University of Zurich
Department of Informatics

Master's Thesis

in the Requirements Engineering Research Group

Topic / Title

Graphical Weaving of Aspects in Product Line Requirements Engineering

Content

Aspect-oriented modeling (AOM) is an emerging modeling paradigm to increase the modularity of models by separating cross-cutting concerns. AOM technically allows to model particular concerns separately from the core model, and to compose them again with it. This composition mechanism is called *weaving* in AOM terminology and is an asynchronous model composition mechanism. Recently, the modularization and weaving mechanisms provided by AOM technology have been adopted to implement software product lines as well.

Software product line engineering (SPLE) is another emerging paradigm that allows a more efficient and higher quality development of sets of related products. Therefore, the commonality and the variability over all products are described and handled in a systematic and organized manner. In this context, aspects are one solution to handle and modularize the variability separately from the product line's commonality. This allows a better structured handling of common and variable concerns of the product line. Further, the weaving mechanisms that AOM technology provides can be used to partially automate product composition when defining concrete products based on a product line.

ADORA (Analysis and Description of Requirements and Architecture) is a graphical language and tool for requirements modeling. The ADORA tool features advanced graphical visualization concepts, including smart line routing and automatic layout adaption for view generation and abstraction operations. In its current version, the ADORA tool also implements aspect-oriented modeling and product line engineering capabilities. In contrast to other existing AOM languages and tools aspects in ADORA are a *graphical concept*, which needs to be visualized and layouted.

This master's thesis focuses on graphical aspect-oriented modeling and weaving of aspects in ADORA. Sophisticated graphical weaving of aspects is especially important when deriving products from a product line model. The main objectives to be reached with this thesis are:

- analysis and documentation of the state-of-the-art in graphical weaving generally, and within ADORA
- formulation of the requirements for a significant improvement of the graphical weaving
    - generally: dynamic weaving shall be reasonably possible
    - also „unweaving" of aspects in partially woven models shall be considered
- improvement of the existing weaving implementation (familiarization with the code)
- development of concepts to improve the graphical layout of woven models (provide space-efficient and human-friendly layouts of woven models)
- implementation of instant weaving when decisions are taken in product derivation in a product line (dynamic weaving)
- implementation of the newly found concepts for graphic layout, and optimization
- realization of a robust implementation

- extensive validation of the new concepts and implementation by various examples

The evaluation of the thesis will consider the state-of-the-art of the existing concepts and implementations, the quality of the newly suggested concepts, the implementation, and the completeness of the validation.

Literature

Literature research and review are also part of the thesis work. The relevant literature shall be identified and reviewed for applicability in the project context. As basic starting literature the following references might be considered:

- Glinz, M., S. Berner, S. Joos (2002). Object-oriented modeling with ADORA. *Information Systems* **27**, 6. 425-444.
- Meier, S., T. Reinhard, R. Stoiber, M. Glinz (2007). Modeling and Evolving Crosscutting Concerns in ADORA. *Proceedings of the 11th Workshop on Aspect-Oriented Requirements Engineering and Architecture Design*, at ICSE'07, Minneapolis, USA.

Prerequisites

- Experience in java programming and eclipse plug-in development
- Knowledge in requirements engineering and the ADORA modeling language

How to proceed

We suggest the following steps to proceed when working out this project:

- Literature and existing implementation study (ca. 20%)
- Concepts & Design (ca. 20%)
- Implementation and validation (ca. 40%)
- Writing (ca. 20%)

Duration: 6 months, 30 ECTS
Adviser: Reinhard Stoiber
Examiner: Prof. Martin Glinz