Analyzing feature runtime dependencies for behavioural conformance between feature and aspect-oriented models in aspect-oriented software product lines (SPLs)

SaadBin Abid

A Software Product Line (SPL) is established with the concept of features implementing certain functionality of a product line. Features have dependencies among them. Feature dependency in a SPL can be observed at different levels of abstraction, (e.g., the feature model level and the implementation). Development of reusable assets (resources/artefacts/models) is responsibility of different team members during domain engineering (DE). Over time during SPL maintenance further deviations can occur, resulting in inconsistencies in the feature relationships in an established product line. Feature dependency conformance analysis at different levels of abstraction should be performed during DE to facilitate product line maintenance. Challenges which can occur for product line engineering include, 1) Not able to extend the product line functionality efficiently, 2) Not able to understand end product behavior correctly, 3) Unable to understand which parts of a system implement a feature to carry out maintenance activities. My research is focusing on conformance analysis for runtime feature dependencies implemented in feature models and aspect-oriented models as aspect-oriented patterns/Aspects.

Research Focus
- Conformance analysis for runtime feature dependencies implemented in feature models and aspect-oriented models as aspect-oriented patterns/Aspects.
- Unless feature interaction behaviour is analyzed, understood and managed during domain engineering, it will lead to errors during product assembly and derivation (Application Engineering).

Research Questions
1. How to perform conformance analysis for runtime feature dependency in domain engineering between feature and aspect-oriented models in aspect-oriented SPLs?
2. To what extent do existing model-driven approaches tools/languages facilitate the process of runtime feature dependency analysis in aspect-oriented SPLs?

Research Methodology
“Engineering/Design Science” [Hevner et al., 2004];
- Environment: Model-Based aspect-oriented SPLs
- Problem: Inconsistency scenarios [Saadbin Abid, 2010]
- Design Process (iterative): conformance analysis approach for RTDs between feature model and AO-Implementation models [SaadBin Abid, 2010]
- Artefact (iterative): Prototype tool for automatically analyzing feature runtime dependencies (RTDs)
- Evaluation: approach and analysis tool validation in aspect-oriented product lines [Lee et al., 2009]

Research Approach
- Domain engineer manages the product line artefacts (1)
- By applying semantic interpretation (2) the feature and aspect-oriented implementation model are transformed into formal representation (3)
- Generate the control flow graph from aspect-oriented project implementation (4)
- Conduct conformance analysis process for feature runtime dependencies (5) between feature and aspect-oriented implementation models

Selected Publications
- Saadbin Abid:“Resolving Feature Dependency Implementations Inconsistencies during Product Derivation”, 6th Traceability workshop (ECMFA-TW) held in conjunction with ECMFA 2010, Paris, France