Thomas Baar Alfred Strohmeier
Ana Moreira Stephen J. Mellor (Eds.)

«UML» 2004 – The Unified Modeling Language

Modeling Languages and Applications

7th International Conference
Lisbon, Portugal, October 2004
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Volume Editors

Thomas Baar
Alfred Strohmeier
Swiss Federal Institute of Technology Lausanne (EPFL)
Software Engineering Laboratory
1015 Lausanne, Switzerland
E-mail: {thomas.baar,alfred.strohmeier}@epfl.ch

Ana Moreira
Universidade Nova de Lisboa, Faculdade de Ciências e Tecnologia
Departamento de Informática
Quinta da Torre, 2829-516 Caparica, Portugal
E-mail: amm@di.fct.unl.pt

Stephen J. Mellor
Mentor Graphics, Corp., Accelerated Technology
Suite 365, 7400 N. Oracle Road, Tucson, AZ 85704, USA
E-mail: Stephen_Mellor@Mentor.com

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Preface

This volume comprises the final versions of the technical papers presented at the ≪UML≫ 2004 conference held in Lisbon (Portugal), October 11–15, 2004.

≪UML≫ 2004 was the seventh conference in a series of annual ≪UML≫ conferences. The series started in 1998 and was located at Mulhouse (France); the following years saw the conference move to Fort Collins (USA) in 1999, York (UK) in 2000, Toronto (Canada) in 2001, Dresden (Germany) in 2002, San Francisco (USA) in 2003, and now Lisbon (Portugal) in 2004. During this time, the ≪UML≫ conference became one of the leading conferences in the area of object-oriented modeling. While in the first years the focus of the conference was on the scientific investigation of the Unified Modeling Language (UML), which had just been adopted by the Object Management Group (OMG) at the time, the focus has changed in recent years to innovations in techniques such as metamodeling, model transformations, model validation and verification, aspect orientation, and beyond. Many recent research activities have been especially stimulated by the Model Driven Architecture (MDA) initiative, started in 2000 by the OMG. The goal of MDA is the definition of a framework to enable the development of software purely based on models. In order to reflect the changes of recent years, the conference series ≪UML≫ will be continued, from 2005 onwards, under the name MODELS (MOdel Driven Engineering, Languages and Systems).

The call for papers for ≪UML≫ 2004 encouraged authors around the world to submit 157 abstracts and 135 technical papers. Each submission was reviewed by at least three referees, in most cases by four. Based on the reviews, the whole program committee discussed in four rounds the submissions' quality, leading to the selection of 30 submissions (26 research papers, 4 experience reports) for publication. In addition, the program committee selected one paper for the *Best Paper Award ≪UML≫ 2004*. After a detailed discussion of selected candidates the committee came to the conclusion that the paper by Alexandre Correa, Cláudia Werner (Brazil), "Applying Refactoring Techniques to UML/OCL Models", deserved the award. Congratulations to the authors!

For managing the review process, the free version of Cyberchair (`http://www.cyberchair.org`) was used. We are grateful to its author Richard van de Stadt who also helped with advice. We also want to take the opportunity to express our greatest gratitude to Arnaud di Clemente whose work on the technical side was invaluable for managing the review process and preparing the conference proceedings.

Besides the presentation of technical papers in 10 sessions, the scientific program of ≪UML≫ 2004 included 3 keynote talks, "Generative Software Development", given by Krzysztof Czarnecki (University of Waterloo), "Goals, Viewpoints, and Components — an MDA Perspective", given by Desmond D'Souza (Kinetium), and "Putting Change at the Center of the Software Process", given by Oscar Nierstrasz (University of Bern), 12 workshops, including a doctoral symposium, 6 tutorials, and a special track with industry papers. In addition to this proceedings, a postconference book entitled *≪UML≫ 2004 Satellite Activities* was published by Springer as LNCS volume 3297. This book includes the papers of the industry track, summaries of the workshops, tool papers and poster papers.

We are glad to express our gratitude to all persons and organizations who were involved in the organization of the conference: to the sponsors and supporters for the financial, organizational, and moral aid, to the reviewers for their dedication in writing reports and contributing to the discussion, and to the members of the local organization committee for their incredible work in coordinating all activities and making the local arrangements.

July 2004

Thomas Baar
Alfred Strohmeier
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Empirically Driven Use Case Metamodel Evolution*

Amador Durán[1], Beatriz Bernárdez[1], Marcela Genero[2], and Mario Piattini[2]

[1] University of Seville
{amador,beat}@lsi.us.es
[2] University of Castilla–La Mancha
{marcela.genero,mario.piattini}@uclm.es

Abstract. Metamodel evolution is rarely driven by empirical evidences of metamodel drawbacks. In this paper, the evolution of the use case metamodel used by the publicly available requirements management tool REM is presented. This evolution has been driven by the analysis of empirical data obtained during the assessment of several metrics–based verification heuristics for use cases developed by some of the authors and previously presented in other international fora. The empirical analysis has made evident that some common defects found in use cases developed by software engineering students were caused not only by their lack of experience but also by the expressive limitations imposed by the underlying use case metamodel used in REM. Once these limitations were clearly identified, a number of evolutionary changes were proposed to the REM use case metamodel in order to increase use case quality, i.e. to avoid those situations in which the metamodel were the cause of defects in use case specifications.

Keywords: metamodel evolution, use cases, empirical software engineering

1 Introduction

Metamodel evolution is usually based on a previous theoretical analysis. The usual *evolution vectors* are elimination of internal contradictions, simplification of unnecessary complexities, or enhancement of expressiveness in order to model unforeseen or new concepts [1, 2]. In this paper, the evolution of the use case metamodel implemented in the REM requirements management tool [3] is described. This evolution has been driven not by a theoretical analysis but by the analysis of empirical data obtained during the assessment of several metrics–based verification heuristics for use cases developed by some of the authors (for a description of the verification heuristics and their implementation in REM using XSLT, see [4]; for their empirical assessment and review, see [5]). This empirical analysis has revealed that some common defects in use cases developed by software engineering students had their roots in the underlying REM metamodel, therefore making its evolution necessary in order to increase requirements quality.

The rest of the paper is organized as follows. In the next section, the initial REM use case metamodel is described. The metrics–based verification heuristics that originated the metamodel evolution are briefly described in section 3. In section 4, the results of the

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empirical analysis in which the problems in the metamodel were detected are presented. The proposed changes to the metamodel and their analysis are described in section 5. In section 6, some related work is commented and, finally, some conclusions and future work are presented in section 7.

2 Initial Use Case Metamodel

The initial use case metamodel, i.e. the REM metamodel [4], is shown in Fig. 1. This metamodel was designed after a thorough analysis of several proposals for natural language use case templates like [6, 7, 8, 9]. One of the goals in mind when this initial metamodel was developed was to keep use case structure as simple as possible, but including most usual elements proposed by other authors like conditional steps or exceptions.

Apart from inherited requirements attributes, a use case in REM is basically composed of a *triggering event*, a *precondition*, a *postcondition*, and a *ordinary sequence* of steps describing interactions leading to a successful end. Steps are composed of one *action* and may have a condition (see Fig. 1). Three classes of actions are considered: *system actions* performed by the system, *actor actions* performed by one actor, and *use case actions* in which another use case is performed, i.e. UML *inclusions* or *extensions*, depending on whether the step is conditional or not [10]. Steps may also have attached *exceptions*, which are composed of an exception condition (modeled by the *description* attribute), an action (of the same class than step actions) describing the exception treatment, and a *termination* attribute indicating whether the use case is resumed or canceled after the performance of the indicated action.

Another metamodel goal was to make XML encoding simple so the application of XSLT stylesheets were as efficient as possible. In REM, XML data corresponding to requirements is transformed into HTML by applying a configurable XSLT stylesheet, thus providing a WYSIWYG environment for requirements management (see Fig. 2).

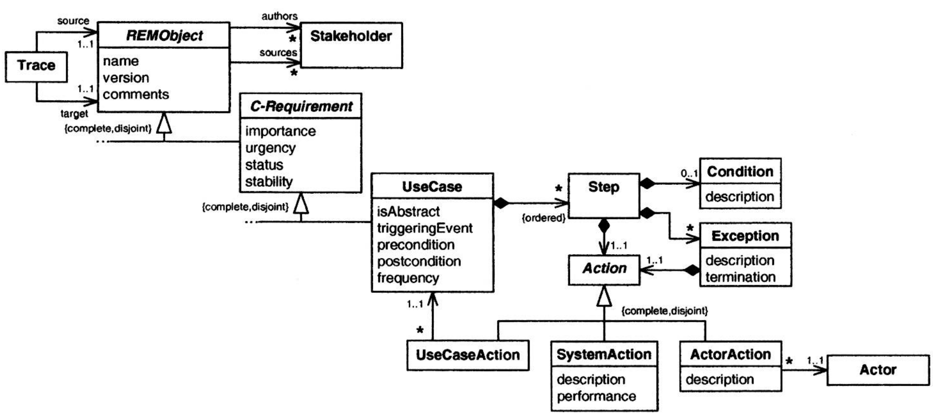

Fig. 1. Initial REM use case metamodel