

Object-Role Modeling: Principles and Benefits

Terry Halpin, LogicBlox, Australia, and INTI Education Group, Malaysia

ABSTRACT

Object-Role Modeling (ORM) is an approach for modeling and querying information at the conceptual level, and for transforming ORM models and queries to or from other representations. Unlike attribute-based approaches such as Entity-Relationship (ER) modeling and class modeling within the Unified Modeling Language (UML), ORM is fact-oriented, where all facts and rules are modeled in terms of natural sentences easily understood and validated by nontechnical business users. ORM's modeling procedure facilitates validation by verbalization and population with concrete examples. ORM's graphical notation is far more expressive than that of ER diagrams or UML class diagrams, and its attribute-free nature makes it more stable and adaptable to changing business requirements. This article explains the fundamentals of ORM, illustrates some of its advantages as a data modeling approach, and outlines some recent research to extend ORM, with special attention to mappings to deductive databases.

Keywords: Business Rules, Conceptual Schema, Data Modeling, Datalog, Deductive Database, Derivation Rules, Fact-Oriented, Information Modeling, Integrity Constraints, Object-Role Modeling

INTRODUCTION

Object-Role Modeling (ORM) is a conceptual approach for modeling, querying, and transforming information. Here “conceptual” is used in the same sense as in the seminal report on conceptual schemas published nearly 30 years ago by the International Standards Organization (van Griethuysen, 1982). A conceptual model is a fully detailed description of the universe of discourse (UoD)—the business domain that we wish to discourse or talk about—cast in language that is readily understood by users of the business domain. We use the term “model” to include both the schema (structure of the

UoD) and the state-dependent population of instances that instantiate the schema.

Modeling approaches include *languages* for expressing constructs, and *procedures* for creating those constructs. ORM includes a graphical and textual language for specifying models, a textual language for formulating queries, as well as procedures for constructing ORM models, transforming them into alternative ORM models, and mapping to/from other kinds of models, including attribute-based models such as Entity-Relationship (ER) models (Chen, 1976), class models in the Unified Modeling Language (UML) (OMG, 2009), and eXtensible Markup Language (XML) documents. Current research is also under way to add procedures for mapping ORM models to

DOI: 10.4018/jismd.2010092302

logic-based languages such as Datalog and the Web Ontology Language (OWL).

ORM is a prime exemplar of *fact-oriented modeling*, a family of modeling approaches that enable one to model information in terms of the underlying facts of interest, where facts and rules may be verbalized in language that is easily understood. Unlike ER modeling and UML class diagrams, fact-oriented models are *attribute-free*, treating all facts as relationships (unary, binary, ternary etc.). For example, instead of using the attributes Employee.isSmoker and Employee.hiredate, fact-oriented models use the *fact types* Employee smokes and Employee was hired on Date.

ORM evolved from another fact-oriented approach known as Natural Information Analysis Method (NIAM) (Wintraeken, 1990), which originated in Europe in the 1970s with the work of the main pioneers Eckhard Falkenberg, Sijr Nijssen, and Robert Meersman, and was first fully formalized in the late 1980s by the author (Halpin, 1989). Another formalization based on the LISA-D language was provided by ter Hofstede et al. (1993). Fact-oriented modeling includes other closely related approaches, such as Fully-Communication Oriented Information Modeling (FCO-IM) (Bakema & Zwart, 2000), and the Semantics of Business Vocabulary and Business Rules (SBVR) approach (Bollen 2008; OMG, 2008). Recently, the original NIAM was modified to become Cognition-enhanced NIAM (CogNIAM) (Nijssen & Lemmens, 2008), and ORM was extended to second generation ORM (ORM 2) (Halpin, 2005).

Fact-oriented modeling has been used productively in industry for over three decades, with many case studies attesting to its practical benefits for information systems engineering in a variety of areas, including service oriented architecture (Piprani, Wang, & He, 2008), data warehousing (Hansen & dela Cruz, 2006), data quality (Piprani & Ernst, 2008), and decision support (Piersen & dela Cruz, 2005). Apart from its use in model driven engineering, fact-orientation is well suited for requirements analysis (Evans, 2005; Piprani et al., 2008) as well as business rules and regulations modeling.

The growing use of fact-oriented languages to capture business rules was given further impetus by the OMG's recent adoption of SBVR.

The fact-oriented approach is supported by many tools. Early NIAM and ORM-based tools include IAST, RIDL*, VisioModeler, ActiveQuery, and the ORM modeling solution in Microsoft Visio for Enterprise Architects (Halpin, et al. 2003). FCO-IM tools include CaseTalk (www.casetalk.com) and Infagon (www.mattic.com). Dogma Modeler (www.starlab.vub.ac.be) and Collibra (www.collibra.com) are ORM-based tools for specifying ontologies. CogNIAM is supported by DocTool (www.pna-group.com). ORM-2 based tools currently under development include Natural ORM Architect (NORMA) (www.ormfoundation.org/files/folders/norma/default.aspx; Curland & Halpin, 2007), the ActiveFacts toolkit (<http://dataconstellation.com/ActiveFacts>), and ORMLite (<http://pureviolet.net/ganttpv/orm/index/>).

Brief introductions to ORM may be found in Halpin (2006; 2008), a thorough treatment in Halpin & Morgan (2008), and comparisons of ORM with ER and UML in Halpin (2004; 2008b). An overview of fact-oriented modeling approaches, including a more detailed history and a discussion of other research directions, may be found in Halpin (2007b). Further resources about ORM are accessible from the ORM Foundation (www.ORMFoundation.org), a non-profit organization devoted to the promulgation of fact-orientation, as well as from the author's website (www.orm.net).

In spite of its long history and broad application, ORM has still not achieved the wide adoption enjoyed by popular modeling approaches such as ER and UML. The fundamental principles that underlie ORM are often unknown or misunderstood, and the benefits deriving from these principles are often not appreciated. The main purpose of this article to try to rectify that situation by providing in one short article a clear exposition of these principles and the advantages that can follow from their adoption. While some of these principles appear here for the first time in print, an article of

21 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/article/object-role-modeling/40952

Related Content

A Survey on Brain Tumor Segmentation and Classification

T.A. Jemimmaand Y. Jacob Vetharaj (2022). *International Journal of Software Innovation* (pp. 1-21).

www.irma-international.org/article/a-survey-on-brain-tumor-segmentation-and-classification/309721

Ensuring Safe and Intelligent Data-Driven Control for Cyber-Physical Systems: Advancing Security, Reliability, and Autonomy

Wasswa Shafik (2026). *Safe Data-Driven Control for Cyber-Physical Systems* (pp. 159-184).

www.irma-international.org/chapter/ensuring-safe-and-intelligent-data-driven-control-for-cyber-physical-systems/390832

Protein Classification Using N-gram Technique and Association Rules

Fatima Kabli, Reda Mohamed Hamouand Abdelmalek Amine (2018). *International Journal of Software Innovation* (pp. 77-89).

www.irma-international.org/article/protein-classification-using-n-gram-technique-and-association-rules/201486

Improving Memory Management Security for C and C++

Yves Younan, Wouter Joosen, Frank Piessensand Hans Van den Eynden (2010). *International Journal of Secure Software Engineering* (pp. 57-82).

www.irma-international.org/article/improving-memory-management-security/43926

Adapting a Requirements Engineering Process by Key Factors Estimation

Graciela Dora Susana Hadad, Jorge Horacio Doornand Viviana Alejandra Ledesma (2022). *Research Anthology on Agile Software, Software Development, and Testing* (pp. 709-725).

www.irma-international.org/chapter/adapting-a-requirements-engineering-process-by-key-factors-estimation/294491