INSTITUT FÜR BAUINFORMATIK
PROF. RAIMAR J. SCHERER
JAHRESBERICHT

TECHNISCHE UNIVERSITÄT DRESDEN

RESEARCH AND LECTURE ACTIVITIES

2006

December 2005

Research at the ”Institute of Construction Informatics – Bauinformatik” (CiB) is in two directions:

Applied Informatics and ***Applied Stochastics***

The view of the brochure is directed to the future, i.e. to new ideas and what is planned to be done in 2006, based on the results achieved in 2005. Current research topics are: (1) engineering and business ontologies for distributed information and knowledge management focused on dynamic virtual enterprising and cross-sectional teams in networked business, exploiting P2P, GRID and agent technology, (2) evolutionary building product and process models, (3) service-oriented architectures for distributed information management, (4) pattern method for dynamic business organization of virtual organization implementations, for context-sensitive information management, and for prognosis of earthquake accelerations, and (5) networked risk management. Further topics covered by current research projects are: Product Data Management, Concurrent Engineering and e-Learning. The scope of research is not restricted to the engineering view but captures the related business opportunities, social impact and education as well.

The institute strongly promotes information technology in research and industry. Prof. Scherer is chairman of the European Association of Product and Process Modelling, which organizes its 6th ECPPM conference hosted by AIDICO at Valencia, Spain in September 2006. The conference will again bring together leading European academic and industrial researchers and developers in construction IT. IAI working groups and members will report on progress in IFC developments and several running European R&D projects will again take the opportunity to present their results (see *http://www.ecppm.org)*.

In July 2005, the institute hosted the 22nd CiB-W78 Conference with about 100 scientific papers as well as the 3rd International Workshop on Construction IT in Education (see *http://cib.bau.tu-dresden.de/w78/*).

Know-how transfer to the industry has indeed a high priority for the institute in order to explore IT solutions. CiB is the German National Information Point for the industry in ProdAEC (*http://www.prodaec.com*), a network of European institutions fostering standardisation in construction IT. CiB is very active in international and national standardization bodies in the domains of IT-related product, process, and document modelling and therefore holds several chair and vice-chairman positions. CiB is engaged in the promotion of IT for the whole construction industry, also for handicraft masters.

Well established in 2004, the “Dresdner Bauinformatik-Gesprächskreis” (Dresden Construction Informatics Dialogue) has initiated a fruitful dialogue with the construction industry and IT-specialists. Workshops were organised in March, June and December (*http://cib.bau.tu-dresden.de/ddbig*).

E-Learning activities have successfully been continued. The European on-line master course in Information Technology in Construction, co-ordinated by the University of Maribor, Slovenia, is in its second academic year now and can be chosen at five European universities. CiB’s contributions are lecturing courses in “Mobile Computing”, “Software Engineering” and “eBusiness and Data Warehouses”. Professor Jim Garrett (Carnegie Mellon University Pittsburgh) has continuously been involved as active guest lecturer.

Research in the areas “ICT in construction management” and “earthquake engineering” was reinforced through intensive information exchange with external scientists. In 2005 we were glad to host Prof. Svetla Radeva of the Sofia University of Architecture, Civil Engineering and Geodesy, working with us in the area of ICT and earthquake engineering. Prof. Scherer was invited as visiting researcher on “IT-supported construction management” by Prof. Attila Dikbas (Istanbul Technical University) and on “Earthquake Engineering and Risk Management” by Prof. Radeva .

In 2005 the Institute continued to fruitfully promote its research staff and their results. Dr.-Ing. habil. Karsten Menzel received the offer from the Cork University College, Ireland to take over the chair in IT in architecture, engineering and construction as a full professor. We wish him all the best for his new job, that he will start in January 2006. For a short time he will stay as a volunteer at the institute to

either finish research projects or smoothly transfer them to Cork. In April, October and November 2005, Jalal Dabagh from Aleppo, Syria, Wael Sharmak from the Tischrin University, Syria and Dr. Eyad Aldoghaim from Homs, Syria, respectively, joined our research staff with scholarships from the Syrian government to do research work with us and to prepare their PhD theses.

Further information can be found at our web pages *http://cib.bau.tu-dresden.de,* which are continuously updated to reflect the state of our research activities.

Dresden, in December 2005 Raimar J. Scherer

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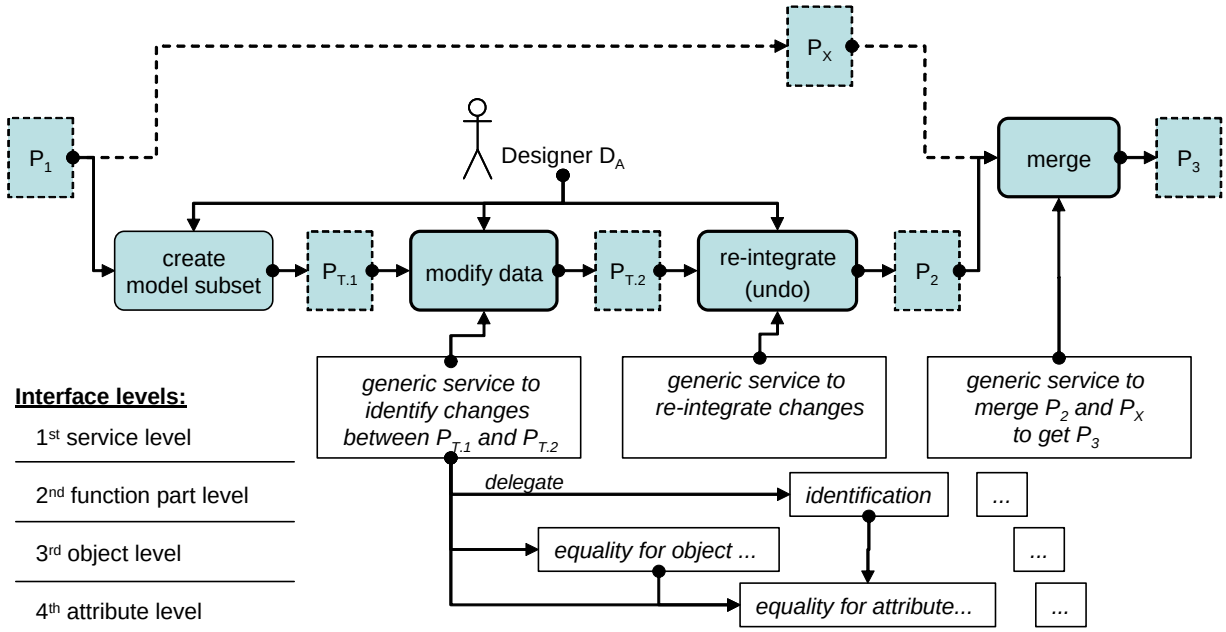
Optimistic Transaction Strategies for Advanced Collaborative Environments

Matthias Weise, Peter Katranuschkov

Objectives

Advanced collaborative environments are not feasible without sharing product model data, i.e. syntactic and semantic interoperability as well as concurrency control. Thanks to standardisation efforts such as STEP and IFC as well as more advanced data management methods we are able to provide basic data sharing scenarios. However, in the presented research we strongly believe that *seamless* data sharing, as needed for trustworthy collaboration, is not possible in the heterogeneous and highly fragmented construction industry.

The objectives of our research is to provide a framework for product data management which enables to identify *design changes* and thus allows more easily to detect failures in the design process. As shown in the figure below it is suggested to break down each design step into three stages and to make them accessible for other designers. The outlined approach is currently supported by a set of generic services which address 1) comparison of model data, 2) re-integration of changes allowing to use model subsets and finally 3) merging of independently changed product data. Thus, we offer basic functionalities to enable data sharing for an optimistic cooperation scenario. These services can be used with any EXPRESS-based product model and thus are highly flexible. The next step of our research is to improve the quality of these services by adding domain knowledge dealing with the semantic of the processed data. Such extension will be modelled and implemented as an *optional add-on*, which can be added in small functional parts without losing flexibility.



Concept of add-on's to generic services to improve quality of data sharing

Approach

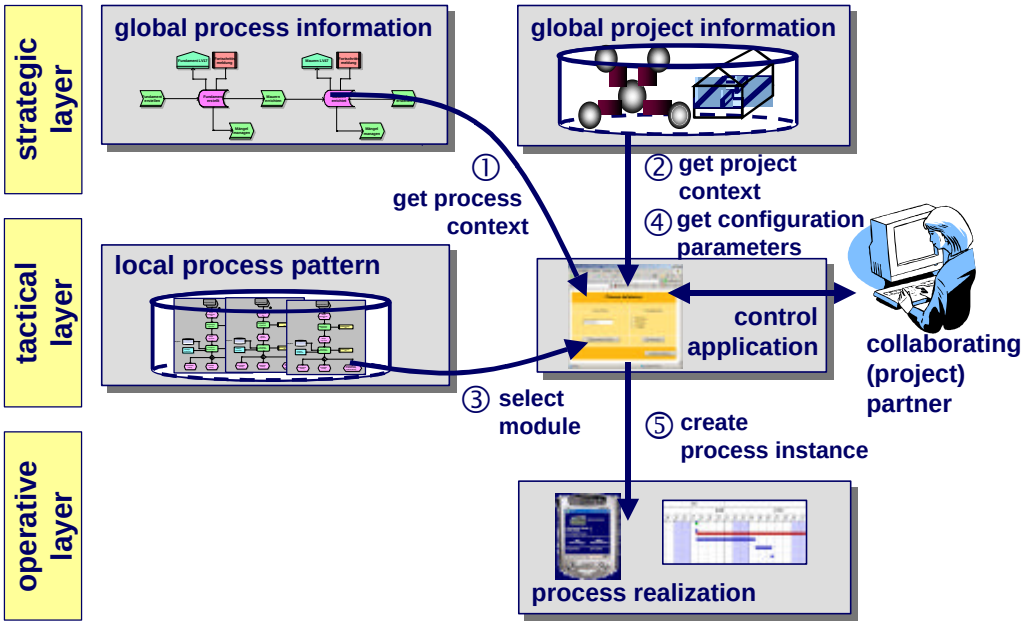
Supporting collaboration requires a lot of knowledge about the problem domain. This knowledge is spread over the used applications, underlying data models and not at least participating designers. The approach of this research is to give possibility to individually add domain knowledge to an already working data sharing environment as needed. This will be achieved by using a concept of *hierarchical interfaces* allowing to replace generic functionalities on different levels. So far we have identified four levels which are 1st the *service level*, i.e. replace the whole service for comparison, re-integration or merging, 2nd the *functional part level*, i.e. high level concepts such as identification or any other specific functionality for an arbitrary set of information, 3rd the *object level*, i.e. object dependent functions and finally 4th the *attribute level*, i.e. object and attribute dependent functions. On each of these levels we will define a set of interfaces which are either static (such as the identified services) or partially dynamic (at least needed for the third and fourth level) and which can be adjusted to the underlying data structure by providing a set of implementations. A main goal of this architecture is to subdivide necessary knowledge and to provide a framework which can be easily adapted to individual needs.

Collaborative Process Management in Construction Project Networks

Martin Keller, Karsten Menzel

Objectives

Projects in the construction industry are highly dynamic and affected by several constraints. Heterogeneous organizational structures and different IT-Systems hamper the realization of a construction project. The need to rapidly establish new organizational structures and to effectively manage these virtual organizations places high demands on the methods and models that are used for the coordination of the project activities. Therefore, common principles should be established throughout the construction industry allowing to flexibly specify and combine construction process information for the inter-organizational collaboration. New members should be supported to join and leave the project consortium by providing them with all relevant project and process information in order to align their local, internal processes and IT-Systems to the global requirements and restrictions of the project.



IT-infrastructure to support collaborative processes management

Approach

We propose a three-layered architecture. On the strategic layer, where the information that influences inter-organizational collaboration is defined, information can basically be divided into the global project and process information. Thus, when joining a construction network partners will be provided with all information required to perform their local tasks. According to this information partners are able to define and coordinate their activities on a tactical layer.

In order to preserve the knowledge gained on the local process flows and to promote future modeling, it should be stored in a re-usable and coherent manner, in so-called process patterns. Such patterns are developed not only for one specific application context, but for various purposes. The aim is to increase the efficiency of these information models by making the initial solutions available and adaptable. Each process pattern represents a logical element with distinct interfaces. These process interfaces are developed for a seamless integration into the global workflow. The process patterns will be identified by specific meta information that defines the context for its selection, its input and output interfaces as well as the parameters for its initialization.

An prototypical IT-infrastructure system will be implemented as indicated in the above figure. The central part of the system is a control application. This control application will support the internal process management of a company in five steps: (1) the context for the company tasks will be received from the global workflow, (2) the project context will be received from the project information server, (3) a suitable local process module can be selected from a library, (4) the process module will be configured according to the project restrictions, and (5) the instantiated process will be executed on an operational layer in domain-specific applications and workflow management systems respectively.

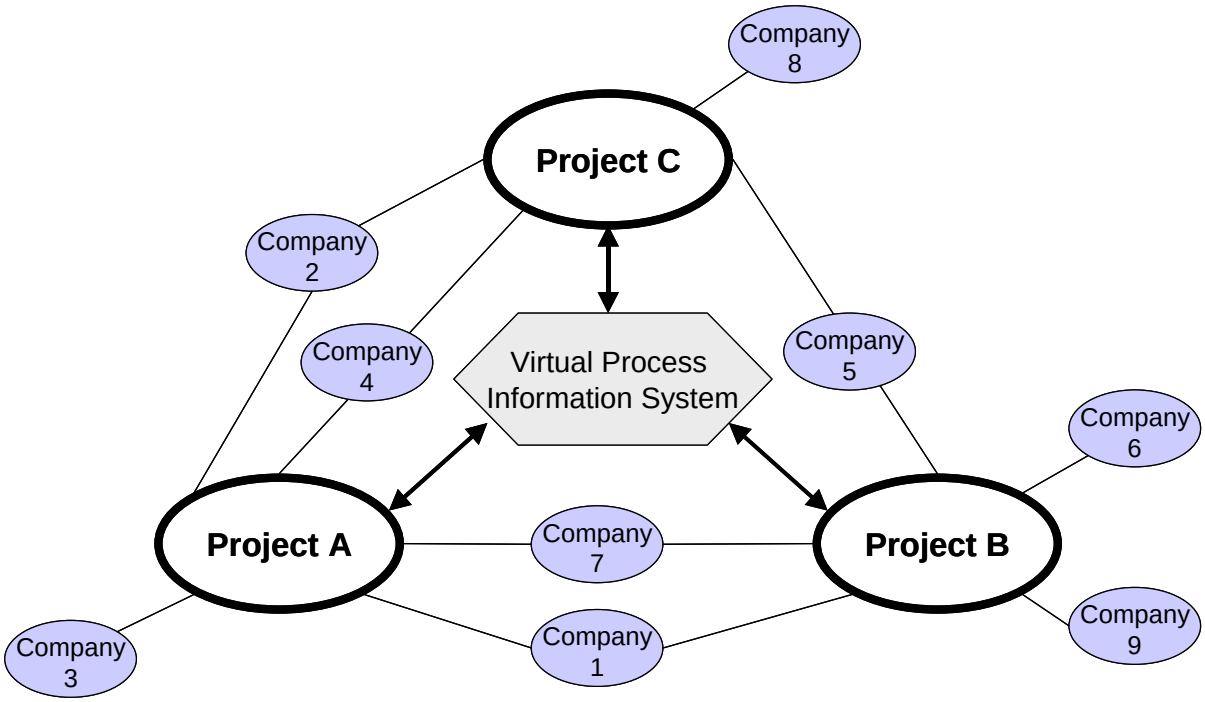
Cross-linking Inter-project Planning Processes

M. Jalal Dabagh, Martin Keller

Objectives

Planning and constructing a new building requires extensive efforts in coordinating processes and data exchange among the different people and organizations involved. By using project-centred workflow management systems accessible through the Internet, coordination efforts can be optimised and the communication between the project partners can be improved. However, partners are regularly engaged in more than one project. Thus, cross-linking between different projects is established by the project partners.

Despite the increasing interrelationships between the different partners and projects, internal workflows are still managed separately. To eliminate these shortcoming, a virtual global process information system must be established to describe these internal workflows with respect to the project processes and to give the multi-project participant the possibility to manage his/her participations coherently. As a result resources can be used more efficiently and project risk management will be improved.



Cross-project process management

Approach

The intention of the research is to develop a process information system for process oriented inter-linking of construction projects. Therefore, a cooperative business process model, which considers and manages company and projects processes in parallel, has to be established. The business process model will be divided into three sub models, which are the organisational structure, process structure and the building structure.

Based on the business process model the interdependencies between the different partners and project can be managed by a workflow-management system. This workflow-management system will be capable to bundle sub-tasks within the process structure and to coordinate the interaction between the participating partners and their recourses.

The approach for the development of such a process model und workflow-management system will be based on Petri-net methods and the graph theories interlinked with the information of the building product model. Therefore, several Petri-net extensions like coloured Petri-nets and high level Petri-nets will be analysed if they fulfil the described requirements.

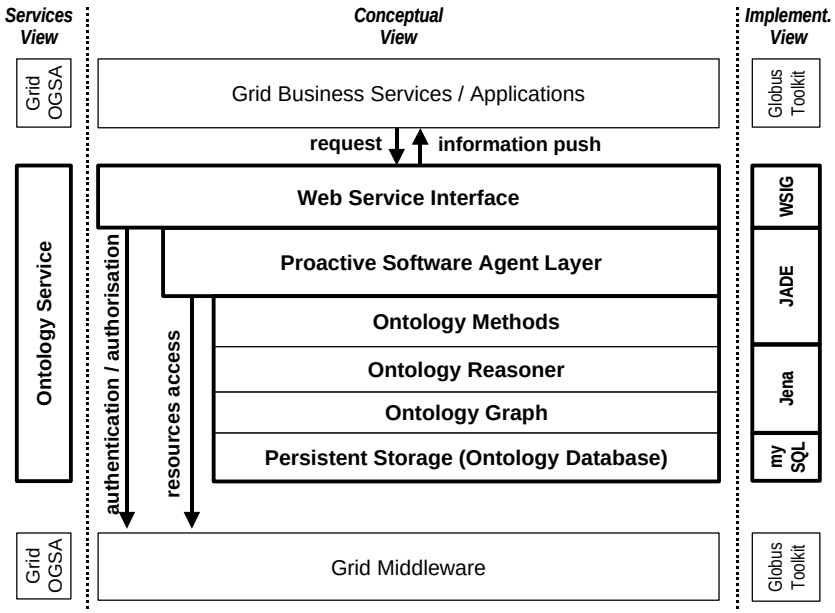
Ontology Services Framework for Grid-based Virtual Organisations

Alexander Gehre, Peter Katranuschkov

Objectives

Virtual Organisations (VOs) are quickly becoming a preferred organizational form for one-of-a-kind businesses delivering one-of-a-kind products, such as AEC/FM. Many challenging aspects distinguish VOs from traditional organisations, such as complex information flows, organisational polymorphism and complicated resource allocation/utilisation mechanisms. Hence, an efficient ICT infrastructure supporting VO interoperability in that direction is a widely recognised prerequisite. Due to the complex nature of interoperability problems on that organisational level, technical and data interoperability must be assisted by semantic interoperability providing a coherent organisational approach for integration.

Methods, services and structural definitions composing the semantic interoperability framework of a VO collaboration platform, as developed e.g. by the InteliGrid project, must be designed as flexible, robust and fault tolerant entities, with special emphasis on maintainability. For the management, integration and utilisation of semantic organisational information and "*meaning*", adequate semantic interoperability has to be established that enables communication on the basis of common shared semantically expressed concepts, i.e. on an *ontological level*, facilitated by dedicated Ontology Services on an operational layer.



Layered architecture for agent supported ontology services in grid environments

Approach

Three particular ontology services were identified as essential for achieving broad semantic interoperability. A *VO Logistics Service* has to provide information about general VO entities, such as actors, roles, persons, organizations and organizational structures of the VO. A *Resource Sharing Service* has to unify resource access and resource metadata exchange facilitating coherent exploitation of available resources in the VO network. A *Resource Integration Service* provides information about what kinds of resources are put together and how in order to compose a business process. Domain specific ontology services exploit these general semantic interoperability to provide functionality tightly associated with the specific business domains of the VO. For example a domain specific Information Retrieval Service extracts information from structured and unstructured documents, databases and product models through proprietary interfaces and then provides the extracted information through a shared description logic based ontological model.

The generalised framework for ontology services in grid environments comprises self-sustained semantic services, each of them designed on the basis of the layered architecture shown in the figure above. Following a Service Oriented Architecture (SoA), common access to the Ontology Service System is provided through a pervasive and platform neutral Web Service Interface, extended by grid security mechanisms in the background. As a vital component of the Ontology Services Framework software agent technology is utilised for coordination and cooperation processes.

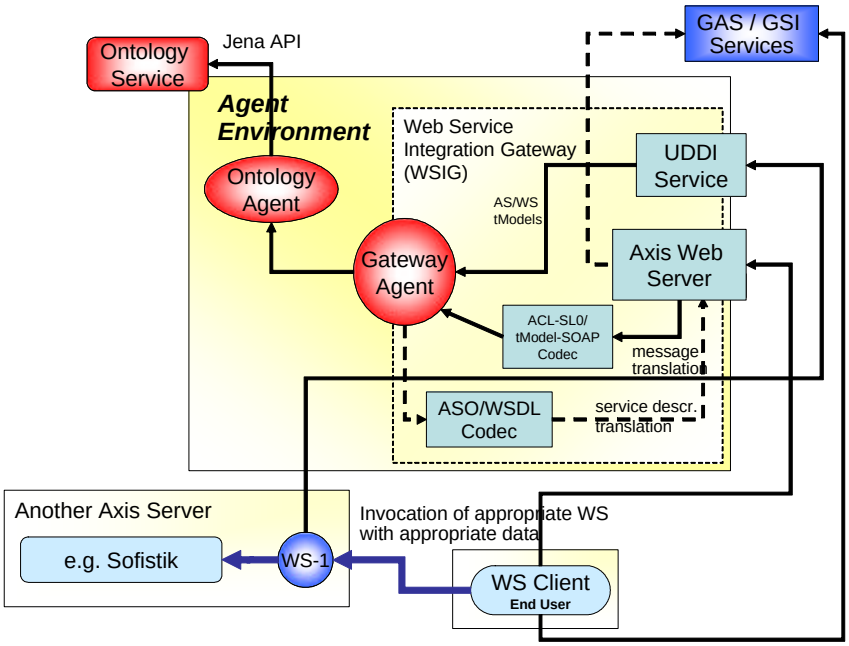
Agent-based Semantic Grid Middleware Services

Ulf Wagner, Peter Katranuschkov

Objectives

The goal is to develop extended grid middleware services that enable coherent access to a set of ontology-based semantic services, extending a grid environment with application and user related semantics.

In the InteliGrid project a collaboration platform is being developed that will be aware of the business concepts that a Virtual Organisation is addressing. The grid on which the platform is based needs to commit to the product's and process's ontology thereby evolving into an ontology committed semantic grid. Accordingly, the objectives are to provide (1) intelligent semantic services for integrating project-centric semantic information management, and (2) ontology-based services that enable manual and/or automated classification of project resources and documents. The semantic grid middleware services will help key engineering collaboration software – an ontology service, a product model database server, a project Web collaboration service and characteristic computer aided design software – to be coherently integrated into an interoperable system, taking advantage of advanced grid and web technologies.



Semantic Grid Services Architecture based on WSIG

Approach

In InteliGrid a European wide VO grid is being set up. It provides the underlying infrastructure for secure authentication (Grid Security Infrastructure – GSI), secure communication (GridFTP) and user rights management (Grid Authentication Service – GAS). Our semantic grid services are built on top of these basic middleware components, bridging ontology-based agent technology, web services and grid technology.

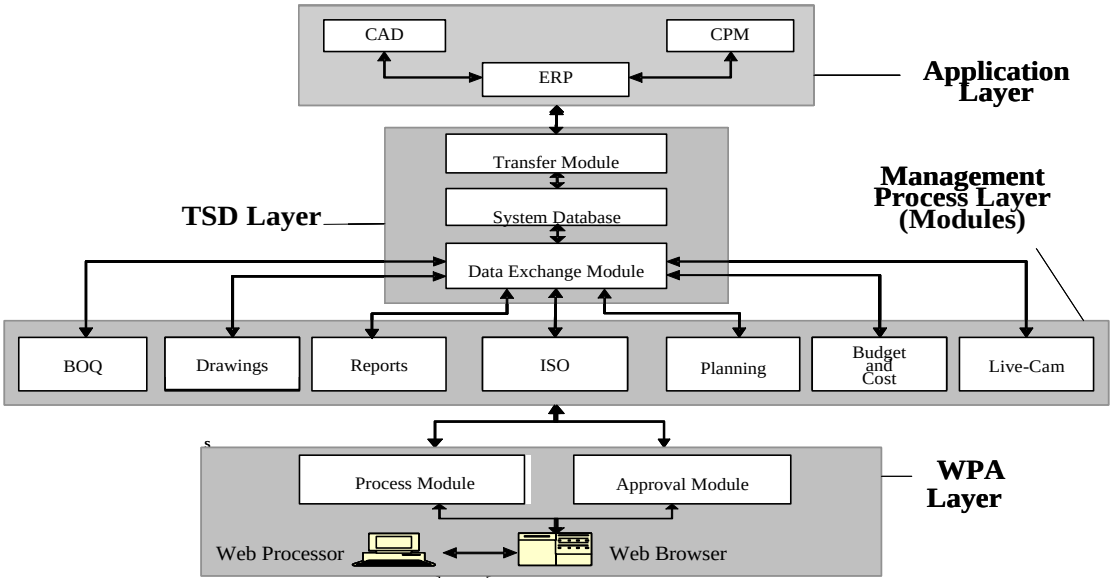
The developed *generic ontology service* has an agent interface (using FIPA-ACL), which is not directly compatible with web services (using SOAP). For the bidirectional translation from FIPA-ACL to SOAP two methods appear feasible. One possibility is to write manually for each agent a web service, which translates the messages, forwards it to the agent, and then waits for the response to send it to the web service client. The advantage of this approach is, that the existing GSI plug-in for the Axis Web Server can be used. The disadvantage is that with increasing agent numbers the development effort becomes hardly reasonable. The second, more general approach is to use a *Web Service Integration Gateway* (WSIG). It automatically deploys new agents onto the Axis Web Server so that no new services have to be developed for any new agents. However, the WSIG has to be made grid enabled to satisfy security, authorisation and other VO-related issues, which requires a set of generic translator modules (see figure). Using WSIG appears to be the smarter approach but a final decision depends on the efficiency and the run-time behaviour, i.e. the expected number and the dynamicity of the needed agents.

Web-based Integrated Construction Management Solution

Kamil Umut Gökçe, Peter Katranuschkov

Objectives

Today, it is generally believed that the integration of different types of software applications is a key instrument to improve the efficiency of the construction environment. Even though several systems integrating CAD, ERP and CPM tools have been developed, there is still lack of efficient data and process interoperability for the purposes of CPM. The solutions are mostly proprietary, taking little account of established standards. This significantly decreases flexibility, information exchange between the component systems, and, last but not least, inter-enterprise cooperation and knowledge transfer. In this context, to manage a building project in a collaborative way requires to establish an adequate software support, a general process methodology and an overall architecture for the technical work in the area of the design of buildings, construction process planning and project management. To fulfil these requirements, a conceptual framework which allows different partners to use the common processes and interrelated interoperable model need to be defined, and a web-based integrated management system using ISO quality management standards supported by CAD, ERP and CPM has to be realised.



Principal data flow in a web-based integrated management system

Approach

In this context, a feasible methodology for interoperability should deal with: (1) The IFC model of the IAI (ISO/PAS 16739) for a hierarchically structured product model, (2) The ISO Quality Management System (ISO 9001) for the existing real-world process specification for managing the quality requirements of outcome and (3) Web-based integrated methods for encompassing the product and process information exchange within the CAD and CPM systems that support IFCs. In this frame of approach, a new construction management structure as an interoperable model has been achieved with using IDEF0, and ARIS methodologies. CPM model phases have been matched with the existing IFC information, and the required resources have been formed to use them in IFC as an extension model. In addition, the system APIs will be developed using the object-oriented modeling methodology, and the system itself will be established as an integrated client-server environment, enabling to plug in all component tools as services via a common GUI implementing the Web Services concept. The entities, attributes and relations covered/not covered by IFC with regard to the identified CPM processes will be clearly identified to find gaps, and modification, extension and re-structuring.

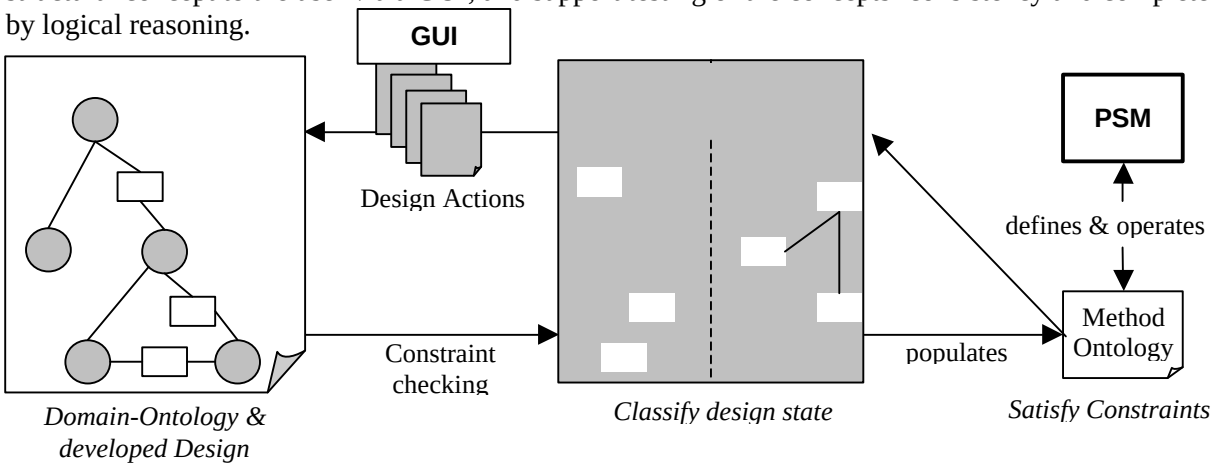
A Description-logic Approach for Knowledge-Based Support of Conceptual Structural Design

Ronny Windisch, Peter Katranuschkov

Objectives

Quality and sustainability of a building structure are considerably affected by the quality of conceptual structural design. In contrast to structural analysis, which is based on pure analytical methods, the quality of structural design depends essentially on the experience and the knowledge of the engineer. The conception of the bearing structure of a building represents a highly knowledge-intensive activity which requires the correct consideration and evaluation of complex structural and functional relationships.

The objectives of this research are (1) to provide goal-driven IT support of the conceptual design process by means of suitable construction and verification methods using a knowledge base, and (2) to represent the conceptual knowledge on concrete building structures in a comprehensive knowledge base. To achieve this, the IT system has to represent the conceptual knowledge about conceivable correct structural concepts in a formal ontology in the knowledge base, provide actions for the development of a structural concept to the user via a GUI, and support testing of the concepts' consistency and completeness by logical reasoning.



Architecture of the Conceptual Structural Design System

Approach

An object-oriented model constructed by using a frame-based representation language provides the baseline of the developed approach. This is extended by a logic-based formalism which enables the representation of conceptual knowledge of higher complexity. The resulting knowledge model forms the foundation for the semantic modelling of the domain knowledge and its processing by adaptive problem solving methods.

The IT design assistance system will be based on the extended object-oriented structural domain model which is stored in the system's knowledge base and is used by the logic-based methods to reason about implicit information to evaluate the developed structural concepts. The reasoning process is guided by constraint checking and theorem proving methods that detect the objects which cause incorrect problem-specific knowledge by violating constraints. The problem solving method then takes the results of the reasoning process and assigns them to predefined characteristics to classify the state of the structural concept. This special description of the developed concept allows the problem solving method to determine a suitable sequence of design actions the execution of which leads to a goal-driven modification of the incorrect objects in the structural concept. The problem solving method itself consists of a combination of classification and constraint propagation mechanisms enabling to evaluate and modify the structural concept efficiently. For better reusing and managing the components of the assistance system, the problem-solving knowledge is also stored in a knowledge base and linked to the structural model by a mapping interpreter which assigns the required information about a problem-specific concept to the appropriate information of the problem solving method. Finally, the system components are incorporated into a graphical user interface. The development is based on the knowledge representation system PROTÉGÉ which provides a wide range of functionalities for developing knowledge-based applications and allows adaptation for the specific purpose of assisting conceptual structural design via its modular architecture and its powerful application programming interface.

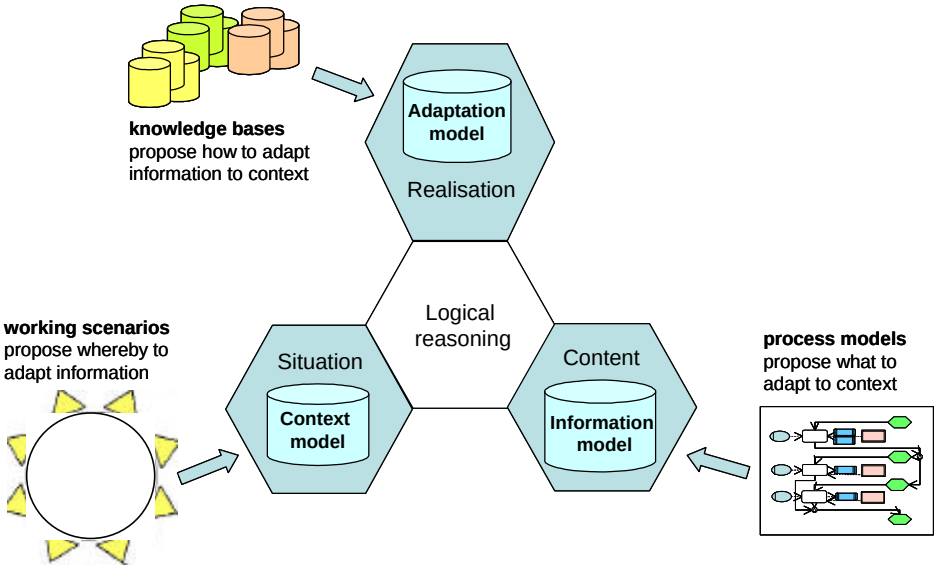
Adaptive Mobile Applications Based on Semantical Descriptions of Information, Context and Adaptation

Karin Eisenblätter, Karsten Menzel

Objectives

The research aims at increasing the effectiveness and efficiency of documentation processes in construction projects by providing field workers with intelligent mobile applications. These applications allow them to easily access context-relevant information from anywhere and at anytime. Context-relevance is determined by the specific business process and the user context. Due to the mobility of the user, the heterogeneity of mobile devices and the technical restrictions of mobile devices, e. g. small display, cumbersome interaction means, such mobile applications should consider the context in which they are used in and adapt to it.

The overall research objective is to develop a strategy that enables flexible integration of mobile computing at the construction site. Based on a conceptual context framework the strategy specifies requirements and activities to be undertaken for implementing context-aware mobile user interfaces and their underlying intelligent services. The current research focus at the semantically description of the information needed in the field and the user interaction context, as well as at the specification of rules that relate the information model and context model in such a way that an inference engine is able to reason on how to adapt the user interface to the current user context.



Conceptual layout: logical reasoning based on three core models.

Approach

We propose a knowledge-based approach to address the issue of context adaptation. Therefore, we need an inference algorithm and semantical descriptions of the needed domain knowledge, so that the inference algorithm is able to conclude on the optimal adaptations for a user interface in a specific context.

The design of context-adaptive systems requires three central questions to be answered: (1) what to adapt, (2) whereby to adapt and (3) how to adapt. We propose to design three models, each reflecting one aspect. The first model is the information model (as part of the domain model) which describes the information that is required in a particular business process. Such information model can be regarded as an augmented process model because the pieces of information are already determined in the construction companies processes. The context model (as the user model) answers the second question. It describes the current user context, e. g. in terms of actor, task, time, location, environment and infrastructure, which we have defined in our previous research work as the concept working scenario. The third model, the adaptation model contains rules on how to adapt the information pieces to the context. An implementation algorithm realizes suggested adaptations at the user interface.

Using a logical description language we are able to semantical describe information pieces in construction processes, context information and corresponding adaptation rules. The open-world-assumption does not require the specification of every potential context and therefore adaptation.

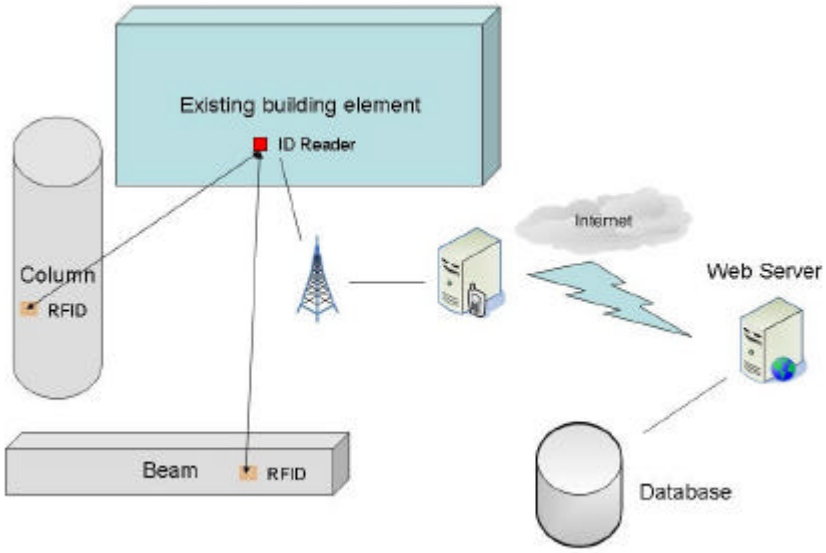
Decentralized Information Management and Mobile Services for Integrated Building Commissioning, Maintenance, and Operation

Ralph Stickl, Karsten Menzel

Objectives

Existing business models and management concepts for life cycle-oriented building management are highly complex and inhomogeneous, especially in terms of cross-company process chains. Furthermore, contracts and employment are designed more and more flexibly. Yet, this also holds the risk of not or only insufficiently ensuring long-term know-how and expertise needed to sustainably maintain and operate built artifacts. Latest studies show that both ad-hoc support for service staff as well as bidirectional know-how transfer between service staff and engineering personnel needs considerable improvement.

Constant update and exchange of artifact data during the entire life cycle as well as beyond company borders still causes major problems today. Reasons lie on the one hand in incompatible information exchange formats and strategies. On the other hand, the synchronization of data of diverging process states needs to be improved. However, new regulations such as the Energy Performance in Buildings Directive (EPBD) of the European Commission require an improved information management over the total value chain construction → commissioning → maintenance → operation / facility management. Therefore, it is the goal of our work to develop an RFID-based concept for decentralized information management using mobile services.



IT-infrastructure

Approach

Service staff in the field is inadequately integrated in the information cycle. The availability of mobile networked devices, networks of novel sensors for environmental information as well as RFID technology are essential components for an mobile service and management platform, which would address the above-mentioned requirements.

This will be carried out by service-oriented architectures (SOA) since company functions may be realized as independent services. The SOA approach will be expanded by the Concept of the Business Domain Model (BDM). This defines the various Business Domains (BD) of a company, which will then be available to other services. The mapping of cross-company processes is realized by BPEL (Business Process Execution Language), since web services alone would not be sufficient for the definition because most of the time several partners are involved in one specific project.

The problems discussed should be expanded by a decentralized component as an addition to the existing central approach which can be found much more frequently in companies. Maintenance of technical equipment should be simplified by the use of RFID (Radio Frequency Identification) which is attached to building systems and components. This should allow quick identification of the respective equipment and contain detailed information, such as manufacturing or the documentation of current maintenance activities.

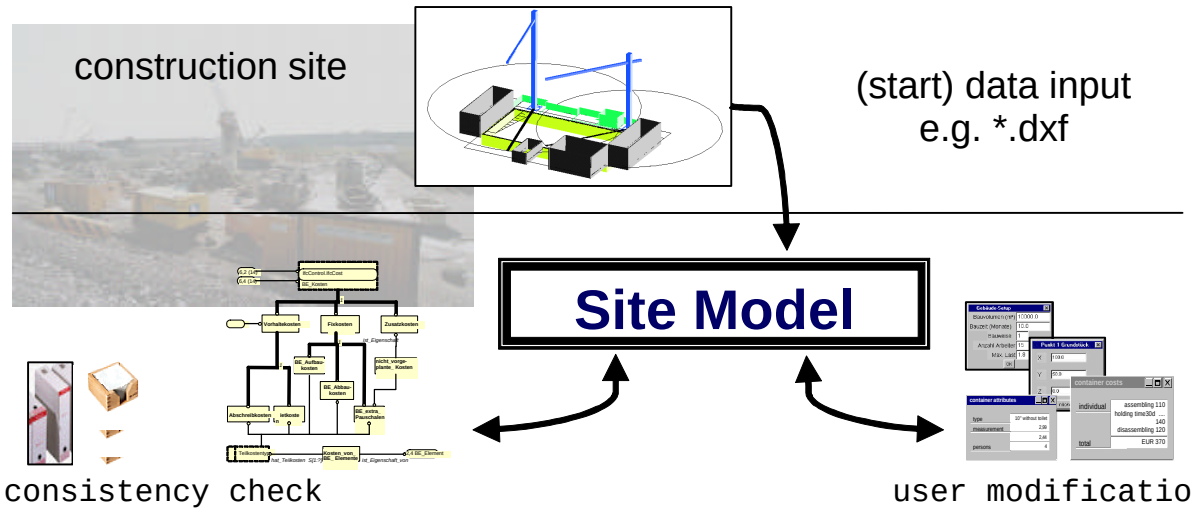
An adaptive process networked product model for Site Installations

Steffen Scheler, Peter Katranuschkov

Objectives

Principally, each construction project has two goals: first the completion of the project in time and with high quality, and second the achievement of a profitable economic result. These goals are relevant for the site facilities as well. However, in current practice the cost effectiveness of the site facilities is most often neglected as a separate economic factor. The result is that the factory "construction site" only rarely produces commensurable profit.

The primary objective of this research project is to capture, monitor and continuously evaluate the pure site facilities costs. The developed approach should enable high-level cost analysis and comparison of alternative solutions through appropriate variation of the site facilities parameters with the help of a software tool



Implemented Site model with consistency check as the main tool between data input and user modification

Approach

The cost analysis of the site facilities is performed on the basis of a dynamically modifiable site product model and a set of knowledge-based methods for classification of the site facilities elements and time-dependent estimation of the cost.

Typically, when construction starts site installations are simple, requiring only site facilities on a low level (e.g. a few containers). Consequently, the product model at that stage will be simple as well. However, when some additional site facilities are needed (crane and therefore haul roads, container etc.), the site will no longer be simple and another product model will be required. Thereby the cost summary of the resulting more complex site model will also change, but not the cost model.

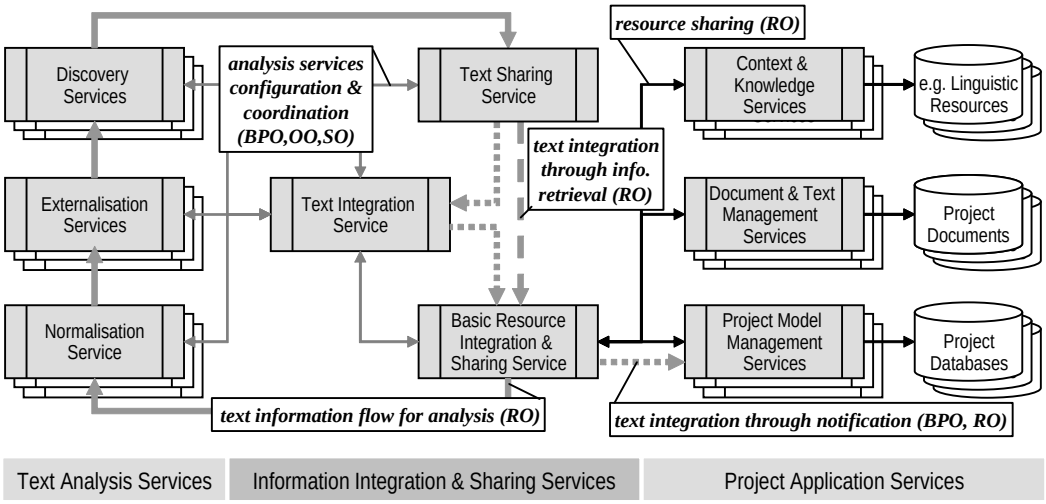
An essential role is attributed to the dynamic substitution of partial models to provide for simulation and evaluation of alternative solutions. The consistency of the overall model is thereby maintained through respectively carried out re-classification of the involved product objects. The re-classification itself is achieved by a dynamic classification method implemented with the help of a tool from the domain of knowledge representation technology. The innovative aspect of the approach is in the dynamic modification of whole model parts and not only the re-classification of instances in a single model. The provided comparisons between alternative site facilities instantiations support the concurrent decision making process through all phases of site planning and construction, e.g. by parallel re-scheduling of activities by the project leader, by design changes made by the contractor for better constructability, by considering the mutual inter-dependencies of time and cost aspects etc.

Service Oriented Architecture for Integrating Text with Model-Based Information

Sven-Eric Schapke, Peter Katranuschkov

Objectives

To enable integrated information and knowledge management throughout separated text and model-based systems, text documents can on the one hand be structured to the level of detail where the content can be shared e.g. through portals or workflow systems. On the other hand text analysis and mining technologies can be applied to automatically extract relevant text information. Both strategies have been explored and several linguistic and data mining technologies have been adopted to compensate for shortcomings of text structuring. However, the potential and effectiveness of text integration greatly varies with a document's focus and style, the availability of linguistic, industry and project knowledge as well as the actual business goals. Total information integration in one logic information base is neither feasible nor necessary. A configurable system is needed that allows for flexibly combining the required structuring, extraction and retrieval technologies according to the most important integration tasks and the available text and context information. Such a system must support the overall integration process of text identification and delivery, information externalisation and analysis as well as information sharing with the targeted model-based systems.



A Service Oriented Architecture for Text Integration in AEC/FM

Approach

A Service Oriented Architecture based on the semantic service framework currently developed in the EU research project InteliGrid in which the distinctive subtasks of the integration process are implemented by specialised services is envisaged to provide for focused text integration (s. figure above). Ontology development in accordance with the InteliGrid Ontology Framework describing business processes, project organisation, services and resources *(referred to as BPO, OO, SO, RO)* shall provide for sharing text resources as well as configuring and coordinating the integration services. In this scenario, a *Text Integration Service* controls the overall integration process (depicted by the thick arrows) specifying source information and integration targets as well as the text analysis configuration. For a first information selection the Resource Ontology is complemented with metadata and linguistic concepts for detailed text annotation and dynamic assembly of linguistic resources such as lexica of project participants, addresses, etc. Furthermore, the definition of text sorts and communication acts shall support the identification of relevant text and targeted model services. Central to the text integration process is the text analysis that may involve text normalisation *(Normalisation Services),* linguistic and domain specific analyzes *(Externalisation Services)* as well as further knowledge discovery *(Discovery Services).* For demonstration, a Normalisation and an Externalisation Service will be realised that allow for ontology based combination of analysis and extraction components. Finally, the externalised text content shall be made available through *Text Sharing Services.* Two respective services will be implemented allowing for (semantic) information retrieval in a pull-mode as well as routing critical information directly to selected application services notifying them in a push mode.

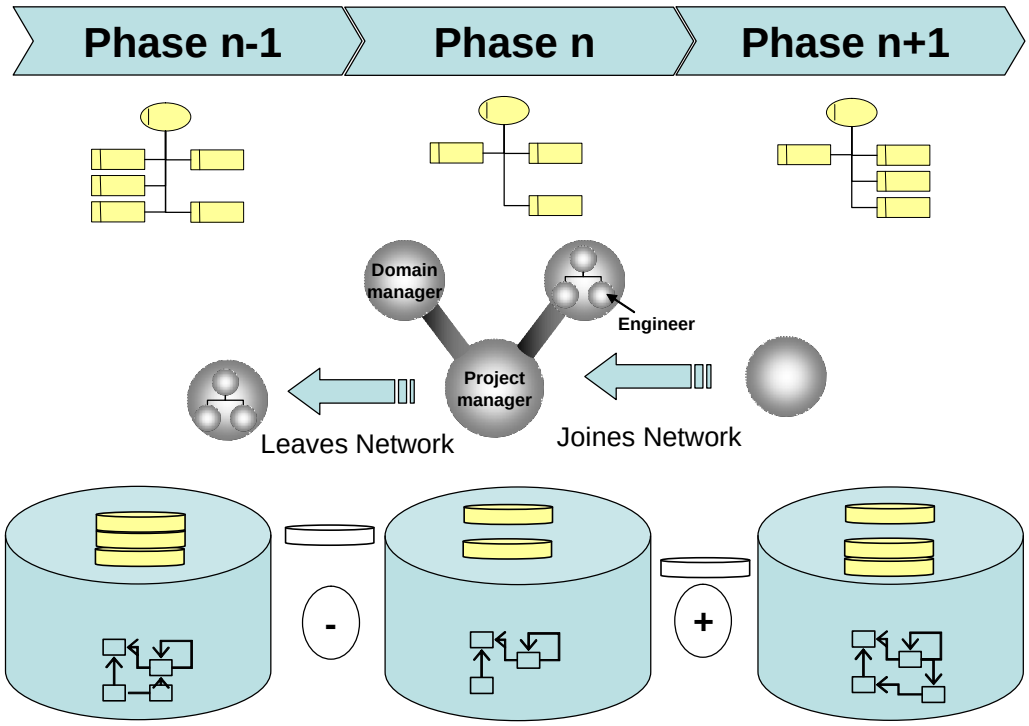
Flexible, life cycle-oriented building information management through evolutionary database schemata

Patrick Wilczek, Karsten Menzel

Objectives

A great amount of information is being accumulated over the life cycle of built artifacts by different types of organization, such as architects, general contractor, subcontractor, craftsmen, etc. This information might be relevant to building operation and maintenance. Especially, most of the data that is acquired during the construction processes only becomes relevant much later, for instance in the case of refurbishment and renovation of buildings. Even more important is the fact that changes of building technology occurring during the buildings' operation phase are not or insufficiently documented. The different types of information systems and their underlying data management approaches are reasons for insufficient data acquisition and maintenance. Standardized formats for data management are not defined yet.

This missing information will cause complications during refurbishment and renovation processes. Thus, it is the goal of our research to contribute to the development of evolutionary database schemata supporting flexible, life-cycle oriented, persistent information management – organized either in centralized or decentralized software architectures.



Building Life-Cycle and evolutionary Data(Base) Schemata

Approach

Firstly, existing data storage systems are analyzed. This analysis includes an analysis of how existing process and product models will change over their whole life cycle as well as the different types of IT infrastructures used in the construction industry. By doing so, requirements on future domain-specific database schemata are determined. In a second step control and management concepts supporting the evolutionary change of databases will be developed. This includes the development of new management principles allowing holistic resource management during the entire life cycle of built artifacts. The parts of the model developed are finally combined into a framework. This framework will provide methods for the initialization, the operation, and the control of business processes in collaborative networks. Thus, a complex software architecture will be developed and prototypically implemented supporting the framework developed. Finally, this software solution should be tested and evaluated with partners from the construction industry.

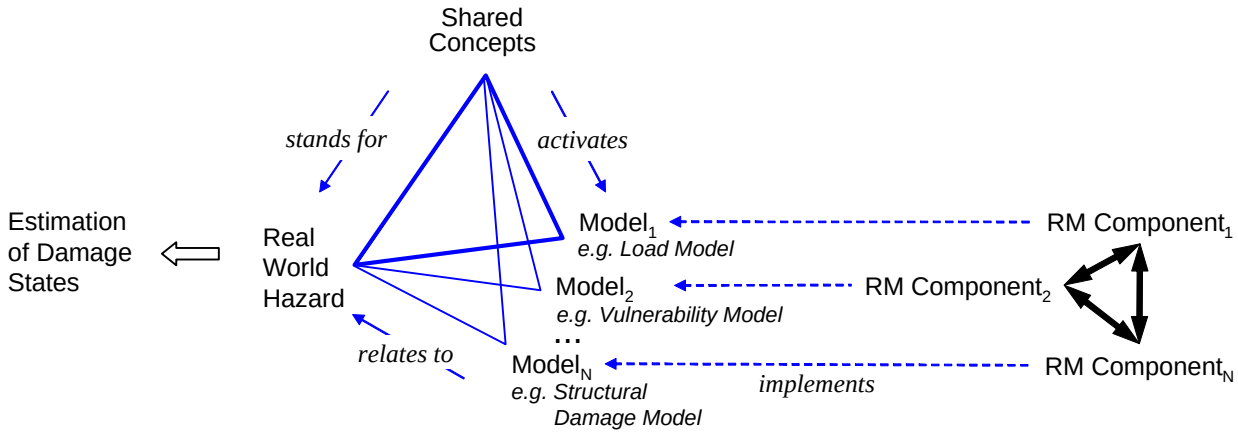
Semantic Framework for a Distributed Risk Management ICT Environment

Gerald Faschingbauer & Peter Katranuschkov

Objectives

The major goal of this research is to develop the framework of a scalable and distributed cross-regional ICT Risk Management System which would enable the flexible configuration of dedicated subsystems and hence the effective involvement of persons, organizations, services and sensors, in accordance with the different types of personal skills, hazards and consequence levels at any specific risk situation.

The focus is on functional and conceptual information integration at the data structure level, for which we will develop a *common semantic framework*. Each component (local tool, web service, human expert) may use a different model. To integrate them in a coherent Risk Management System it is necessary to define a common *Risk Management (RM) Ontology* providing the basis for the semantic interoperability of the overall system. The framework will rely on a functional description that allows capturing of the desired specifications of any component and is capable to support the transfer of this knowledge to all concerned stakeholders during the RM processes and stages. The RM ontology has to serve two different objectives, namely (1) the interoperability on the high semantic level of information models, tools and services, and (2) the organizational issues of the environment on the technical level, namely the logistics of services and the controlled access to these services depending on time and status of the evolving/devolving crisis.



Communication between distributed RM services enabled via commitment to a set of shared ontology concepts

Approach

Development of the RM Ontology is based on a consistent description of the RM life cycle providing for better understanding of the requirements of the ICT environment on knowledge, information flows and management. Risk Management terms are structured in logically defined units that form an organizational Risk Management structure, an information logistics and authentication system and a responsibility structure.

The high-level RM Ontology schema defining the risk management issues in general will be based on the standardized building object data structure IFC (ISO/PAS 16739) developed by the IAI. This basic risk management ontology will be extended with *Domain Specific Ontologies*, representing specific knowledge of different disciplines - i.e. different types of hazards - describing properly all hard/software components, security and operation modes. We will use as most as possible existing IFC objects and draft the extensions as IFC property sets. The ontology schemas defined in OWL will be appropriately referenced; i.e. all RM tools and services will commit to respective well-defined parts of the RM ontology.

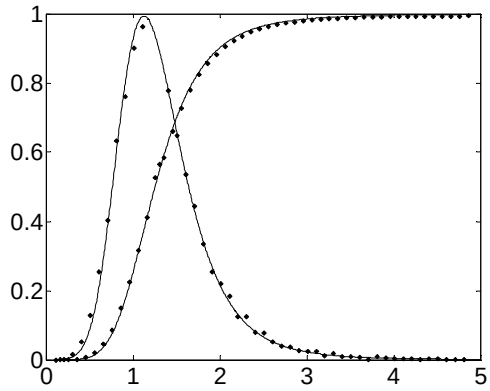
Use of the ontology will be supported by a set of ontology-based semantic services, subdivided into two categories: (1) *general environment ontology services* including a generic logistics service, a resource sharing service and a resource integration service, and (2) *domain-specific ontology services*, dedicated to the support of specific tasks, such as the matching of model and sensor data, the mapping of data between different application-specific representations and so on. Realization of all services will be based on Semantic Knowledge Technology, using the Web Ontology Languages OWL/OWL-S for the formal ontology specifications of information and services.

Numerical Computation of Probability Density Functions for Multi-Dimensional Stochastic Problems

Gerald Faschingbauer

Objectives

The goal of this research is to develop a numerical method for the computation of the probability density function (PDF) of variables, which are dependent on a multi-dimensional random space and the fact that an analytical solution does not even exist for the underlying deterministic model. Motivation for this work is the computation of the PDF of resonant frequencies of stratified soil with several layers over half-space. The stochastic description of the resonance behavior of layered media is of particular interest in various engineering disciplines, e.g. earthquake engineering, geotechnical engineering, acoustics. In engineering practice this kind of problem is dealt with Monte Carlo Simulation which is applicable for almost all problems, if a deterministic solution – either analytical or numerical – is well-known. Nevertheless, simulation methods need a large number of realizations in order to deliver appropriate results. Especially for the computation of very low probabilities the Crude Monte Carlo Simulation reaches its limits. Therefore Monte Carlo Simulations usually are improved by Importance Sampling Methods, but these methods are also limited, especially in dimensionality of random space. The envisaged research, based on a very first method, called Discrete Random Variable Method (DRVM), may offer an alternative approach which is based on basic probabilistic principles and improved by advanced methods of informatics.



PDF and CDF of the resonant frequency for one layer over half-space
- analytical solution (solid line) and solution with DRVM (dotted line) -

Approach

The envisaged methodology will be based on discretised random variables. Each random variable will be discretised in a defined domain around the mean value and all possible combinations of these discrete values will be generated. For each combination the probability of occurrence and also the deterministic solution for the sought variable can be computed. The sorted values of the sought variable and the cumulative sum of the corresponding discrete probabilities will result in the discrete cumulative density function (CDF). For simple deterministic models, the results of this rough algorithms show good results (see Figure). Disadvantage of this first implementation is the computational expense for higher dimensionality of the random space. Nevertheless, the method has high potential for further development and improvement. The numerical computation of the deterministic solution of the deterministic basic model will be advanced through an estimator, e.g. based either on non-linear regression analysis or on neural networks. Based on this estimator the random variables will be ranked according to their importance on the result of the sought variable and the most influential sectors of each random variable will be identified. On this basis the sampling intervals of discretisation will be determined following pre-defined criteria. The occurrence probability of the discrete random values will be computed by numerical integration. A new algorithm for the computation of all the possible and meaningful combinations of discrete values will be developed. The occurrence probability of the combinations will be computed out of the several probabilities of discrete random values. The corresponding deterministic value of the objective function will be computed by the aforementioned estimator and verified by a control sample. In order to make the procedure as fast as possible all algorithms will be preferably based on vectors and matrices in order to use vector- and matrices oriented programming techniques. The envisaged method will be verified concerning its reliability, applicability and problems.

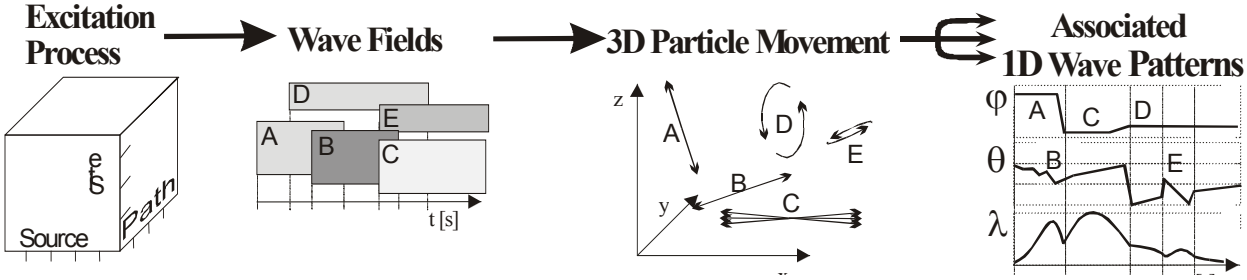
Identification of Wave Fields in Strong Motion Records by Pattern Recognition in Time-dependent Stochastic Principal Axes

Jörg Bretschneider

Objectives

Adequate stochastic non-stationary modelling of seismic building load should be based on wave fields, which in turn requires their identification in recorded 3D strong motion acceleration records. Wave types are characterised by specific axial and planar particle dynamics, leading to a stable trend of the principal direction of acceleration for each wave field. The sequence of these wave fields is determined by general, invariant physical settings, while their duration, form and intensity are influenced by the rupture process, upper crust structure and local site effects, but not in an unambiguous way. This leads to certain variable patterns in the course of the 3D principal direction of acceleration.

The focus is to find patterns which clearly identify wave fields significant for the load process, to analyse and model these wave fields separately as non-stationary load modules. Especially, fast single-record indicators for surface waves are sought, as these waves carry heavy risk for buildings, demonstrated e.g. 1985 in central Mexico City and elsewhere. These waves usually do not have strong amplitudes, but long duration and narrow spectrum in the response range of buildings. As they are often overlaid by stronger wave fields, they have not properly been identified in near field records so far, and are neglected in current design regulations.



From Excitation Process to 1D Wave Patterns in Principle Stochastic Axis

Approach

Wave patterns in original components are not very pronounced or stable due to the overlap of the wave fields. The entry part to separate the wave fields and hence receive stable patterns is the particle movement of the wave. Stochastic principal axes are stamped by the particles movement of the instantaneous dominant waves. The figure on the right shows a typical diagram of the two angles (φ, θ) and the Eigenvalue (λ) of the main principal axis revealing characteristic wave-related patterns. Identification is interpretation and hence needs a comparative model. We will use an iterative refinement process. A starting model of the excitation process is set up, which consists of a unidirectional one-phased rupture with direct waves and normal site amplification, which leads to model wave fields. The related 1D-model patterns are formulated in a general way using parametric shape functions. Associated patterns in corresponding indicators are significant. These functions will be fitted to empirical data. The model of the excitation process is stepwise extended to more complex rupture, regional and local wave generating features in the ground etc. until there is good agreement achieved measured by an error function formulated on the basis of seismological and structural engineering, e.g. load relevance terms. Datasets of several strong earthquakes with different rupture mechanics will be used.

Research Contracts

Title:	**InteliGrid – Interoperability of Virtual Organisations on Complex Semantic Grid**
Financial Support:	EU, IST-2004-004664, **inteliGrid**
Person Years:	30 (total), 5.3 (CIB, TU Dresden), Duration 2.5 years
Approach:	InteliGrid is extending the semantic grid paradigm to support dynamic virtual organizations (VO) that collaborate on the design, production and maintenance of products that are described in complex, structured, product model databases. The hypothesis of the project is that the collaboration platform - the semantic grid itself - must be aware of the business concepts (e.g. car, plane, house) that the VO is addressing. The grid itself needs to commit to the product's and process's ontology thereby evolving into an ontology committed semantic grid. The goal of this project is to create an architecture and a prototype for such an infrastructure, based on existing grid middleware and test it in the context of industries mentioned above. The main results are the generic business-object-aware extensions to grid middleware, implemented in a way that would allow grids to commit to an arbitrary ontology. These extensions are propagated to toolkits that allow hardware and software to be integrated into the grid.
Partners:	University Ljubljana (Slovenia), VTT Technical Research Centre of Finland, ESoCe Net (Italy), Poznan Supercomputing and Networking Centre (Poland), Obermeyer Planen + Beraten (Germany), Conject AG (Germany), SOFiSTiK Hellas (Greece), EPM Technology (Norway).

Title:	**ArKoS - Architektur Kollaborativer Szenarien** *(Framework and Architecture to Support Collaborative Scenarios)*
Financial Support:	BMBF (German ministry of education and research)
Person Years:	30 (total), 3.4 (CIB, TU Dresden), Duration: 3 years
Approach:	The main objective of the ArKoS project is to improve the management of collaboration and cooperation between different enterprises from a conceptual to the system level. Therefore the project will start with a State-of-the-Art analysis and requirements definition. Derived from this a comprehensive architecture, which consists of modelling techniques on macro and micro level, integrating meta-models and a modelling tool, will be established. In a second phase domain-specific reference models and software systems will be developed and validated. Within the project the building industry will serve as the reference-domain for design and validation of the aspired methodology.
Partners:	Institut für Wirtschaftsinformatik (IWi) am Deutschen Forschungszentrum für Künstliche Intelligenz, Saarbrücken; Inst. für Wirtschaftsinformatik & BWL, Universität Mainz; FG Bauinformatik, FH Gießen-Friedberg; Nemetschek AG München; f:data GmbH Sömmerda; WeltWeitBau GmbH Berlin; INTERACTIVE Software Solutions GmbH, Saarbrücken, Müller-Altvatter Bauunternehmung GmbH & Co. KG, NL Dresden

Title:	**Cooperative model for monitoring and control of diverging design states – Identification of design data conflicts**
Financial Support:	DFG (German research foundation), Sche223/27-3
Person Years:	2, Duration: 2 years
Approach:	Concurrent parallel design inevitably leads to diverging data states. Therefore methods are needed to recognize the emerging differences and to transform the various concurrently modified partial domain models into a consistent state. The project continues the work of a prior DFG project that dealt with the development of a declarative mapping specification language for building construction and realisation of a respective mapping engine to enable modelling object transformations between heterogeneous representations. The work at this stage of the overall research on the subject is particularly dedicated to the tackling of differences occurring by the concurrent modification of partial models by different designers. This includes: (a) specification of partial model subsets, (b) check-out of partial models for local processing, (c) identification of changes, (d) classification of detected differences and notification of other affected designers, (e) prioritising the differences to help subsequent co-ordination and re-conciliation processes, and finally (f) re-integration of the local data into the consistent co-operative building model, including version management. The implementation is carried out within the environment of a Product Model Server developed at CiB, thereby enhancing the existing functionality of the latter.

Title:	**IuK-Sytem Bau – Information and Communication System to Support Construction Management Activities in SME using mobile, networked technologies**
Financial Support:	BMBF (German ministry of education and research)
Person Years:	14 (total), 3 (CIB, TU Dresden), Duration: 4 years
Approach:	Development and prototypical implementation of a mobile information and communication system for controlling construction activities in SMEs using PDA or "handhelds", accessing data through a web-based portal, and re-engineering of existing business process models. Research is focused on context-based interfaces and context-focused information applying data warehouse methods. Information will be represented in XML and structured according to the domain-specific standards, such as IFC and BC-XML. The data model will be implemented using a distributed, object-relational DBMS. For the implementation, commercially available software packages and hardware components are used ensuring that SMEs will be enabled to apply cost-efficient, up-to-date, easy to learn information and communication technologies.
Partners:	TU Dresden, Institut für Baubetriebswesen; Claus Dittrich Dachdeckermeister GmbH & Co. KG, Dresden; Müller-Altvatter Bauunternehmung GmbH & Co. KG, Niederlassung Dresden; ACI Systemhaus Dresden.

Title:	**M³ - Mobiles Mängel Management** **(Errors and Omissions Management using mobile technologies)**
Financial Support:	Construction and IT-Industry
Person Years:	1,5, Duration: 2.3 years
Approach:	The project aims on effective technology transfer to the construction industry. This is achieved by using synergy effects between the research projects “ArKoS” and “IuK-System Bau”. First an “in-depth” process analysis on different construction sites in Germany was performed. Intensive re-engineering activities carried out in close co-operation with high-level management and senior engineers led to strongly improved process models in the field of Errors and Omissions Management. Based on these results three software prototypes were developed. The *Construction Diary-Application* and the *Complaint Management-Application* represent a closed MVC-architecture using a common repository. The *Errors and Omissions Management-application* is designed for off-line data acquisition on construction sites using a two layer architecture. The data exchange is managed by web services based on the SOAP-protocol.
Partners:	Bilfinger Berger AG, Mannheim; ACI EDV-Systemhaus, Dresden; Müller-Altvatter Bauunternehmung GmbH & Co. KG, NL Dresden; Panasonic Deutschland GmbH.

Lecture Activities 2006

Title: Computer-Aided Design and Drafting

Intended Audience: 1st semester, students of civil engineering
Lectures and Tutorials: Scherer/Böttcher
Subjects: This course provides background knowledge of the methodology and techniques of computer-aided design. Basic CAD 2D and 3D functionality is presented as well as advanced methods for the efficient application of CAD technology in civil engineering design, such as data structuring techniques (layers, blocks, symbol libraries), data exchange paradigms and formats (DXF, STEP, IFC), user interface and output facilities. The general features of CAD systems are presented on the example of ALLPLAN/ALLPLOT. Attention is given also to specialised systems for building design with examples from the field of reinforcement detailing.

Title: Computer-Aided Solutions of Engineering Problems

Intended Audience: 2nd semester, students of civil engineering
Lectures and Tutorials: Scherer/Gerk
Subjects: The systematic analysis, synthesis and implementation of software solutions for engineering problems are presented. Focus is on numerical engineering problems. The use and benefit of a formal graphical representation language using the structogram method is demonstrated. Special emphasis is given to distinguishing between the topological, geometrical and the visualization model. The practical tutorials aim at writing and testing structured programs in the programming language C++.

Title: Data structures and data bases

Intended Audience: 3rd semester, students of civil engineering
Lectures and Tutorials: Scherer/Gerk
Subjects: Introduction to abstract data types, sets, relations, objects and classes. Classification in linear data types, partitions, graphs and associations. Definition of equivalence relationship and introduction to relational data structures and corresponding basis operations. Presentation of the corresponding support of C++ for objects, classes, methods, inheritance and operators. The Tutorials practise these methods and algorithms in the programming language C++.

Title: Numerical Mathematics

Intended Audience: 4th semester, students of civil engineering
Lectures and Tutorials: Hauptenbuchner
Subject: This lecture informs on, and consolidates methods of numerical mathematics being used in CAD and CAE-software. After a general introduction to the methods of numerical mathematics, algorithms of solution for linear systems of equations, esp. the Cholesky method, and algorithms of solution for large band-structured matrices are introduced; this is followed by a survey of algorithms of solutions for eigenvalue problems. Graphical representation of results from numerical methods, which are available in discrete form, is realized by interpolation methods, esp. SLINE-methods.

Title: Relational data structures and systems data management

Intended Audience: 5th semester, students of civil engineering
Lectures and Tutorials: Scherer/Gerk
Subjects: First, an introduction to data management and data bases is given and hierarchical and relational data structures are shortly opposed. The requirements of engineering applications like very long term transactions are summarized and opposed to other applications. The basics of relational data structuring like entities, relations and association types, cardinality, key attributes, transformation of relations, redundancy, recursive relations, generalization, specialization are presented. The bottom-up procedure of a data base design using the normalization approach is shown. Basics of SQL are introduced. Tutorials are carried out applying ORACLE software.

Title: Computer-Aided Engineering: Applications for Structural Engineering

Intended Audience: 6th semester, students of civil engineering
Lectures and Tutorials: Scherer/Wagner
Subjects: Introduction in object modelling, EXPRESS and EXPRESS-G representation techniques and STEP physical file format. A simplified IFC compliant model for the structural system modelling and analysis is outlined. Basic principles and techniques for the effective use of numerical analysis programs in the solution of various structural design tasks are introduced. An insight into the methods for correct modelling of engineering problems as well as for the appropriate structuring of the necessary information and the proper interpretation of analysis results is given. Special emphasis is put on the formulation of FEM analysis tasks in terms of the entity relationship modelling approach. Examples include the modelling and solution of typical FEM problems, such as stress-strain analysis of slabs and shear walls subject to various kinds of loads applying the CAD/CAE tool Nemetschek Allplan.

Title: Software Engineering (read in English)

Intended Audience: 7th semester, students of civil engineering and of ITC-Euromaster course
Lectures and Tutorials: Menzel
Subject: The course aims on combining the special knowledge in the fields of Databases, Information Modelling, and the development of CAE-solutions. It furthermore integrates aspects of “E-business and E-commerce”. The main objective of the course is the presentation of knowledge about the different “software life-cycle models”. Civil Engineering students learn how to perform a requirements elicitation, how to analyse a domain model and how to transfer a domain model into a complete system model in co-operation with IT-specialists using standardized methods and notations such as UML.
Furthermore, the students learn how to initiate and manage large interdisciplinary teams and how to moderate negotiations between clients, users, IT-managers and developers.
Within the project the students work in groups on the design, development and prototypical implementation of a complete software system.

Title: Object-Oriented Modelling - Fundamentals and Application in Structural Engineering

Intended Audience: 8th semester, students of civil engineering, track structural engineering
Lectures and Tutorials: Scherer/Katranuschkov
Subject: This course aims at giving civil engineering students an understanding of the basic principles and the practical application of the object-oriented modelling methodology as a powerful vehicle for the design and realisation of complex computer-aided engineering tasks. Special emphasis is put on the discussion of advanced product data technology methods based on the international standard STEP and the industry standard IFC of the IAI. The students are actively involved in modelling tasks selected from everyday engineering practice with focus on the adequate formal

specification of structural design problems and the respective product data representation and product data exchange specification.

Title: eBusiness & Data Warehouses in A/E/C and FM (read in English)

Intended Audience: 8th semester, students of civil engineering and ITC-Euromaster course
Lectures and Tutorials: Menzel

Subject: Within this course students will get a broad understanding of e-business in AEC and Facilities Management. Firstly, the different types of "eBusiness" are explained in general. Secondly the students gain detailed knowledge about methods of Business Process Modelling (BPM). Furthermore, the students acquire fundamental knowledge about basic IT-methods and technologies supporting eCommerce. The major focus is on multi-dimensional data management. Finally, the students will get an overview about technical aspects of data security and billing systems. Within seminars the students learn how to implement a project using ROLAP technology.

Title: Artificial Intelligence Methods and Their Application in Structural Engineering

Intended audience: 9th semester, students of civil engineering, track structural engineering
Lectures and Tutorials: Scherer/Katranuschkov

Subject: This course of lectures aims at introducing methods of Artificial Intelligence (AI) to engineers related to specific problems of their daily practice, especially with regard to design, processing of standards and team work. The students gain an understanding that computer support is not restricted to numerical computation, as e.g. programs for structural analysis or CAD, but can also involve manipulation of symbols thereby providing "intelligent" behaviour. The lecture is intended to introduce AI as underlying technology for advanced programs that might influence the way engineers will do their design in the future.

Title: Mobile Computing (read in English)

Intended Audience: 7th semester, students of civil engineering and of ITC-Euromaster course
Lectures and Tutorials: Menzel/Prof. Rebolj, University of Maribor

Subject: The purpose of the subject is to understand the potentials and the importance of mobile computing in construction, to learn about underlying technologies of mobile computing and the ways of using it in construction projects, especially in the building phase. An essential part of the subject is to gain experiences with introducing and applying mobile computing in the field. The intended learning outcomes are: in depth understanding of the basic technologies and potentials of mobile computing. Furthermore the participants will analyse and specify usage scenarios for mobile computing technologies in the AEC or FM-sector.

Title: Construction Information Management

Intended Audience: 9th semester, students of civil engineering, track structural engineering
Lectures and Tutorials: Scherer/Katranuschkov

Subject: The effective management of design, construction and facility management information throughout the whole life cycle of a building is a task with strategic importance for the competitiveness of the building industry. This course discusses basic information management techniques used in current engineering practice (structuring of CAD information, data exchange paradigms, workflow management, team collaboration), as well as emerging new software methods and techniques, especially with regard to the World Wide Web. On the basis of typical co-operative engi-

neering scenarios, advanced information management methods like Internet-based communication, product, process and document modelling and information sharing are discussed. Emphasis is given to the organisation of concurrent engineering work.

Title: Building history (read in English)

Intended Audience: 1st semester, Master programme in rehabilitation engineering
Lectures and Tutorials: Scherer (co-ordination), Curbach, Haller, Herle, Herz, Pohl
Subjects: This course offers a short outline of essential aspects in building history covering the historical development of building technology from medieval times to present. Furthermore the correspondence between social conditions of living and working, the development of urban and suburban areas, the demands on engineering solutions, the development of engineering science and the institutionalisation of engineering education with its feedback to new solution capabilities are outlined. Each lecture of the course is a self contained unit dealing with a special subject showing the development of technology and engineering on best practice examples.
The lectures are Historical Framework (Scherer), Geotechnical Engineering History (Herle), Timber Building History (Haller), Hydraulic Engineering History (Pohl), Bridge Engineering History (Curbach), Structural Engineering History (Scherer), Dresden Baroque (Herz).

Title: Management information systems (read in English)

Intended Audience: 2nd semester, Master programme in rehabilitation engineering
Lectures and Tutorials: Scherer/Katranuschkov
Subjects: The first part of the module covers methods for object-oriented modelling of complex engineering systems. Further course material focuses on communication methods and formal representation of communication goals, which allow the efficient application of automatic evaluation and decision support methods and –algorithms. The third focus is placed on control methods and develops a methodology for performance measurement.

Title: Information mining (read in English)

Intended Audience: 2nd semester, Master programme in rehabilitation engineering
Lectures and Tutorials: Scherer/Faschingbauer
Subjects: This course introduces methods for data analysis and data mining, e.g. correlation and regression, classification, decision trees and clustering. Their application aims at the early detection of damages and faulty system behaviour. The scope of their application and how they are complemented are discussed. An additional part of the lecture covers data pre-processing since the efficiency of the methods strongly depends on the modelled data. The inter-dependencies of the methods for modelling and data structures are explicated.

Title: GIS for infrastructure systems

Intended Audience: 2nd semester, Master programme in rehabilitation engineering
Lectures and Tutorials: Scherer/Faschingbauer
Subjects: This course gives an introduction into graph theory, by which the partitioning and the formal area-related variables dependencies can be described. The mapping from object-oriented data models to area-related representations and the generation of area boundaries by means of data mining methods are discussed. Different ways of graphical representation for complex, multi-layered information in terms of area magnitude are introduced. The lecture deduces and accounts for preferred modelling and data analysis techniques for corresponding graphical representation methods.

Title: Informatics in civil engineering

Intended Audience: 6th semester, students of science of the economy
Lectures and Tutorials: Hauptenbuchner
Subjects: This lecture aims at giving an introduction to the specific problems of software in civil engineering, the special requirement to the hardware, the way of work with the software and the future trends. Especially the area of the functionality of CAD- and CAE software will be discussed. The students get a survey of the software used in civil engineering offices and can acquire knowledge that allows them to judge such software products concerning quality and performance. A further aim is to enable the students to assess the expenditures on installation of new software, training of staff to operate it and carrying out of projects by appropriate software products.

Title: Informatics in architecture

Intended Audiences: 1st semester, students of architecture
Lectures and Tutorials: Hauptenbuchner
Subjects: The course shall allow the students to acquire knowledge of and proficiency in computerized data processing that will enable them to prepare multi-media documents of up-to-date quality. This requires experienced skills in using operating systems, text and graphic processing software, calculation programs and data bases as well as interfaces between them. Because of their wide-spread use Microsoft Office products are particularly presented. A performance test after the course shall prove the knowledge of and proficiency in the usage of Microsoft Office products incl. of interfaces provided to prepare a document of a subject chosen at liberty but according to well defined criteria.

Publications in 2005

[1] SCHERER, R. J.; EISFELD, M.: A Situated Planning Assistant for Conceptual Design of Building Structures, ICCC 2005, Cancun, June 2005.

[2] SCHERER, R. J.; FASCHINGBAUER, G.: Stochastic Moments of Seismic Waves in Stochastic Homogeneous and Heterogeneous Media, ICOSSAR 2005, Rome, June 2005.

[3] KELLER, M., SCHERER, R. J.: Use of business process modules for construction project management, In: proceeding of cib-w78 2005 – 22nd Conference on Information Technology in Construction, Scherer R.J, P. Katranuschkov & S.-E. Schapke (ed.);CIB Publication, ISBN 3-86005-478-3, pp. 91-96, July 2005.

[4] CEROVSEK, T.; KATRANUSCHKOV, P.: Active Process Model Supported Collaboration, In: proceeding of cib-w78 2005 – 22nd Conference on Information Technology in Construction, Scherer R.J, P. Katranuschkov & S.-E. Schapke (ed.); CIB Publication, ISBN 3-86005-478-3, pp. 97-104, July 2005.

[5] WEISE M. & KATRANUSCHKOV P.: Supporting State-based Transactions in Collaborative Product Modelling Environments, In: proceeding of cib-w78 2005 – 22nd Conference on Information Technology in Construction, Scherer R.J, P. Katranuschkov & S.-E. Schapke (ed.); CIB Publication, ISBN 3-86005-478-3, pp. 269-276, July 2005.

[6] GEHRE, A., KATRANUSCHKOV, P., STANKOVSKI, V., SCHERER, R.J.: Towards Semantic Interoperability in Virtual Organisations, In: proceeding of cib-w78 2005 22nd Conference on Information Technology in Construction, Scherer R.J, P. Katranuschkov & S.-E. Schapke (ed.);CIB Publication, ISBN 3-86005-478-3, pp. 307-314, July 2005.

[7] SCHERER, R. J., SCHAPKE, S.-E.: Constructing Building Information Networks from Proprietary Documents and Product Model Data, In: proceeding of cib-w78 2005 22nd Conference on Information Technology in Construction, Scherer R.J, P. Katranuschkov & S.-E. Schapke (ed.);CIB Publication, ISBN 3-86005-478-3, pp. 343-348, July 2005.

[8] K. EISENBLÄTTER & K. MENZEL: Implantation strategy of mobile technologies in construction. In proceeding of cib-w78 2005 22nd Conference on Information Technology in Construction, Scherer R.J, P. Katranuschkov & S.-E. Schapke (ed.); CIB Publication, ISBN 3-86005-478-3, pp. 489-496, July 2005.

[9] SCHERER, R.J.; WEISE M.; KATRANUSCHKOV P.: A Cooperation Model for the Control of Diverging Design Data, German-Russian Symposium on Construction Informatics in Moscow/St. Peterburg, Sept. 2004, ISBN 5-7264-0341-X (in Russian), Staatliche Bauuniversität Moskau, September 2005.

[10] WINDISCH R., KATRANUSCHKOV, P.: Wissensbasierter Tragwerksentwurf: Eine Frame-basierte Ontologie zur Abbildung des Tragwerksmodells, In: Forum Bauinformatik 2005, Schley, F., Weber, L. (Hrsg.), S. 193-200, 327-334, ISBN 3-934934-11-0, Cottbus, September 2005.

[11] M. KELLER, K. MENZEL & R.J. SCHERER: Towards a Meta-Model for Collaborative Construction Project Management. PRO-VE 2005, 6th IFIP Working Conference on Virtual Enterprises, Valencia Spain, 26-28 September 2005.

[12] WILCZEK, P., STICKL, R., MENZEL, K.: Von der Prozessanalyse zum pervasive Computing, In: Forum Bauinformatik 2005, Schley, F., Weber, L. (Hrsg.), S. 327-334, ISBN 3-934934-11-0, Cottbus, September 2005.

[13] STANKOVSKI, V., GEHRE, A., KATRANUSCHKOV, P., BALATON, E., TURK, Z.: Ontology Services for the Virtual Enterprise, In: eChallenges 2005, October 2005.

[14] SCHERER R. J., BRETSCHNEIDER, J.: Identification of Temporal Patterns Indicating Wave Fields in the Course of Time-dependent Principal Axes of Seismic Ground Acceleration, AI-METH Symposium 2005, Gliwice, Poland, November 2005.

[15] ZSOHAR, M. & SCHERER, R. J.: Stochastic Moments of Seismic Waves in Random Heterogeneous and Homogeneous Media, submitted to Journal of Prob. Eng. Mech., 2005.

[16] SCHERER, R. J., ZSOHAR, M., FASCHINGBAUER, G.: Numerical Computation of the Probability Density Function of Resonant Frequencies in Stochastic Layered Soil (in German), submitted to Journal of Bauingenieur, 2005.

[17] SCHERER, R. J., BRETSCHNEIDER, J., FASCHINGBAUER, G.: Behaviour of Seismic Waves in Stochastic Homogeneous and Heterogeneous Media, submitted to Journal of Soil Dynamics & Earthquake Engineering, 2005.

[18] SCHERER, R. J., FASCHINGBAUER, G. & BRETSCHNEIDER, J.: Amplification of Seismic Waves in Stochastic Homogeneous and Heterogeneous Layered Media, submitted to Journal of Soil Dynamics & Earthquake Engineering, 2005.

Editorial Boards Positions

Advanced Engineering Informatics	Elsevier Publishers	The Netherlands
Information Technology in Construction (electronic journal)	TH Stockholm	Sweden
Construction Innovation	Arnold Journals Publisher	Great Britain

Membership in standardization groups

DIN Dok-Bau	Standardization committee for technical product documentation in civil engineering	Vice chairman
DIN NAM 96.4.1-3	Product data exchange in civil engineering	Vice chairman
ISO 10303/BC	Standard Exchange of Product Data, work group Building Construction	Member
IAI	International Alliance of Interoperability (product modelling in civil engineering)	Co-ordinator of the academic group
IAI/ST-4	ST-4 Structural Model	Vice chairman