

Architecture-Centric Quality Engineering for Software Product Lines

Ronny Kolb and Dirk Muthig

Fraunhofer Institute for Experimental Software Engineering (IESE)

Fraunhofer-Platz 1, 67661 Kaiserslautern, Germany

{kolb, muthig}@iese.fraunhofer.de

The product line approach to software development is based on the systematic, large-scale reuse of development artifacts such as architecture, design, and components between a set of functional similar products. It promises, among others, to shorten the development time of software systems and to significantly reduce development and maintenance costs. In order to achieve the promised improvements, however, the components and artifacts intended for reuse must be of high quality. Therefore, more than for traditional software development, quality engineering (i.e., constructive and analytical activities performed to assure the quality of development artifacts and end products) becomes a very crucial part of every software product line effort.

Even though quality engineering has not only become more critical for product lines, but also more complex due to the special properties such as genericity, research in the field of software product lines to date has primarily focused on analysis, design, and implementation. In particular, the quality engineering challenges that arise in a product line context have been addressed only insufficiently so far and there is little guidance for product line organizations on how to perform quality engineering and to systematically assure the quality of product lines and reusable artifacts.

The overall goal of this full-day tutorial is to provide an understanding of the problem of quality engineering in the context of software product lines and its importance for successful product line development. In particular, the tutorial aims at providing the attendees with a detailed understanding of how quality engineering for software product lines and generic software components needs to be different from traditional software systems and how quality engineering can be performed in the context of product lines. To this end, the tutorial will provide a discussion of the difficulties and challenges of quality engineering

for product lines and investigates the implications of product lines and reusable components on quality engineering. Next, the tutorial discusses what role software architecture can and should play in quality engineering for product lines and introduces the basic ideas of architecture-centric quality engineering.

The tutorial aims to provide an understanding of existing constructive and analytical quality engineering techniques and methods and how these techniques and methods can be applied in a software product line context. The methods and techniques addressed include systematic architecture design and evaluation, architecture conformance checking, inspections, testing, metrics and measurement evaluation, and risk management. For each technique or method, it is discussed what the problems and challenges in the context of software product lines are, which benefits and limitations the technique or method has, and how it has to be extended to be applicable for assuring the quality of software product lines and reusable artifacts.

The final part of the tutorial deals with the problem of defining or selecting an appropriate quality strategy for software product lines. It discusses basic quality strategies and gives some guidance on how to come up with a product line quality strategy that takes quality requirements and project context into account.

The tutorial integrates industrial experiences with Fraunhofer PuLSE™ in the area of architecture-centric quality engineering that are now offered to industry under the trademark ArcQuE™. It addresses industrial practitioners, as well as applied researchers, working in the area of quality assurance or product lines. In particular, the tutorial provides researchers with a concise overview of the current state of the art of quality assurance in the context of software product lines and presents relevant issues and approaches in the area of quality assurance for product lines, while providing industrial practitioners with a profound understanding of best practices they can apply.