Chapter III
Extending the ORM Conceptual Schema Language and Design Procedure with Modeling Constructs for Capturing the Domain Ontology

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ABSTRACT

In this chapter the authors extend the ORM conceptual modeling language with constructs for capturing the relevant parts of an application ontology in a list of concept definitions. The authors give the adapted ORM meta model and provide an extension of the accompanying Conceptual Schema Design Procedure (CSDP) to cater for the explicit modeling of the relevant parts of an application- or domain ontology in a list of concept definitions. The application of these modeling constructs will significantly increase the perceived quality and ease-of-use of (Web-based) applications.

INTRODUCTION

The objective of this book is to disseminate best practices and research outcomes of the information systems modeling (ISM) community to researchers, practitioners and students in the ISM field of knowledge. This chapter presents some extensions to an information modeling methodology called Object-Role Modeling (ORM) (Halpin, 2001).

ORM (including other fact-oriented languages (e.g. (Bakema, Zwart, & van der Lek, 1994; Lemmens, Nijssen, & Nijssen, 2007))) is a conceptual modeling approach that models the world in terms of objects and roles that they play (Halpin, 2001). ORM has a single fact encoding construct: the fact type, in contrast to other popular conceptual modeling methodologies, e.g. ER (Chen, 1976)

and (E)ER (Teorey, Yang, & Fry, 1986) that contain at least two fact encoding constructs: the *attribute* and the *relationship* (Chen, 1976; Teorey et al., 1986).

The roots of ORM can be traced back to the early seventies, when the research focus in the ISM field was on database modeling languages (see for an overview of ORM's history the review article of Halpin (Halpin, 2007)). The objective of the researchers at that time was to define a truly conceptual modeling language for expressing database requirements, independently from the database implementation languages, that were existing at that time, e.g. CODASYL, hierarchical, or relational and object-oriented databases. ORM (or one of its ancestors at any point in time) and other contemporary fact-oriented modeling languages, have evolved over the past 30 years. The modeling constructs have evolved in order to enable the language to model an ever increasing range of domain requirements in a declarative way. Until the nineties, ORM and other fact-oriented modeling languages were mainly focused on modeling the requirements in the information perspective. In the past 20 years, the language has been extended with modeling constructs and methodology, that also cover the process- and event- perspectives in conceptual modeling (Balsters, Carver, Halpin, & Morgan, 2006; Bollen, 2007a, 2007b; Morgan, 2006, 2007; Prabhakaran & Falkenberg, 1988).

In the literature a number of definitions for ontology can be found: "the definition of the basic terms and relations comprising the vocabulary of a topic area" (Neches et al., 1991), " an ontology is a description of the concepts and relationships for an agent or a community of agents." (Gruber, 1993), " shared understanding of a domain that can be communicated between people and application systems." (Fensel, 2001), "an ontology is a formal conceptualization of a real world, sharing a common understanding of this real world." (Lammari & Metais, 2004, p.155).

Burton-Jones et al. (2005) distinguish four types of material ontologies: *application-, domain-, generic-* and *representation* ontologies. Application ontologies specify definitions needed for a particular application, domain ontologies specify conceptualizations specific to a domain, generic ontologies specify conceptualizations generic to several domains and representation ontologies specify conceptualizations that underlie knowledge representation formalisms.

In the last 10 years, the penetration of the world-wide web into the heart of the business information systems, has lead to a renewed interest in conceptual modeling, albeit now from the perspective of 'connected' agents that communicate with each over via the internet. The research field that has attracted a lot of scholars and practitioners is the field of ontology, leading to standards for communication via the world wide web. Examples of these standards are the Web Ontology Language OWL (Bechhofer et al., 2004) and the Web Service Modeling Language WSML (Bruijn et al., 2005).

In this chapter we will extend the ORM conceptual modeling methodology and its *representation* ontology with additional modeling constructs to help us capture the relevant part of a *domain-* or *application ontology* in an implementation-independent way.

RELATED WORK

Weber and Zhang (Weber & Zhang, 1996) analyze the extent in which a pre-decessor to ORM: NIAM complies to the Bunge-Wand-Weber (BWW) model for ontological expressiveness.

Spyns, Meersman and Jarrar (Spyns, Meersman, & Jarrar, 2002) introduce the DOGMA ontology engineering approach in which they separate an ontology base from the ontological commitment that contains the specific rules of the application domain. DOGMA uses a binary ver-

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