Centro de Investigación en Matemáticas, A.C.

Maestría en Ingeniería de Software

Domain-focused Quality Assessment of Software Product Lines

Francisco Javier Aragón Sandoval

Dr. Cuauhtémoc Lemus Olalde

Domain-focused Quality Assessment of Software Product Lines

Francisco Javier Aragón Sandoval

September 16, 2009

Abstract

This document describes the importance of domain-relevant quality attributes assessment models to assure benefits of software product line engineering.

1 Introduction

According to Clements et. al. architectures allow or preclude nearly all of the system's quality attributes. If software architectures are important, then so are software architecture evaluations [1]. And of course software product line (SPL) architecture evaluations because in a reuse context an inadequate design decision in a reusable asset could propagate to several products and the consequences could be difficult to fix and expensive. But SPL architecture evaluations are not for free, actually the SEI's Framework for Software Product Line Practice, Version 5.0 states that in a SPL there is an architecture for the product line as a whole, and there are architectures for each of the products. The latter are produced from the former by exercising the built-in variation mechanisms according to the production plan. All the architectures should be evaluated which is costly. Because of this, several evaluation methods have been created, but most of them try to find shortcuts to reduce effort and cost, some based on extended evaluation methods [6, 7]conceived for single architecture products.

2 Problem statement

There are several methods or techniques to assess the reference architecture and derived product architectures of a software family as reviewed by Etxeberria and Sagardui [3]. They surveyed evaluation techniques, qualitative and quantitative, including the different moments when evaluation of architectures takes place. This effort highlights the lack of a quality model to cope with current challenges such as evaluating quality domain-relevant attributes of a software product line in a cost-effective manner. A domain-relevant attribute is an important quality attribute for a specific domain such as safety in safety-critical domain, performance in real-time domain, reliability in embedded systems and so on.

3 Related work

Montagud and Abrahão [2] review quality evaluation methods for software product lines used in the last 10 years. They found these fail to consider priority levels in quality attributes, follow standards, provide feedback to the design and provide a tool for supporting the evaluation. Besides only a few of them have been applied on an industry environment. So there is a need for a quality assessment model to evaluate quality in software product lines showing empirical experimentation, along with considering the fact that the above criteria are not being fulfilled.

Etxeberria and Sagardui [4] had propose a method to capture and manage domain-relevant quality attributes variability to facilitate quality assesment by introducing quality aware software product line engineering. This creates a generic evaluation model that when applied, uses one of the existing methods for any quality attribute, but such existing methods are not complete as shown by [2]. There is some work in progress to create more complete software product line architecture evaluation models [5].

4 Research proposal

This document proposes conducting research on the creation of a domain-relevant quality attributes assessment model for software product lines. This model has to cope with current challenges such as evaluating quality domain-relevant attributes of a software product line in a cost-effective manner.

4.1 Research objectives

The main objective is **to develop a domain-relevant quality attributes assessment model for software product lines**. The specific objectives are:

1. Identify desirable characteristics for quality assessment models.

2. Identify a specific domain to extract domain relevant quality attributes.

3. Assure desirable characteristics are part of the quality assessment model for the identified specific domain.

4. Apply and validate the quality assessment model created on one case study and at least on one empirical experiment.

5. Contrast or compare the quality assessment model created with selected existing quality assessment models on performed evaluation cost.

4.2 Justification

There are a lot of quality evaluation methods for SPL [3], but just a few methods for evaluating domain-relevant quality attributes [2], and most of them lack information about the appropriateness and limitations for ensuring the quality of software products which threatens SPLs improvement in the software development process. In particular with respect to development costs and time to market [8] and the need for cost-effective domain-relevant quality attributes assessment models to guarantee quality for reference architecture and derived product architectures in software product line practice.

4.3 Research hypothesis

A domain specific and cost-effective domain-relevant quality attributes assessment model is more adequate than existing approaches to evaluate software product lines.

4.4 Research method

- As one form to test the hypothesis, historical data will be recollected to compare results of effort by quality assessment.

- Realize quantitative and qualitative analysis of stakeholders' feedback after quality evaluation assessment through a questionnaire.

4.5 Scope and limitations

- Initially the scope of the research is set on producing one domain-relevant quality attributes assessment model, although several quality assessment models might be created for domain relevant quality attributes.

- Some limitations of the research include getting access to quality evaluation data of existing SPL methods for comparison purposes and access to perform quality assessment at one or more industry projects.

4.6 Validation of research

To validate the research, projects with similar characteristics will be chosen to perform the case study and the industry project quality evaluations trying to avoid external influence on quality assessment that could alter results and comparison.

4.7 Outcomes of research

- Updated survey of architecture evaluation methods for SPL.

- Desired characteristics for domain specific quality assessment models.

- Proved domain-relevant quality attributes assessment model.

5 Summary

This document has the main objective, of proposing the development of a domain-relevant quality attributes assessment model for software product lines to improve results of current evaluation methods by providing a more complete approach.

In conclusion, the proposed research will produce significant contributions to the knowledge on software engineering as well as an important quality assessment model for SPL practice.

References

[1] Clements P., Kazman R., and Klein M. Evaluating Software Architectures – Methods and Case Studies. The SEI Series in Software Engineering. Addison-Wesley, Reading, MA, 2002.

[2] Montagud S., Abrahão S. Gathering Current Knowledge about Quality Evaluation in Software Product Lines. Proceedings of the 13th International Software Product Line Conference (SPLC 2009), August 24–28, San Francisco-CA, USA, IEEE Press (to appear).

[3] Etxeberria, L., Sagardui, G. Product-Line Architecture: New Issues for Evaluation. Springer Berlin / Heidelberg. Volume 3714/2005. 174-185.

[4] Etxeberria, L., Sagardui, G. Quality Assessment in Software Product Lines. Proceedings of the 10th international conference on Software Reuse: High Confidence Software Reuse in Large Systems, Beijing, China. Springer Berlin / Heidelberg. Volume 5030/2008. 178-181.

[5] De Oliveira Junior, E. A., Gimenes, Itana., Maldonado, J.C. A Metric Suite to Support Software Product Line Architecture Evaluation. XXXIV Conferencia Latinoamericana de Informática (CLEI 2008), pages 489-498, 2008.

[6] T. Kim, I.Y. Ko, S.W. Kang, D.H. Lee. "Extending ATAM to assess product line architecture". IEEE CIT 2008.

[7] Femi G. Olumofin and Vojislav B. Misic. Extending the atam architecture evaluation to product line architectures. In Proceedings of the 5th Working IEEE/IFIP Conference on Software Architecture, WICSA, pages 45–56. IEEE Computer Society, 2005.

[8] Van der Linden, F., Schmid, K., and Rommes, E. Software Product Lines in Action. Springer, 2007.