Tuesday, August 30, 14:00, Room MA144

Development of OR Based Software Systems

Michael F. Reiff, Hochschule St. Gallen

The development of OR–based software systems is a complex and difficult task. Compared with the development of other sorts of software systems, certain characteristic aspects should be taken into consideration. Nevertheless, there are no theories or concepts to support this development process.

Based on an analysis of the specific problems arising during the development of OR–based systems certain concepts for a development strategy will be presented. These concepts concern mainly

- a general architecture of OR–based software systems,
- the organization and structuring of the data base,
- the design of the user interface, and
- the decomposition of the system into components and their interaction.

The application of these concepts aims at an improved user acceptance, an easier application in practice and lower expenses for the development and maintenance of the systems considered.

Tuesday, August 30, 14:30, Room MA144

Limits of Object Orientation for Operations Research Application Development

Markus Holocher, FAW Ulm

One current problem in Operations Research is the support of application development for complex Operations Research based information systems. Algorithms used are often of complex nature and work on complex data structures. Application development in this context becomes even more involved, because the technical infastructure requires the implementation of distributed Client/Server applications in heterogeneous environments. Different software engineering concepts are discussed in this context, most of them are model oriented. One important focus in this discussion is Object Orientation, covering different aspects of modeling languages, programming languages, but also databases and operating systems. One aim of this paper is to show certain limitations of object oriented approaches in this field. In addition, other aspects from software engineering, such as reuse, organisations of method shells, and others, that are of special interest for operations research, are discussed.

Tuesday, August 30, 15:00, Room MA144

Concepts for User Support in the Method Base System $\mathcal{M}$

Peter Becker, Universität Tübingen

$\mathcal{M}$ is a model and method base system especially designed for discrete optimization problems. Aim of $\mathcal{M}$ is to provide models of discrete optimizaton problems, solution algorithms, and algorithmic meta knowledge in an integrated way.

This lecture presents the different concepts of user support offered by $\mathcal{M}$. Beside weak concepts of user support based on textual help and simple advice methods we show, how a given problem can be classified according to a *specialization hierarchy* of models. Classification renders the detection of more powerful solvers applicable for a problem. Moreover we show, how algorithmic knowledge can be incorporated in *strategy objects*, which serve as a means to solve problems automatically based on a user's preference.

Tuesday, August 30, 15:30, Room MA144

Knowledge Representation and Selection of Methods

Ralf Michalski, FAW Ulm

Users often have many difficulties to find fitting methods for given problem descriptions especially when they have to deal with large data and method bases or even distributed knowledge bases. The problem description must be suitable to identify data structures and methods and to activate (networkwide) fitting methods. Within the framework of an overall architecture, a knowledge-based broker functionality is developed which will support the search for and the selection of suitable method components and their activation in a network. Mechanisms to construct solution alternatives out of method components can be basically defined on a model which represents data structures and algorithms. In the modelling process, we also use graphtheoretical approaches for the description of Eigenmodels. For a given problem description a suitable solution space can be generated based on the model and a solution process given as a chain of algorithms can be activated. The broker functionality and its method parts are also represented in the knowledge base. This enables a possible adaption process of the system to changes in the knowledge base and user preferences concerning the method or solution selection process. Our experiences in using this approach in the field of communications will also be reported.

Semi-Plenary Lecture

Tuesday, August 30, 16:30, Room MA041

The Role of Logic in Enterprise Modelling: Formalizing Activity, Cost and Quality

Mark S. Fox, University of Toronto

Over the last decade there has been a shift in how we view the operations of an enterprise. Rather than being hierarchical in both structure and control, a distributed view where organisational units communicate and cooperate in both problem solving and action has evolved. Enterprise Integration is concerned with how to improve the performance of distributed organisations and markets. It focuses on the communication of information and the coordination and optimisation of enterprise decisions and processes in order to achieve higher levels of productivity, flexibility and quality. To achieve integration it is necessary that units of the enterprise, be they human or machine based, be able to understand each other. Therefore the requirement exists for a language in which enterprise knowledge can be expressed. Minimally the language provides a means of communicating among units, such as design, manufacturing, marketing, field service, etc. Maximally the language provides a means of representing knowledge for use in the enterprise, such as in computer-aided design, production control, etc. The goal of the TOVE Enterprise Modelling Project is to design and implement a generic Enterprise Data Model for use in multi-agent systems. The objectives of the TOVE Enterprise Modelling project are 1) to create a shared terminology (aka ontology) of the industrial enterprise that intelligent agents can jointly understand and use, 2) define the meaning of and constraints on each term (aka semantics) in a precise and as unambiguous manner as possible using First Order Logic, 3) implement the semantics in a set of axioms that will enable TOVE to automatically deduce the answer to many "common sense"questions about the enterprise, 4) define a symbology for depicting a concept in a graphical context, and 5) provide a methodology for instantiating enterprise models that minimises the complexity of the process. To date, we have developed a model that spans activity, state, time, causality, resources, cost and quality.

Wednesday, August 31, 10:00, Room MA144

Decision Support with Operations Research Models

Matthias F. Lachmann, Universität Karlsruhe

An approach for the combined use of OR models and algorithms in DSS will be presented. Based on a special structure of a model base several graphical modelling tools enable the DSS user to describe problems independently from a priori known OR methods. While using schemata of well known application problems as model building blocks a composite model will be created. A problem decomposition and analysis of corresponding methods in order to solve the application problem will be computed by the DSS. In the process of selection and integration of methods which will solve different parts of the user's overall problem several goals (e.g. computational complexity, total estimated processing time) will be considered. Using the described approach the DSS user can build new heuristics easily in an interactive environment.

Wednesday, August 31, 10:30, Room MA144

Interactive Decision Support System for Operations Research

Nenad Marovac, San Diego State University
Ulrich Tüshaus, Hochschule St. Gallen

Our world is becoming by the day more complex, dynamic and competitive.

This forces us to make management and operational decisions faster and tighter, i.e. decisions which will bring us competitive edge. On the other hand problems which we are concerned with are becoming larger and more complex.

This indicates a need for decision support tools that will enable us to make decisions based on fast appraisal of the situation and development of appropriate models and solutions.

These tools must be highly interactive, easy to interface to different information repositories, i.e. external data bases, execution environments, and should be applicable to situations in different application domains.

In the paper we propose such a tool for Operations Research in the form of an interactive platform based on HyperNet—a world-wide distributed hypermedia system—as its infrastructure.

Wednesday, August 31, 14:00, Room MA144

Monotone Bisector Trees — A Tool to Represent and Process Proximity and Similarity Efficiently

Hartmut Noltemeier, Universität Würzburg

We investigate the representation of sets (of complex objects) including their similarity and/or proximity properties. The goal is a comprehensive representation as well as the support of various kinds of operations. We shortly review bisector trees, Voronoi trees and introduce monotone bisector trees, showing some major advantages of this class of trees. Variants of this class (MB*T) are efficient tools f.e. for the compact representation and efficient partitioning of complex scenes of geometric objects, and we are showing additionally that by this single data structure a lot of different kinds of operations can be supported very well. We report on extensive experimental results and point to some topics of further interest.

Wednesday, August 31, 14:30, Room MA144

A Network Talk on CSCW – Defining CSCW by the Use of the Network Formalism

Edeltraud Egger, Technical University of Vienna
Hardy Hanappi, Technical University of Vienna

Computer Supported Co-operative Work (CSCW) is based on some fundamental concepts which are rather described in a more prosaic sense than defined. Due to this these descriptions are very vague, under the consideration of such ambiguous concepts nearly all systems are CSCW-applications. In our view it is necessary to find definitions of the basic CSCW-concepts like 'co-operative work', 'logical dependency', 'time dependency', 'control', 'power' and 'co-ordination' in order to have an instrument to distinguish between technical systems which are CSCW-applications and others which are not. In our view Petri nets can be an adequate language to represent the CSCW-concepts graphically and so they can provide system designer with a formally constituted logical link allowing an unambiguous classification of applications.

Since Petri nets are activity oriented a first step of using this language for defining the basic CSCW-concepts is to analyse which kind of activities do arise in an organisation and what is the logistic (the sequence) of the tasks. Therefore a Petri net can represent a labour process by defining the set of the necessary tasks, the sequence and the duration of the tasks. As a second step it has to be analysed which people can do which jobs. Since the meaning of labour- and time-flexibility is increasing , the assignment of people to tasks is enlarged by priority lists of the concerned people.

In the paper it will be defined how the basic concepts of a CSCW-application can be elaborated by using Petri nets: e.g. co-operation among group members can be shown by having parallel segments in the person-task assignment and branching in the Petri net.

Wednesday, August 31, 15:00, Room MA144

Construction of Sparse Broadcast Networks

Jose Ventura, The Pennsylvania State University

Broadcast is the task of disseminating a message from any node to all the other nodes in a network. A minimal broadcast network (mbn) with n nodes is a communication network in which a message originated at any node can be broadcasted in minimum time. An optimal broadcast network (obn) is an mbn with minimum number of edges. No method is known for constructing an obn with an arbitrary number of nodes. In this presentation, a new method called doubling procedure is introduced to construct sparse mbn's with 2n and 2n-1 nodes when an obn or a good mbn with n nodes is known. The new construction method is based on the concepts of center node and center node set of an mbn. An algorithm to find a center node set for a given mbn is also proposed. It is shown that an obn with 2n nodes can be constructed based on a known obn with n nodes for all ny9, n=15, 31 and 63, by applying the doubling procedure. This method also generates the best mbn's for some values of n y 64.

Wednesday, August 31, 15:30, Room MA144

SYNAPSE-1: A New Dimension in Neurocomputing

Susanne Marchart, Siemens Nixdorf, Munich

Since the development of neural networks computers can be used in the new area of applications, e.g. classification of objects, such as patterns, signals, sequences. When using a conventional computer the simulation of neural networks is done sequentially, which limits the size of possible networks due to long training times.

SYNAPSE-1 is equipped with a special hardware for efficient execution of the key operations of neural algorithms. This allows for the first time to calculate very large networks in very short time - e.g. recall a factor of 8000 faster than SPARC 2.

Using of SYNAPSE-1 is easy: conventional C++ with NAPL class library for special matrix operations, plus a library for complete algorithms. In addition, the link to a graphical user interface with algorithm builder is under preparation.

Wednesday, August 31, 16:30, Room MA144

On Reliability of the Replicated And-Or Graphs

Deron Liang, IIS of Academia Sinica, Taiwan
Rong-Hong Jan, National Chiao-Tung University, Taiwan

A computation task running in distributed systems can be represented as a directed graph $H(V,E)$ whose vertices and edges may fail with known probabilities. In this paper, the distributed task reliability is defined to be the probability that the task can be successfully executed. Due to the *And-Fork/And-Join* constraint, the traditional network reliability problem is a special case of the distributed task reliability problem, where the former is known to be NP-hard in general graphs. For two-terminal *And-Or Series-Parallel* (AOSP) graphs, the distributed task reliability can be computed in polynomial time. We consider a graph $H^k(\hat{V},\hat{E})$, named *k-Replicated And-Or Series-Parallel* (RAOSP) graph, which is obtained from an AOSP graph $H(V,E)$ by adding $(k-1)$ replications to each vertex and adding proper edges between two vertices. Previously, only exponential time algorithms as used in general graphs are known for computing the reliability of $H^k(\hat{V},\hat{E})$. In this paper, we present a linear time algorithm with $O(K(|V|+|E|))$ complexity to evaluate the reliability of the graph $H^k(\hat{V},\hat{E})$, where $K=\max\{k^2 2^{2k}, 2^{3k}\}$.

Wednesday, August 31, 17:00, Room MA144

Computerunterstützte Kommunikation

Andrzej Kopaczyk, FAW Ulm

Die anwenderbezogene Kommunikation in einem verteilten System wird im Projekt KIWI 2000 als eine Anwendung, aufbauend auf einer einheitlichen Systemschnittstelle, organisiert. Das Ziel dieser Anwendung ist die Abwicklung der Kommunikationswünsche auf einem hohen Abstraktionsniveau, möglichst ohne Kenntnisse der zugrundeliegenden technischen Infrastruktur. Ein Kommunikationsvorgang wird dazu durch eine veränderte Reihenfolge der Bedienungsschritte beschrieben, in dem die Formulierung der Nachricht, die Auswahl des Empfängers und erst zum Schluß die Auswahl der Kommunikationstechnologie erfolgt. Die Entscheidung über die eingesetzte Kommunikationstechnologie wird hierbei von der Verfügbarkeit dieser

Technologie, ihrer aktuellen Belegung, sowie von den Präferenzen des Benutzers abhängig gemacht. Die wichtigsten Eigenschaften dieser Anwendung werden charakterisiert durch die Methodik der Entwicklung, die im Rahmen eines neu gestalteten, softwaremäßig unterstützten Anwendungsentwicklungsprozesses stattfand, durch die Ausführung in einer neutralisierten Ausführungsumgebung, die ein heterogenes verteiltes System bildet und durch die Einführung der Präferenzelizitierung als Bestandteil der Anwendung, zur Entlastung des Benutzers bei der Wahl eines Kommunikationskanals. Aus der dargestellten Architektur ergeben sich die anwendungsorientierten Merkmale des gesamten Systems wie die Benutzerfreundlichkeit, vergleichsweise leichte Erweiterbarkeit um neue Kommunikationstechnologien, sowie Skalierbarkeit in Bezug auf die Anzahl der kommunizierenden Teilnehmer.