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Chapter VI

A Reflective Meta-Model of Object-Process Methodology: The System Modeling Building Blocks

Iris Reinhartz-Berger, University of Haifa, Israel

Dov Dori, Technion, Israel Institute of Technology, Israel

Abstract

In this chapter, we introduce a highly expressive, self-contained reflective meta-model of object-process methodology (OPM). OPM enables universal system modeling based on the notions of processes that transform objects. Extending the object-oriented approach, which views processes as residents of objects, OPM provides for the existence of stand-alone processes that can represent transformations in complex systems such as businesses, aircrafts or organisms. A system modeling and development methodology,

which is a combination of a language for expressing the universal (or domain) ontology and an approach for developing systems that uses this language, can be expressed in OPM using objects, processes and links among them. Through the reflective OPM meta-model, we demonstrate the expressive power of OPM and its applicability as a universal tool for architecting systems that involve structure and dynamics in a highly, intertwined manner.

Introduction

A system modeling and development methodology is a combination of a *language* for expressing the universal or domain ontology and an *approach* or a *protocol* for developing systems that makes effective use of this language. Meta-modeling, the process of modeling a methodology, enables building, understanding, comparing, and evaluating methodologies. The meta-modeling process produces a meta-model, that is, a model of the methodology (Meta-Model, 2003). We refer to a methodology that can model itself as a *reflective methodology*, and to meta-modeling of a reflective methodology as *reflective meta-modeling*. In other words, a reflective meta-model is defined exclusively in terms of the modeled methodology. A reflective methodology is especially powerful since it is self-contained, so it does not require auxiliary means or external tools to model itself. Object-process methodology (OPM), which is a holistic system modeling, development and evolution approach that combines object-oriented notations with process-oriented concepts, is a reflective methodology.

As noted, meta-models have become important means for comparing and evaluating methodologies and their supporting CASE tools. By and large, meta-models are structure- or object-oriented, and hence pertain only to the static elements and relations of the methodology. They therefore do not include the procedural parts of the methodology (also known as “the software process”). Rather, these are usually described loosely and informally in some natural language, most often English. The main reason for this omission of the methodology’s “process” part is the lack of expressive power of the methodology to seamlessly and straightforwardly describe not only objects and structure but also processes and behavior.

OPM overcomes this shortcoming by treating objects and processes as two equally important entities rather than viewing object classes necessarily as superiors to and owners of processes. Through the bimodal OPM model presentation of object-process diagrams (OPDs) and object-process language (OPL) sentences, this chapter presents the reflective meta-model of the

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