Foundations of Web Information Systems

Klaus-Dieter Schewe
Massey University,
New Zealand
http://infosys.massey.ac.nz/staff/StaffDetail.php?staffId=kdschewe

Klaus-Dieter Schewe (MSc, PhD, DSc) is full professor at Massey University in New Zealand and Director of Massey's Information Science Research Centre. His major research interests are database theory and systems, logic in databases and systems development methodologies, in particular for web information systems. He has published more than 120 refereed publications, and has been programme committee chair for several international events such as ADC, FoIKS and QSIC.

Bernhard Thalheim
Christian Albrechts University Kiel, Germany
http://www.is.informatik.uni-kiel.de/~thalheim

Bernhard Thalheim (MSc, PhD, DSc) is full professor at Christian Albrechts University in Germany. His major research interests are database theory, logic in databases, and systems development methodologies, in particular for web information systems. He has published more than 200 refereed publications, and has been programme committee chair for several international events such as MFDBS, ER, FoIKS, ASM, NLDB and ADBIS.

Tutorial Content Outline

The tutorial will consist of three parts:

1. Introduction
2. WISs as Data-Intensive Systems
3. WISs as Dialogue Systems

Introduction

We start from the various aspects that have to be taken into account when developing a web information system (WIS): purpose, usage, content, functionality, context, presentation. On this basis we develop a layered architecture for WISs, the Abstraction Layer Model (ALM). We use ALM as a reference model to specify systems on di®erent levels of abstraction. In the following blocks we will focus on two of these abstraction layers: the conceptual layer, which deals with content and functionality aspects, and the business layer, which deals with storyboarding. For the lower level of abstraction, the conceptual layer, we will emphasise extended views called media types, which highlight the perspective of WISs as data-intensive systems, while on the higher level of abstraction, the business layer, we will emphasise the story space, the actors and the tasks, thus highlighting the perspective of WISs as dialogue systems.

WISs as Data-Intensive Systems

A WIS is a database-backed information system that is realized and distributed over the web with user access via web browsers [19]. Abstracting from the page level the obvious idea is to design views on some underlying database that will result in the content to be presented. We will formally define such views using an IQL-like language, which will enable us to consider the static navigation structure as part of the views. We will then take a particular look how this can be supported by XML Schema for the underlying database and XQuery for the defining queries of the views. In doing so we obtain XML suites. We will then briefly sketch that the content support leads to a large view integration and cooperation problem, and describe a rule-based approach to deal with this problem. With respect to functionality we add operations to the views. These operations have to be understood as detailed specifications of user actions. We will present an abstract language for modelling these operations and define its semantics by using dynamic logic. In doing so we enable the formalisation of desirable properties of the system by formulae of a dynamic logic. We will also show how the logic can be used for verification purposes.

Furthermore, we discuss adaptivity of the system to user preferences as well as technical restrictions such as channel bandwidth or end-devices into account. This leads to another extension of the view mechanism by cohesion, for which we employ preorders and proximity values. We will show that will such a model there is an algorithmic solution of the adaptivity problem, while the model only requires the specification of cohesion . In a last step we introduce hierarchies, which enable more coarse or more detailed presentation of information. We indicate how to define hierarchies and which operations have to be made available to switch presentation along the hierarchy.

WISs as Dialogue Systems

On a higher level of abstraction we are not so much interested in the details of the content model and the operations. On this level we capture the usage of the intended system, for which we use storyboarding. Storyboarding consists of three interconnected parts: the

modelling of the story space, the modelling of the actors, i.e. clases of users, and the modelling of tasks. For the story space we start from the obvious idea to regard a web information system as a collection of abstract locations (called scenes), between which a user navigates. While navigating through the system a user will execute certain actions. Thus, we first obtain a rough story space language, which consists simply in modelling graphs. Then we take a closer look into the sequencing of actions executed by a user. Using sequential and parallel composition, a choice operator and pre- and postconditions we model the micro-level of the story space by an assignment-free process algebra. This algebra can in fact be represented as a Kleene algebra with tests (KATs) . This enables a simple form of system personalisation. Preferences and goals of users that are modelled by equations on the KAT can be exploited for simple, but e®ective term rewriting for the purpose of simplifying the story space according to a user's needs.

For the actors we first address the modelling of roles together with their rights and obligations. This leads to a deontic logic. We mainly describe the usage of the logic for expressing the requirements rather than going into details of how to exploit the logic for reasoning purpose. The second part of actor modelling addresses the profiling of users. We present a model that combines characteristics and then defines important user types. For each user type we then derive preference rules describing the user behaviour. These preference rules link the user types to the equations used for the personalisation of the story space. The tasks link the actors with the story space. A task will consist of a goal, involved actors and required actions that are linked together again by deontic logic. Reasoning about tasks will permit to set up task execution plans. The goals will also link the tasks to the personalisation of the story space.

Literature

The work presented in the tutorial is subject to book
Schewe, K.-D., and Thalheim, B. Design and Development of Web Information Systems. Springer-Verlag, 2005. to appear.

Mobile Location Solutions and Data Management Challenges.

Yannis Theodoridis
University of Piraeus,
Greece http://www.unipi.gr/faculty/ytheod

Dr. Yannis Theodoridis, born in 1967, is Assistant Professor at the Department of Informatics, University of Piraeus, also keeping a joint research position with the Computer Technology Institute (CTI). His research interests include spatial and spatio temporal databases, management of location based services, data mining, and geographical information systems. He was scientist in charge and coordinator of two European FP6 projects, namely PANDA (IST-2001-33058 FET Working Group; 2001-04) and CODMINE (IST-2001-39151 FET Assessment Project; 2002-03), on pattern-base management and privacy preserving data mining, respectively. He has co-authored one book published by Kluwer and over 30 articles in scientific journals, such as Algorithmica, ACM Multimedia, IEEE TKDE, and conferences, such as ACM SIGMOD, PODS, ICDE, VLDB. His work has over 300 citations in scientific journals and conference proceedings. He has served in the program committee for SIGMOD, ICDE, ICDM, SSTD and other conferences and as general chair for the 8th Int'l Symposium on Spatial and Temporal Databases (SSTD'03). He is member of ACM and IEEE.

Tutorial abstract

With the integration of wireless communications and positioning technologies, the concepts of Mobile Location Solutions (MLS) and Location-Based Services (LBS) have become increasingly important and have posed a great challenge to the data management community. In such location-aware environments, current DBMS are not well equipped to handle continuously changing data (i.e., moving objects) while, on the other hand, emerging location-dependent services call for new data management algorithms and techniques to deal with both the spatial and temporal domains. The tutorial will start by introducing background wireless technology (GSM, UMTS, etc.), current positioning solutions (including GPS and CGI) and short presentations of operating MLS/LBS. Then, LBS will be classified in terms of stationary vs. mobile providers and recipients of information and advanced examples from each class will be given, together with appropriate algorithms for their implementation. In the second part of the tutorial, issues on the efficient and effective development of MLS on top of extensible DBMS will be discussed. Issues to be considered include modeling of moving object databases (MOD), the notion and representation of 'trajectory', querying and query processing on MOD, indexing of either past or current states of moving objects. The tutorial will be concluded by giving hints for open research issues, such as efficient processing of continuous queries and trajectory data mining (and related privacy issues).