Chapter IV

An Object-Oriented Hypermedia Reference Model Formally Specified in UML

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ABSTRACT

Although the Unified Modeling Language (UML) is by now accepted as a standard and is widely used as an object-oriented modeling language, some languages such as Z or VDM are preferred to formally specify reference models. Here, we present a reference model for hypermedia systems in UML. It is an object-oriented and Dexter-based approach that uses UML to provide an intuitive graphical representation of the model. The class diagrams are supplemented with formal constraints in the Object Constraint Language (OCL), adding invariants on elements as well as preconditions and postconditions on operations. The result is an easily extendable reference model for describing specific hypermedia systems, for example, like adaptive or mobile systems. Our contribution shows how formal and semiformal object-oriented techniques can be integrated in the metamodeling process.
INTRODUCTION

The Dexter Hypertext Reference Model and some of its variants gained wide acceptance as a basis for the design of hypermedia systems and interoperability tools. It was formalised by Halasz and Schwarz (1990) in Z, a specification language based on set theory. Since then, the object-oriented paradigm is widely adopted in design and implementation of information systems. In addition, more emphasis is now put on visual modeling languages that make models more intuitive. A first object-oriented specification for the Dexter Model was presented by Van Ossenbruggen and Eliëns (1995). It is an Object-Z approach without graphical representation.

This work is motivated by the lack of a hypermedia reference model described using current specification techniques, i.e., object orientation and visual modeling. Such techniques allow one to easily extend the reference model to describe specific hypermedia systems, like adaptive or mobile systems. Our contribution provides an integration of formal and semiformal object-oriented techniques in the specification of the reference model. It is an object-oriented specification of a Dexter-based reference model for hypermedia systems in the Unified Modeling Language (UML). The specification consists of a visual representation with UML class diagrams supplemented with constraints on model elements in the Object Constraint Language (OCL). A graphical representation is chosen, as it augments the intuitive comprehension of the metamodel, UML (1999) is selected as it is the standard modeling language and OCL (1999) — part of the UML — is used to specify invariants on elements as well as preconditions and postconditions on operations.

A visual model has the advantage of showing at a glance the relevant concepts, how they are organised and how they are related to each other. This semiformal graphical representation is supplemented with semantic information formally written in OCL. The use of OCL improves the model precision — as stressed by Richters and Gogolla (1999) — compared to constraints imposed when written as text. In this work, it provides an object-oriented formal specification that is comparable to a Z (Halasz & Schwarz, 1990) or a VDM specification (Tochtermann & Ditrich, 1996), for example.

This work is structured as follows: The second section gives an overview of the state-of-the-art in the field of reference models for hypermedia systems. The third section presents the goals of the current approach. Section four describes the argument of using UML and OCL. The fifth section presents the reference model. Section six summarises the extension possibilities of this model. Finally, in the two last sections, some future steps and conclusions are outlined.