tjoa and G. Pernul; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 09.10.2007.
- » D. Markovic: "Image Stylization from Stereo Views of Natural Scenes"; Supervisors: M. Gelautz and F. Breitenecker; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 20.03.2007.
- » E. Michlmayr: "Ant Algorithms for Self-Organization in Social Networks"; Supervisors: G. Kappel and W. Nejdl; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 21.12.2007.
- » M. Murzek: "The Model Morphing Approach - Horizontal Transformation of Business Process Models"; Supervisors: G. Kappel and D. Karagiannis; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 04.03.2008.
- » K. Mustafa: "Ontology-Based Annotation: an Approach to Bring More Semantic Metadata in a Personal Digital Memory Framework"; Supervisors: A. M. Tjoa and R. Wagner; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 24.04.2007.
- » T. Neubauer: "Business Process Based Valuation and Selection of IT Investments"; Supervisors: A. M. Tjoa and C. Strauß; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 09.10.2007.
- » F. Nirschl: "Management von Kompetenzen für Personalauswahl und Teambildung in sicherheitskritischen Bereichen"; Supervisors: J. Dorn and H. Tellioglu; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 17.06.2008.
- » A. Öztürk: "Embedding the Evidence Information in Computer-Supported Guidelines into the Decision-Making Process"; Supervisors: S. Miksch and C. Popow; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 26.02.2007.
- » M. Pichlmair: "Evaluierung von Kompetenzmanagement für Studierende"; Supervisors: J. Dorn and G. Steinhardt; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 17.06.2008.
- » G. Pözlbauer: "Advanced data exploration methods based on Self-Organizing Maps"; Supervisors: A. Rauber and W. Merkl; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 18.12.2008.
- » B. Riedl: "PIPE: Pseudonymization of Information for Privacy in e-Health"; Supervisors: A. M. Tjoa and G. Quirchmayr; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 21.10.2008.
- » S. Rozsnyai: "Managing Event Streams for Querying Complex Events and Event Patterns"; Supervisors: S. Biffi and A. Schatten; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 15.04.2008.
- » A. Schauerhuber: "aspectUWA - Applying Aspect-Oriented to the Model-Driven Development of Ubiquitous Web Applications"; Supervisors: G. Kappel and W. Retschitzegger; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 04.12.2007.
- » W. Schreiner: "Security and Privacy Management in Service Oriented Architectures"; Supervisors: J. Dorn and A. M. Tjoa; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 12.06.2007.
- » V. Stefanov: "Conceptual Models and Model-Based Business Metadata to Bridge the Gap between Data Warehouses and Organizations"; Supervisors: G. Kappel and J. Trujillo; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 04.12.2007.
- » N. Stolba: "Towards a Sustainable DWH Approach for Evidence-Based Healthcare"; Supervisors: A. M. Tjoa and T. Mück; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 20.11.2007.
- » M. Strommer: "Model Transformation By-Example"; Supervisors: G. Kappel and C. Huemer; Institut für Softwaretechnik und Interaktive Systeme, 2008.
- » D. Wahyudin: "Quality Prediction and Evaluation Models for Products and Processes in Distributed Software Development"; Supervisors: S. Biffi and A. M. Tjoa; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 05.11.2008.
- » M. Wimmer: "From Mining to Mapping and Roundtrip Transformations - A Systematic Approach to Model-based Tool Integration"; Supervisors: G. Kappel and W. Retschitzegger; Institut für Softwaretechnik und Interaktive Systeme, 2008; Rigorosum: 21.04.2008.
- » B. Yildiz: "Ontology-Driven Information Extraction"; Supervisors: S. Miksch and G. Salzer; Institut für Softwaretechnik und Interaktive Systeme, 2007; Rigorosum: 24.04.2007.

Keynotes

Gerti Kappel

„A Framework for Building Mapping Operators Resolving Structural Heterogeneities“, United Information Systems Conference (UNISCON) 2008, Klagenfurt, Austria

A Min Tjoa

“Educational Efforts and Best Practices: OLPC, ICDL, University Curricula, Applications in School and Education“, Asia-Africa Conference on Open Source (AAOS) 2008, Jakarta, Indonesia

“Integration of Semantic XForms and Personal Web Services as a Tool to Bridge the Gap between Personal Desktops and Global Business Processes“, United Information Systems Conference (UNISCON) 2008, Klagenfurt, Austria

Conference chair/organizer

Gerti Kappel

Tutorial Co-Chair Very Large Databases Conference (VLDB) 2007

A Min Tjoa

General Chair of The First International Conference on Complex, Intelligent and Software Intensive System (CISIS) 2008 in Vienna, Austria

Honorary Chair of Very Large Databases Conference (VLDB) 2007 in Vienna, Austria

Asia-Africa Conference on Open Source (AAOS) 2008 in Jakarta, Indonesia

Stefan Biffli

Program committee co-chair of the international Conference on Complex, Intelligent, and Software-Intensive Systems (CISIS) 2009 in Fukuoka, Japan

Co-chair of the “Software Product and Process Improvement” (SPPI) Track at Euromicro Conference on Software Engineering and Advanced Applications (SEAA) 2008

Co-chair of the Workshop on “Event-Based IT Systems” at the Conference on Availability, Reliability, and Security 2007 in Vienna, Austria.

Publicity chair of the European Software Engineering Conference and Foundation of Software Engineering 2007 in Dubrovnik, Croatia

Publication chair ACM/IEEE Symposium on Empirical Software Engineering and Measurement 2007

Steering Committee member of the Central & Eastern European Conference on Software Engineering Techniques 2008

Andreas Rauber

ECDL 2008: Tutorial Chair 12th European Conference on Research and Advanced Technology for Digital Libraries, September 14-19 2008, Aarhus, Denmark

ISMIR 2007: Co-Chair 8th International Conference on Music Information Retrieval, 2007, Vienna, Austria.

WebArchiving 2008: Program Chair of the 8th Workshop on Web Archiving, September 18/19 2008, Aarhus, Denmark

WebArchiving 2007: Program Chair of the 7th Workshop on Web Archiving, June 23 2007, Vancouver, Canada

Chair for Workshop on Data Analysis in Mlynsky, Slovakia, 2008

Edgar Weippl

PC Chair of the Conference on Availability, Reliability, and Security (ARES) 2008 in Barcelona, Spain.

PC Chair of the Conference on Availability, Reliability, and Security (ARES) 2009 in Fukuoka, Japan.

PC Chair of World Conf. on Educational Multimedia, Hypermedia & Telecommunications (ED-MEDIA) 2008 in Vienna

Member of Steering Committee World Conf. on Educational Multimedia, Hypermedia & Telecommunications

Stefan Fenz

Chair of the Workshop on “Models” at the Conference on Availability, Reliability & Security 2008 in Barcelona, Spain.

Chair of the Workshop on “Access Control & Algorithms” at the Conference on Availability, Reliability, and Security (ARES) 2008 in Barcelona, Spain.

Chair of the Workshop on “Risk Management” at the Conference on Availability, Reliability, and Security (ARES) 2008 in Barcelona, Spain.

Hannes Werthner

General chair of the International Conference on E-Commerce 2008 (ICEC 08) in Innsbruck, Austria

Chairman of the International Conference on E-Commerce (ICEC) standing committee

Man Tho

Program Chair Data Warehousing and Knowledge Discovery (DAWAK) 2008 in Torino, Italy

Thomas Lidy, Jakob Frank and Rudolf Mayer

as „local organising committee“ of the ISMIR 2007 conference

Awards

Master thesis Awards

2007 Distinguished Young Alumnus Award (Best Master's Thesis at the Faculty of Informatics) (Thomas Lidy)

2007 Microsoft Förderpreis (Thomas Lidy)

Epilog Best Poster Award Veronika Zenz Automatic Chord Detection in Polyphonic Audio Data. 2007 Andreas Rauber

Epilog Best Poster Award: Andrei Grecu: Musical Instrument Separation. Master Thesis (English), Department of Software Technology and Interactive Systems, Vienna University of Technology, October 2007. (Andreas Rauber)

OCG Förderpreis: Andrei Grecu: Musical Instrument Separation. Master Thesis (English), Department of Software Technology and Interactive Systems, Vienna University of Technology, October 2007. (Andreas Rauber)

2008: Rudolf Sallinger Preis for Stefan Fenz "Security Ontologies: Improving Quantitative Risk Analysis" Edgar Weippel

PhD thesis Awards

2007: Siemens Dissertation Award of the Faculty of Informatics, TU Vienna, (Sabine Graf)

2007: Siemens Dissertationsstipendium der Fakultät für Informatik der TU Wien. (Dietmar Winkler)

2007: "GIT Award for PhD thesis given by Österreichischer Verband für Elektrotechnik", M. Bleyer, "Segmentation-based Stereo and Motion with Occlusions", PhD Thesis.

2008: Excellence Dissertation Award of Federal Ministry of Science and Research (Manuel Wimmer)

Best Paper Awards

2007: H. Berger, M. Denk, M. Dittenbach, D. Merkl, A. Pesenhofer, Quo Vadis Homo Turisticus? Towards a Picture-based Tourist Profiler, 14th Int'l Conference on Information and Communication Technologies in Tourism (ENTER'07), Ljubljana, Slovenia.

2007: Best "Short Paper", Sabine Graf; 7th IEEE International Conference on Advanced Learning Technologies, Niigata, Japan, "Effect of Learning Styles on Peer Assessment in an Agent-based Collaborative Learning Environment"

2007: Best "Full Paper", Sabine Graf, 7th IEEE International Conference on advanced Learning Technologies, Niigata, Japan, 19th July 2007, "Analysing the Relationship between Learning Styles and Cognitive Traits"

2008: Stefan Biffli, Muhammad Ali Babar, and Dietmar Winkler, "Impact of Experience and Team Size on the Quality of Scenarios for Architecture Evaluation" at the 12th Conference on Evaluation and Assessment in Software Engineering (EASE), Bari, Italy, 2008.

2008: J. Dorn and T. Naz, Structuring Meta-search Research by Design Patterns, International Computer Science and Technology Conference, San Diego, CA.

2008: Best Quantitative Research Paper D. Merkl, H. Berger, M. Dittenbach, A. Pesenhofer, Tourist Type Profiling in Web 3D: A Second Life Experience, IADIS Int'l Conference on Information Systems, Carvoeiro, Portugal.

2008: Best student paper M. Zapletal, A Holistic Methodology for Model-Driven B2B Integration, at the Doctoral Consortium at the 10th International Conference on Electronic Commerce (ICECO8), CEUR, Innsbruck (Austria)

2008: Michael Bleyer and Margrit Gelautz: U.V. Helava Award - Best Paper (Vol. 59) of ISPRS Journal of Photogrammetry and Remote Sensing (A Layered Stereo Matching Algorithm Using Image Segmentation and Global Visibility Constraints)

2007: Nevena Stolba; 2007 IRMA Conference, 20–23 May 2007, Vancouver Canada "Towards a Data Warehouse Based Approach to Support Healthcare Knowledge Development and Sharing"

Miscellaneous Awards

2007: Finalist of Hagenberg Software Award for SOPA platform (Amin Anjomshoaa)

2007: Best project proposal for FIT-IT call for "Semantic Systems" for Bsopt (Business Semantics on top of Process Technology) was awarded to Hannes Werthner, Marco Zapletal, Christian Huemer

2007: Austrian Congress Award des Austrian Convention Bureau (Hannes Werthner)

2007: Margrit Gelautz: FEMtech Award Expert of the Month (September 07), granted by the Austrian Ministry BMVIT for significant achievements of women in science and technology.

2007: Google Europe Anita Borg Award (Martina Umlauf)

2007: 2nd rank in Audio Genre Classification contest + 3rd rank in Audio Mood Classification contest in the Music Information Retrieval Evaluation eXchange (MIREX 2007) (Thomas Lidy)

2008: 3rd rank in Audio Mood Classification contest in Music Information Retrieval Evaluation eXchange (MIREX2008) (Thomas Lidy)

2008: Second best FIT-IT proposal for Security and Privacy in IT Systems' call (Amin Anjomshoaa)

Research-Guided University Teaching

University Teaching

The academic staff of our institute offers about 190 lectures each year addressing mainly students of the studies

- » Bachelor Media Informatics
- » Bachelor Software & Information Engineering
- » Bachelor Business Informatics
- » Informatics Teacher Education
- » Master Media Informatics
- » Master Software Engineering and Internet Computing
- » Master Business Informatics

All our teaching is research guided. Each year more than 70 students write their master's thesis and more than 10 students receive their PhD at our institute.

Pre-Studies Course "prolog"

Our institute is highly involved in the organization and carrying out of the pre-studies course "prolog" that is offered to all students starting their bachelor studies at the Faculty of Informatics. This course is held during the first two weeks of the winter term and covers topics that are important to know when beginning university studies at the Faculty of Informatics: how to organize your studies, algorithmic thinking, computer functionality, basics of computer programming, knowledge engineering, and a refresher course in mathematics. Monika Lanzenberger covers the knowledge engineering lessons and Gerald Futschek teaches algorithmic thinking in this course.

Student Excursions

The institute puts effort into facilitating international contacts for our students with leading academic and industrial research institutions. In the last years, two excursions were organized that covered visits to the universities of Munich, Trento, Nuremberg and Prague, and to Siemens Munich, Skoda Prague, and Sun Research Prague. Early 2009, another one week excursion has been organized to England, with visits to the universities of Oxford, Southampton, and Surrey, and the Google Lab in London.

e-Learning Award

In 2007, Marion Brandsteidl and Edgar Weippl won an e-Learning award for the best e-learning lecture at the Vienna University of Technology with their lecture "Security".

Academic Teaching Management

Academic Roles

In the reporting period, Prof. Gerti Kappel, followed by Prof. Hannes Werthner held the position of Dean of Studies for all Business Informatics studies. Gerald Futschek held the role of Deputy Dean of Studies for all Informatics studies and informatics teacher training.

Vienna PhD School of Informatics

Hannes Werthner headed a proponent team that prepared a PhD School at the Faculty of Informatics that will start in the winter term 2009. Interested students from all countries can apply for a limited number of scholarships.

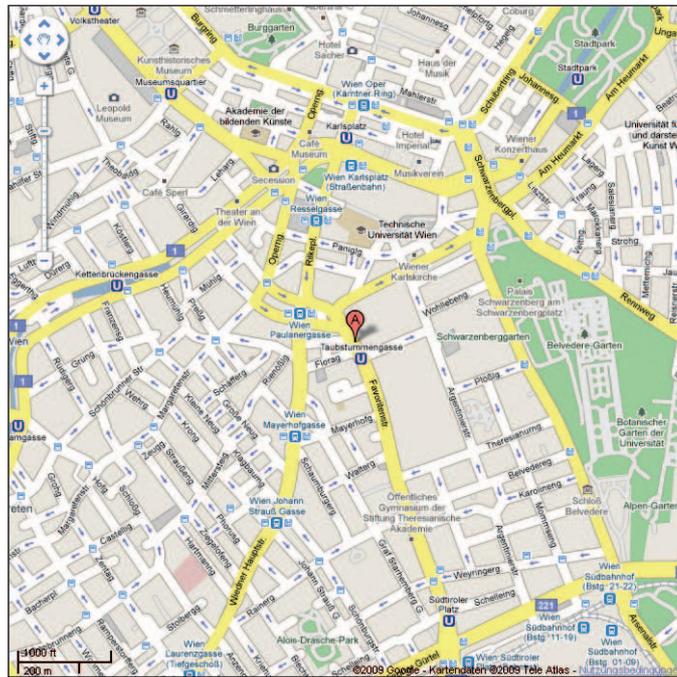
Off University IT Education Activities

Bebras International Contest

Gerald Futschek organized the Austrian version of the international Bebras contest on informatics and computer literacy for Austrian schools. In 2007, more than 1,100, and in 2008, more than 3,900 secondary school pupils from all parts of Austria participated in this contest. The objective was to motivate and encourage the pupils to become more interested in informatics by providing interesting tasks for them to solve.

ECDL

2007 marked the 10th anniversary of the launch of the "European Computer Driving Licence" in Austria in September 1997. Gerald Futschek has been the leader of this education initiative since the very beginning. So far, nearly 300,000 people in Austria have passed all 7 tests that are required to achieve this IT user certificate. The Austrian Computer Society OCG is the national operator of this international initiative for computer users.



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