Chapter I

Evaluating UML Using a Generic Quality Framework

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ABSTRACT
Many researchers have evaluated different parts of UML™ and have come up with suggestions for improvements to different parts of the language. This chapter looks at UML (version 1.4) as a whole, and contains an overview evaluation of UML and how it is described in the OMG™ standard. The evaluation is done using a general framework for understanding quality of models and modeling languages in the information systems field. The evaluation is based on both practical experiences and more theoretical evaluations of UML. Based on the evaluation, we conclude that although being an improvement over it is predecessors, UML still has many limitations and deficiencies, both related to the expressiveness and comprehensibility of the language. Although work is well underway for the next version of UML (version 2.0), not all of the important problems seem to be addressed in the upcoming new version of the language.

INTRODUCTION
According to Booch, Rumbaugh and Jacobson (1999), developing a model for an industrial-strength software system before its construction is regarded increasingly as a necessary activity in information systems development. Good models are essential for communication among the members of project teams, and to assure that it is possible to implement the system.
Modeling has been a cornerstone in many traditional software development methodologies for decades. The use of object-oriented modeling in analysis and design started to become popular in the late 1980s, producing a large number of different languages and approaches. Lately, UML has taken a leading position in this area, partly through the standardization of the language within the Object Management Group (OMG).

In this chapter, we give an assessment of UML (version 1.4), highlighting both the positive aspects and the areas where improvement is needed. We first present the evaluation framework. We then evaluate the language quality of UML. In earlier work, we had also looked at how UML, in combination with the modeling techniques found in one UML-tool Rational Rose®, can support the development of models of high quality (Krogstie, 2001b). In this chapter, we look at language quality in more detail than has been reviewed in previous work.

**BACKGROUND ON THE EVALUATION FRAMEWORK**

Most existing UML evaluations focus narrowly on what we call language quality, either by:

- Evaluating UML relative to an existing approach, and highlighting those areas where the other approach is better than UML.
- Looking upon detailed aspects of the language and presenting improvements for these areas.
- Using a framework for assessing limited aspects of language quality such as expressiveness in a certain context.

Even those using a general evaluation framework look upon the language quality features as goals to achieve. Contrary to this, Krogstie, Sindre, and Lindland (Krogstie, Lindland, & Sindre 1995; Krogstie & Sølvberg, 2000) have developed a framework for discussing the quality of models in general, motivating the focus on language quality as a means to achieve models of high quality.

The framework:

- Distinguishes between quality goals and the means to achieve these goals. Language quality goals are one type of means, but means can also be related to modeling processes, techniques, and tools. Even if it can be argued from both activity theory and decision theory that the interrelationships between goals and means are being determined through the preference function of the modeler, we have found that most modeling techniques, in practice, contribute primarily to a specific model quality goal.
- Is closely linked to linguistic and semiotic theory. In particular, the core of the framework (including the discussion on syntax, semantics, and pragmatics), is parallel to the use of these terms in the semiotic theory of Morris. It is further based on the use of semiotic theory within the information systems field by Stamper (1998).
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