



## Requirements Engineering II

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# Assignment 5: Requirements for Software Product Lines

## 1. Tasks

- Read the mandatory items in the reading list
- Be prepared to answer the questions given below in class
- 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 family of automatic teller machines (ATMs) as follows. The basic machine can just authenticate users and dispense money in a single currency. Additional features are: printing a receipt, inquiring the account balance, displaying/printing a statement of account, recharging a cash card, dispensing money in two different currencies. The ATM supports the following currencies: CHF, EUR, GBP, JPY, USD. The printing features require that the ATM is equipped with a printer. ATMs that dispense two currencies always can print receipts. Use a feature diagram as described in Fig. 3 of [Jarzabek, Ong, and Zhang 2003].

## 2. Reading List

### Mandatory Reading

Chapter 2 of [Pohl, Böckle, and van der Linden 2005] and [Chastek et al. 2001] provide an overview. Feature and variability modeling is treated in sections 1-3 of [Schobbens, Heymans, and Trigaux 2006], in [Jarzabek, Ong, and Zhang 2003] and in [Bühne, Lauenroth, and Pohl 2005].

### Mandatory Browsing

Browsing the pages listed in the site roadmap at <http://www.softwareproductlines.com> is helpful for understanding the basics of Software Product Lines.

### Optional Reading

[Clements 1999] motivates the use of software product lines with an example. [Reiser and Weber 2006] extend the notion of feature trees to multi-level feature trees. [Schobbens, Heymans, and Trigaux 2006] provide an overview of feature modeling and give formal semantics for feature diagrams. [Schmid and John 2004] present a decision-oriented approach to variability modeling. [Beuche et al 2007] present an evaluation of requirements engineering tools for software product lines.

## 3. Questions

- What is a software product line?
- What is the role of domain engineering and application engineering in a software product line?
- In a software product line, we always have two types of requirements. Which ones?
- What are the additional tasks and challenges for requirements engineering when using a software product line?
- Which different types of requirements exist in software product lines? And how does product line scoping help analyze application requirements for new products?
- Is feature-oriented domain analysis sufficient for variability modeling in a product line?

#### 4. Themes for Presentation

(Will be assigned by the research assistant who tutors this course; your group can apply for the theme you would like to work on)

- A. An overview of requirements engineering for software product lines:  
General overview, rationale for using product lines, domain analysis and application analysis processes, advantages and challenges,...
- B. Feature-oriented domain requirements analysis:  
What it is, basic approach, advanced feature tree models<sup>1</sup>, advantages and limitations of feature modeling
- C. Modeling variability in software product lines:  
What is variability, a meta-model of variability<sup>2</sup>, instrumentation of models for enabling variability<sup>3</sup>

#### References

Beuche, D., A. Birk, H. Dreier, A. Fleischmann, H. Galle, G. Heller, D. Janzen, I. John, R. Tavakoli Kolagari, T. von der Massen, A. Wolfram (2007). „Using Requirements Management Tools in Software Product Line Engineering: The State of the Practice“, 11<sup>th</sup> International Conference on Software Product Lines (SPLC 2007), Kyoto, Japan.

Bühne, S., K. Lauenroth, and K. Pohl (2005). Modelling Requirements Variability across Product Lines. Proceedings of the 13th IEEE International Conference on Requirements Engineering (RE'05), Paris, France. 41-50.

Chastek, G., P. Donohoe, K.C. Kang, and S. Thiel (2001). Product Line Analysis: A Practical Introduction. CMU/SEI Technical Report CMU/SEI-2001-TR-001.

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

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, and F. van der Linden (2005). Software Product Line Engineering – Foundations, Principles, and Techniques. Heidelberg: Springer.

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

Schmid, K. and I. John (2004). A Customizable Approach to Full Lifecycle Variability Management. Science of Computer Programming **53**, 3. 259–284

Schobbens, P.-Y., P. Heymans, J.-C. Trigaux (2006). Feature Diagrams: A Survey and a Formal Semantics. Proceedings of the 14th IEEE International Conference on Requirements Engineering (RE'06), Minneapolis, MN, USA. 139-148.

#### Web Resources

<http://www.softwareproductlines.com>

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<sup>1</sup> [Schobbens et al 2006] provide an overview. In particular, present the variant described in Fig. 3 of [Jarzabek et al 2003]

<sup>2</sup> See [Bühne et al 2005]

<sup>3</sup> See [Jarzabek et al 2003] and [Beuche et al 2007]