

Preface

INTRODUCTION

Database management is an integral part of many business applications, especially considering the current business environment that emphasizes data, information, and knowledge as crucial components to the proper utilization and dispensing of an organization's resources. Building upon the work of previous volumes in this book series, we are once again proud to present a collection of high-quality and state-of-the-art research conducted by experts from all around the world .

This book is designed to provide researchers and academics with the latest research-focused chapters on database and database management; these chapters will be insightful and helpful to their current and future research. The book is also designed to serve technical professionals and aims to enhance professional understanding of the capabilities and features of new database applications and upcoming database technologies.

This book is divided into four sections: (I) Analysis and Evaluation of Database Models, (II) Database Designs and Applications, (III) Database Design Issues and Solutions, and (IV) Semantic Database Analysis.

SECTION I: ANALYSIS AND EVALUATION OF DATABASE MODELS

Chapter I, "A Rigorous Framework for Model-Driven Development," describes a rigorous framework that comprises the NEREUS metamodeling notation, a system of transformation rules to bridge the gap between UML/OCL and NEREUS and, the definition of MDA-based reusable components and model/metamodeling transformations. This chapter also shows how to integrate NEREUS with algebraic languages using the Common Algebraic Specification Language.

Chapter II, "Adopting Open-Source Development Tools in a Commercial Production Environment: Are We Locked in?" explores the use of a standardized interchange format for increased flexibility in a company environment. It also reports on a case study in which a systems development company has explored the possibility of complementing its current proprietary tools with open-source products for supporting its model-based development activities.

Chapter III, “Classification as Evaluation: A Framework Tailored for Ontology Building Methods,” presents a weighted classification approach for ontology-building guidelines. A sample of Web-based ontology-building method guidelines is evaluated in general and experimented with when using data from a case study. It also discusses directions for further refinement of ontology-building methods.

Chapter IV, “Exploring the Concept of Method Rationale: A Conceptual Tool to Understand Method Tailoring,” starts off explaining why systems development methods also encapsulate rationale. It goes on to show how the combination of two different aspects of method rationale can be used to enlighten the communication and apprehension methods in systems development, particularly in the context of tailoring of methods to suit particular development situations.

Chapter V, “Assessing Business Process Modeling Languages Using a Generic Quality Framework,” evaluates a generic framework for assessing the quality of models and modeling languages used in a company. This chapter illustrates the practical utility of the overall framework, where language quality features are looked upon as a means to enable the creation of other models of high quality.

Chapter VI, “An Analytical Evaluation of BPMN Using a Semiotic Quality Framework,” explores the different modeling languages available today. It recognizes that many of them define overlapping concepts and usage areas and consequently make it difficult for organizations to select the most appropriate language related to their needs. It then analytically evaluates the business process modeling notation (BPMN) according to the semiotic quality framework. Its further findings indicate that BPMN is easily learned for simple use, and business process diagrams are relatively easy to understand.

Chapter VII, “Objectification of Relationships,” provides an in-depth analysis of objectification, shedding new light on its fundamental nature, and providing practical guidelines on using objectification to model information systems.

Chapter VIII, “A Template-Based Analysis of GRL,” applies the template proposed by Opdahl and Henderson-Sellers to the goal-oriented Requirements Engineering Language GRL. It then further proposes a metamodel of GRL that identifies the constructs of the language and the links between them. The purpose of this chapter is to improve the quality of goal modeling.

SECTION II: DATABASE DESIGNS AND APPLICATIONS

Chapter IX, “Externalisation and Adaptation of Multi-Agent System Behaviour,” proposes the adaptive agent model (AAM) for agent-oriented system development. It then explains that, in AAM, requirements can be transformed into externalized business rules that represent agent behaviors. Collaboration between agents using these rules can be modeled using extended UML diagrams. An illustrative example is used here to show how AAM is deployed, demonstrating adaptation of inter-agent collaboration, intra-agent behaviors, and agent ontologies.

Chapter X, “Reuse of a Repository of Conceptual Schemas in a Large-Scale Project,” describes a methodology and a tool for the reuse of a repository of conceptual schemas. The methodology described in this chapter is applied in a project where an

existing repository of conceptual schemas, representing information of interest for central public administration, is used in order to produce the corresponding repository of the administrations located in a region.

Chapter XI, “The MAIS Approach to Web Service Design,” presents a first attempt to realize a methodological framework supporting the most relevant phases of the design of a value-added service. The framework has been developed as part of the MAIS project. It describes the MAIS methodological tools available for different phases of service life cycle and discusses the main guidelines driving the implementation of a service management architecture that complies with the MAIS methodological approach.

Chapter XII, “Toward Autonomic DBMSs: A Self-Configuring Algorithm for DBMS Buffer Pools,” introduces autonomic computing as a means to automate the complex tuning, configuration, and optimization tasks that are currently the responsibility of the database administrator.

Chapter XIII, “Clustering Similar Schema Elements Across Heterogeneous Databases: A First Step in Database Integration,” proposes a cluster analysis-based approach to semi-automating the interschema relationship identification process, which is typically very time-consuming and requires extensive human interaction. It also describes a self-organizing map prototype the authors have developed that provides users with a visualization tool for displaying clustering results and for incremental evaluation of potentially similar elements from heterogeneous data sources.

Chapter XIV, “An Efficient Concurrency Control Algorithm for High-Dimensional Index Structures,” introduces a concurrency control algorithm based on link-technique for high-dimensional index structures. This chapter proposes an algorithm that minimizes delay of search operations in high-dimensional index structures. The proposed algorithm also supports concurrency control on reinsert operations in such structures.

SECTION III: DATABASE DESIGN ISSUES AND SOLUTIONS

Chapter XV, “Modeling Fuzzy Information in the IF₂O and Relational Data Models,” examines some conceptual data models used in computer applications in non-traditional area. Based on a fuzzy set and possibility distribution theory, different levels of fuzziness are introduced into IFO data model and the corresponding graphical representations are given. IFO data model is then extended to a fuzzy IFO data model, denoted IF₂O. This chapter also provides the approach to mapping an IF₂O model to a fuzzy relational database schema.

Chapter XVI, “Evaluating the Performance of Dynamic Database Applications,” explores the effect that changing access patterns has on the performance of database management systems. The studies indicate that all existing benchmarks or evaluation frameworks produce static access patterns in which objects are always accessed in the same order repeatedly. The authors in this chapter instantiate the Dynamic Evaluation Framework, which simulates access pattern changes using configurable styles of change, into the Dynamic object Evaluation Framework that is designed for object databases.

Chapter XVII, “MAMDAS: A Mobile Agent-Based Secure Mobile Data Access System Framework,” recognizes that creating a global information-sharing environment in the presence of autonomy and heterogeneity of data sources is a difficult task.

The constraints on bandwidth, connectivity, and resources worsen the problem when adding mobility and wireless medium to the mix. The authors in this chapter designed and prototyped a mobile agent-based secure mobile data access system (MAMDAS) framework for information retrieval in large and heterogeneous databases. They also proposed a security architecture for MAMDAS to address the issues of information security.

Chapter XVIII, “Indexing Regional Objects in High-Dimensional Spaces,” reviews the problems of contemporary spatial access methods in spaces with many dimensions and presents an efficient approach to building advanced spatial access methods that effectively attack these problems. It also discusses the importance of high-dimensional spatial access methods for the emerging database applications.

SECTION IV: SEMANTIC DATABASE ANALYSIS

Chapter XIX, “A Concept-Based Query Language Not Using Proper Association Names,” focuses on a concept-based query language that permits querying by means of application domain concepts only. It introduces constructions of closures and contexts as applied to the language which permit querying some indirectly associated concepts as if they were associated directly and adopting queries to users’ needs without rewriting. The author of this chapter believes that the proposed language opens new ways of solving tasks of semantic human-computer interaction and semantic data integration.

Chapter XX, “Semantic Analytics in Intelligence: Applying Semantic Association Discovery to Determine Relevance of Heterogeneous Documents,” describes an ontological approach for determining the relevance of documents based on the underlying concept of exploiting complex semantic relationships among real-world entities. This chapter builds upon semantic metadata extraction and annotation, practical domain-specific ontology creation, main-memory query processing, and the notion of semantic association. It also discusses how a commercial product using Semantic Web technology, Semagix Freedom, is used for metadata extraction when designing and populating an ontology from heterogeneous sources.

Chapter XXI, “Semantic Integration in Multidatabase Systems: How Much Can We Integrate?” reviews the semantic integration issues in multidatabase development and provides a standardized representation for classifying semantic conflicts. It then explores the idea further by examining semantic conflicts and proposes taxonomy to classify semantic conflicts in different groups.

These 21 chapters provide a sample of the cutting edge research in all facets of the database field. This volume aims to be a valuable resource for scholars and practitioners alike, providing easy access to excellent chapters which address the latest research issues in this field.

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