



Requirements Engineering II

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Assignment 4: Requirements Engineering for Software Product Lines

1. Tasks

Individual Tasks

- Read the mandatory items in the reading list
- Be prepared to answer the questions given below in class

Group Tasks

- Prepare a 15 minutes presentation (5-10 slides) on the theme assigned to your course group. Browse/read additional papers and/or web pages where necessary.
- Build a feature tree for a product line of point of sale (POS) systems as follows. 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 ATM 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 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 an ATM 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.

2. Reading list

Mandatory reading

Chapter 2 of [Pohl, Böckle, and van der Linden 2005] provides an overview of software product line engineering. [Clements 1999] introduces software product lines with an example and [Clements 2009] reasons on differences between product line scope and product line requirements.

Theme-specific reading

[Schobbens et al 2007], [Reiser and Weber 2006]: Feature-oriented Domain Analysis
[Jarzabek et al 2003], [Stoiber, Glinz 2009]: Specifying Product Line Variability in Requirements Models
[Czarnecki et al 2005], [Batory 2005]: Product Derivation with Feature Diagrams and Requirements Models

3. 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 modelling software product line variability?

4. Themes for presentation

(Will be assigned by the research 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? What are the benefits of explicit variability specification in requirements specifications?)

C. Product Derivation with Feature Diagrams and Requirements Models

(What is the difference between a domain and an application feature model? Why is formalization for feature modeling important? What is a variability constraint? What is an LTMS? Why are requirements specifications important when defining single products? How can tools support defining specifications of single products based on a product line?)

References

Batory, D. (2005). Feature Models, Grammars, and Propositional Formulas. *9th International Software Product Line Conference (SPLC 2005)*. Rennes, France.

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

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.

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.

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 (2009). Modeling and Managing Tacit Product Line Requirements Knowledge. *2nd International Workshop on Managing Requirements Engineering Knowledge (MaRK'09)*. Atlanta, USA.

Web References

Clements, P. (2009). 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>