

Flexible software process lines in practice: A metamodel-based approach to effectively construct and manage families of software process models

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Abstract: Process flexibility and adaptability is frequently discussed, and several proposals aim to improve software processes for a given organization-/project context. A software process line (SPrL) is an instrument to systematically construct and manage variable software processes, by combining pre-defined and standardized process assets that can be reused, modified, and extended using a well-defined customization approach. Hence, process engineers can ground context-specific process variants in a standardized or domain-specific reference model that can be adapted to the respective context. We present an approach to construct flexible SPrLs and show its practical application in the German V-Modell XT. We contribute a proven approach that is presented as metamodel fragment for reuse and implementation in further process modeling approaches.

This summary refers to the paper *Flexible software process lines in practice: A metamodel-based approach to effectively construct and manage families of software process models* [Ku16]. This paper was published as original research article in the Journal of Systems and Software.

Keywords: Software Process, Software Process Lines, Process Design, V-Modell XT Metamodel

1 Introduction

Software development is characterized by its diversity and, therefore, defining the optimal approach to develop software is for years subject to debate. Software processes must reflect the needs of software projects and, thus, they need to be flexible and adaptable.

Problem Statement & Objective In 2005, Rombach proposed to adopt principles from software product lines [Ba97] to software processes—so-called *software process lines* (SPrL; [Ro05]), which are a promising route toward managing families of evolving software processes. Yet, SPrL-related research is still considered immature, notably lacking practically relevant and evaluated approaches. Our overall goal is thus to provide process engineers with a toolbox to help design, implement, and manage software process lines.

Contribution We contribute an approach to extend software process metamodels with SPrL concepts to support software process development and management. Our approach extends existing process tailoring instruments by the two concepts *Partitioned Software*

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Process and Variability Operation to organize process variants within an SPrL and to declare required modifications of a standard process model.

2 Results

The *partitioned process* splits a process model in several (physically) self-contained parts (modularization), and the *variability operations* allow for declaring changes of a reference model when customizing it for a specific context. As modifications are externalized, those modifications do not affect the reference process model and, therefore, allow for a sophisticated lifecycle management, e.g., to allow for company-specific update procedures. Finally, organization-specific process models are generated from the different model parts.

The two concepts were implemented in the metamodel of the V-Modell XT, and its deployment was studied over a 2-year period. Two baselines of the V-Modell XT SPrL (reference model and five organization-specific variants) and the used variability instruments and tactics were studied. The feasibility of the approach could be confirmed. Furthermore, an analysis of the five variants showed the value of the variability operation concept to improve adaptability—especially as highly flexibility instrument for process engineers, who, inter alia, can define variant-specific variability operation sets to allow for optimized process adaptations. In total 616 variability operation exemplars were analyzed from which a catalog comprising 78 unique variability operation types was crafted.

3 Conclusion

The presented approach emerges from a 10-year research endeavor and was used to enhance the metamodel of the V-Modell XT and to allow for improved process variability and lifecycle management. Practical dissemination and complementing empirical research show the suitability of the concept. Furthermore, data collected so far allows for directing further quantitative and qualitative research, e.g., on standardized variability instruments, standard use cases, and effectiveness and appropriateness of organization-specific software processes.

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