



Assignment 5

Requirements Engineering for Software Product Lines

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I. Tasks

Individual Tasks

- Read the mandatory items in the reading list
- Prepare a critique of each mandatory paper. For each paper, we will select a student to present her or his critique orally in class (3-5 minutes). Particular questions to be addressed are:
 - What is the main message of the paper?
 - What are the expected practical benefits?
 - What are the strengths and weaknesses of the paper?
 - What questions do you have about the paper? (prepare at least two questions)
 - What is your personal opinion about the paper? Do you agree or disagree with its findings?
- Be prepared to answer the questions given in Sect. III below in class

Group Tasks

- Prepare a 10-12 minutes presentation (plus 6-8 minutes of discussion) on the theme assigned to your course group (cf. Sect. IV) and choose two students from your group to present it.
 - At the beginning of your presentation, relate your topic to the session's topic (as represented by the mandatory reading)
 - Browse/read additional papers and/or web pages where necessary.
 - Send your presentation to Norbert and Eya after the session to share it with others.
- Consider the following product line of point of sale (POS) system.

Every POS system can authenticate a registered cashier, identify sales items with a barcode reader, print receipts, and supports at least one method for payment. There are several options for payment methods, which include payment in cash, payment by debit card and payment by credit cards. Furthermore, there are three ways of identifying sales items: scanning the price tag, entering the article code over a keyboard, and calculating the price by weighing the item and entering the item's type using the keyboard. All payment methods and all price identifications can be supported by one POS system, but at least one always has to be. Whenever a debit card or a credit card is selected, also an additional card issuer online connection module needs to be selected.

Use a feature diagram as described in Fig. 3 of [Jarzabek et al. 2003] to specify the variability of the POS system. Send in your solution as a PDF to Norbert and Eya before the assignment discussion.

II. Reading List

Mandatory reading

Chapter 2 of [Pohl et al. 2005] provides a framework for software product line engineering. [Clements 1999] introduces software product lines with an example while [Clements 2003] highlights the differences between product line scope and product line requirements.

Theme-specific reading

[Reiser and Weber 2006], [Schobbens et al. 2007]: Feature-oriented Domain Analysis

[Jarzabek et al. 2003], [Stoiber and Glinz 2010b]: Specifying Product Line Variability in Requirements Models

[Czarnecki and Antkiewicz 2005], [Stoiber and Glinz 2010a]: Product Derivation with Requirements Models

III. Questions

- What is a software product line? What is domain engineering and what is application engineering?
- How do we call requirements that are mandatory for all products of a software product line? How are they handled?
- How are requirements handled that differ between the products of a software product line?
- What are the requirements engineering tasks specific to software product lines?
- What is the role of product line scoping in software product line engineering? How does scoping relate to requirements engineering for a software product line?
- Is building a feature model sufficient for modeling software product line variability?

IV. Themes for Presentation

Themes will be assigned by the assistant who tutors this course; your group can apply for a theme.

A. Feature-Oriented Domain Analysis

What is the basic approach for domain analysis? What does a feature model express? What is the purpose of a feature model? What advanced forms of feature models exist? How do they differ? What are the benefits and limitations of feature modeling for domain analysis? How are feature models used in the software product line engineering process?

B. Specifying Product Line Variability in Requirements Models

What is product line variability? Why is there a need to specify product line variability in requirements specifications? What are the two approaches to extending existing modeling languages to support variability modeling? How does feature unweaving reduce the effort for specifying variability in requirements models?

C. Product Derivation with Requirements Models

How can a requirements model be derived from a product-line specification? Explain briefly both approaches for production derivation and contrast them. What are their advantages and limitations?

References

Clements, P. (1999). Software Product Lines: A New Paradigm for the New Century. *Crosstalk* **12**, 2 (Feb. 1999). 20-22.

Clements, P. (2003). What's the Difference Between Product Line Scope and Product Line Requirements? *News at SEI*. CMU. URL: <http://www.sei.cmu.edu/library/abstracts/news-at-sei/productlines2q03.cfm>

Czarnecki, K., M. Antkiewicz (2005). Mapping Features to Models: A Template Approach Based on Superimposed Variants. *4th International Conference on Generative Programming and Component Engineering (GPCE'05)*. Tallinn, Estonia. 422-437.

Jarzabek, S., W.C. Ong, and H. Zhang (2003). Handling Variant Requirements in Domain Modeling. *Journal of Systems and Software* **68**, 3. 171-182.

Pohl, K., G. Böckle, F. van der Linden (2005). *Software Product Line Engineering – Foundations, Principles, and Techniques*. Springer. 20-38.

Reiser, M.-O., M. Weber (2006). Managing Highly Complex Product Families with Multi-Level Feature Trees. *14th IEEE International Conference on Requirements Engineering (RE'06)*, Minneapolis, MN, USA. 149-158.

Schobbens, P.-Y., P. Heymans, J.-C. Trigaux, Y. Bontemps (2007). Generic Semantics of Feature Diagrams. *Computer Networks* **51**, 2 (Feb. 2007). 456-479.

Stoiber, R., M. Glinz (2010a). Supporting Stepwise, Incremental Product Derivation in Product Line Requirements Engineering. *4th International Workshop on Variability Modelling of Software-intensive Systems (VaMoS'10)*. Linz, Austria.

Stoiber, R., M. Glinz (2010b). Modeling Feature Unweaving: Efficient Variability Extraction and Specification for Emerging Software Product Lines. *4th International Workshop on Software Product Management (IWSPM'10)*. Sidney, Australia.