

Chapter XVIII

Enhancing UML Models: A Domain Analysis Approach

Iris Reinhartz-Berger
University of Haifa, Israel

Arnon Sturm
Ben-Gurion University of the Negev, Israel

ABSTRACT

UML has been largely adopted as a standard modeling language. The emergence of UML from different modeling languages that refer to various system aspects causes a wide variety of completeness and correctness problems in UML models. Several methods have been proposed for dealing with correctness issues, mainly providing internal consistency rules but ignoring correctness and completeness with respect to the system requirements and the domain constraints. In this article, we propose addressing both completeness and correctness problems of UML models by adopting a domain analysis approach called ap-

plication-based domain modeling (ADOM). We present experimental results from our study which checks the quality of application models when utilizing ADOM on UML. The results advocate that the availability of the domain model helps achieve more complete models without reducing the comprehension of these models.

INTRODUCTION

Conceptual modeling is fundamental to any area where one has to cope with complex real-world systems. The most popular, de-facto modeling language today is UML, which is used for specifying, visualizing, constructing, and documenting

the artifacts of software systems, as well as for business modeling and other non-software systems (OMG-UML, 2003; OMG-UML, 2006). Although UML provides convenient, standard mechanisms for software engineers to represent high-level system designs, as well as low-level implementation details (Tilley & Huang, 2003), it also introduces a variety of correctness and completeness problems. According to Major and McGregor (1999), *correctness* is measured as how accurately the model represents the information specified within the requirements. For defining the correctness of a model, a source that is assumed to be (nearly) infallible is identified. This source, termed a “test oracle,” is usually a human expert whose personal knowledge is judged to be sufficiently reliable to be used as a reference. The accuracy of the model representation is measured relatively to the results expected by the oracle. *Completeness*, on the other hand, deals with the necessity and usefulness of the model to represent the real life application, as well as the lack of required elements within the model (Major & McGregor, 1999). In other words, completeness is judged as to whether the information being modeled is described in sufficient details for the established goals. This judgment is based on the model’s ability to represent the required situations, as well as on the knowledge of experts.

Different studies concluded that it is difficult to model a correct and consistent application using UML and even to understand such a specification (Dori, 2001; Kabeli & Shoval, 2001; Peleg & Dori, 2000; Reinhartz-Berger & Dori, 2005; Siau & Cao; 2001). Several methods have been suggested for checking the correctness of UML models. However, these mainly deal with syntactic issues directly derived from the modeling language metamodel, neglecting the correctness and completeness of the models with respect to the domain constraints and the system requirements.

In this research we utilize the application-based domain modeling (ADOM) approach

(Reinhartz-Berger & Sturm, 2004; Sturm & Reinhartz-Berger, 2004), whose roots are in the area of domain engineering, for enhancing UML models. ADOM enables specifying and modeling domain artifacts that capture the common knowledge and the allowed variability in specific areas, guiding the development of particular applications in the area, and validating the correctness and completeness of applications with respect to their relevant domains. ADOM does these with regular application and software engineering techniques and languages, bridging the gap between the different abstraction levels at which application and domain models reside and reducing learning and training times. We present initial results from our study which checks the comprehension and quality of UML models when applying ADOM.

Following the introduction we review relevant works from related areas and briefly introduce the ADOM approach, emphasizing its usage for developing correct and complete UML models. We then elaborate on the experiment we conducted, its hypotheses, settings, and results. Finally, we summarize the advantages and limitations of the proposed approach, raising topics for future research.

LITERATURE REVIEW

Shull, Russ and Basili (2000) defined six types of software defects that can be found in object-oriented designs: missing information, incorrect facts, inconsistent information, ambiguous information, extraneous information, and miscellaneous defects. Incorrect facts, inconsistent information, ambiguous information, and extraneous information refer to the model correctness, while missing information refers to completeness.

Several solutions have been proposed over the years for handling these defects, mainly concerning consistency and integration problems. These solutions can be roughly divided into translation and verification approaches. Translation ap-

20 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/chapter/enhancing-uml-models/28562

Related Content

Reverse Engineering from an XML Document into an Extended DTD Graph

Herbert Shiu and Joseph Fong (2009). *Database Technologies: Concepts, Methodologies, Tools, and Applications* (pp. 2489-2509).

www.irma-international.org/chapter/reverse-engineering-xml-document-into/8048

Privacy-Preserving Outsourced Similarity Search

Stepan Kozak, David Novak and Pavel Zezula (2014). *Journal of Database Management* (pp. 48-71).

www.irma-international.org/article/privacy-preserving-outsourced-similarity-search/118088

Using Graphics to Improve Understanding of Conceptual Models

Kamal Masri, Drew Parker and Andrew Gemino (2010). *Principle Advancements in Database Management Technologies: New Applications and Frameworks* (pp. 310-334).

www.irma-international.org/chapter/using-graphics-improve-understanding-conceptual/39362

A Novel Approach to Managing the Dynamic Nature of Semantic Relatedness

Youngseok Choi, Jungsuk Oh and Jinsoo Park (2016). *Journal of Database Management* (pp. 1-26).

www.irma-international.org/article/a-novel-approach-to-managing-the-dynamic-nature-of-semantic-relatedness/165160

An Overview of Fuzzy Approaches to Flexible Database Querying

Slawomir Zadrozny, Guy de Tré, Rita de Caluwe and Janusz Kacprzyk (2008). *Handbook of Research on Fuzzy Information Processing in Databases* (pp. 34-54).

www.irma-international.org/chapter/overview-fuzzy-approaches-flexible-database/20348