



FAKULTÄT FÜR
INFORMATIK

Current state and future challenges in Optional Weaving

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Agenda

Motivation

Feature optionality problem

Optional Weaving

Conclusion

Motivation

- software product lines at JETI
 - firmware was built according to pcb layout (spl with preprocessor)
 - PC software was built “new” according to measurement device
 - copy and paste including errors
 - new errors emerging
 - software was full of features \Rightarrow one feature \leftrightarrow one customer

Motivation

- software product lines (spl) become more and more important in software development
- major design principle of spl: separation of concerns
- features
 - describe concerns of spl
 - selectable units within spl
 - mandatory or optional

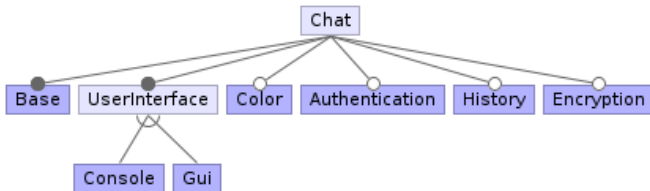
FOP/AOP

- separation of concerns realized with
 - aspect-oriented programming (AOP)
 - aims on separating the crosscutting concerns (code scattered across multiple components)
 - implementation of crosscutting concerns as aspects
 - pointcuts and advice for additional features, traditional design concepts for core
 - feature-oriented programming (FOP)
 - aims on feature traceability
 - idea: build program by composing features, where feature refines another feature incrementally
 - features composed by mixin approach within AHEAD toolsuite

FOP/AOP

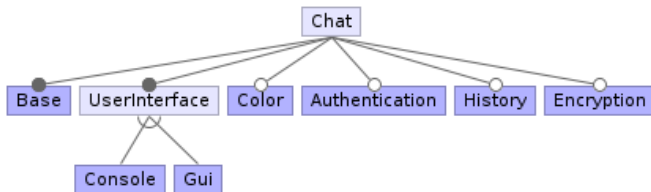
- features in software product lines are often optional and interact with / depend on each other
- leads to the feature optionality problem when features interact and are optional
- often interacting optional features were implemented mandatory

Feature optionality problem



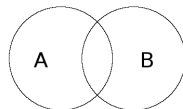
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Feature optionality problem

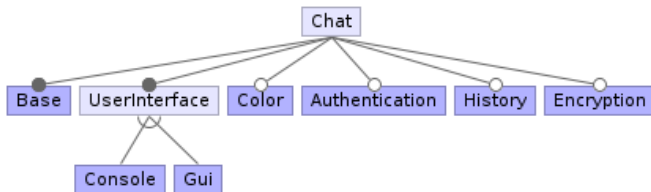


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- occurs when features that interact are optional

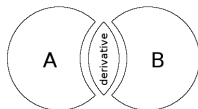


Feature optionality problem



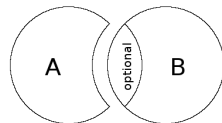
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- occurs when features that interact are optional
- first idea: encapsulation of interacting code as derivative feature



Optional Weaving

- implementation of optional interactions within feature
- i.e. the interaction code remains within feature but is optional
- optional interaction code is woven when both features are implemented



Optional Weaving

- FeatureC++
 - combination of AOP and FOP
 - Approach:
 - improvement of mixins to cope with optional features by introducing AOP concepts to mixins
 - refinements with the keywords *before*, *after*, *around* are optional

Optional Weaving

- AspectJ
 - not usable for optional weaving in the current state because of
 - the lack of referencing optional classes, methods or member variables in optional advice statements resulting in code replication
 - this approach only for advice statements and not for inter type member declarations

Optional Weaving

- AspectJ
 - not usable for optional weaving in the current state because of
 - the lack of referencing optional classes, methods or member variables in optional advice statements resulting in code replication
 - this approach only for advice statements and not for inter type member declarations
 - need to overcome these lacks because of
 - avoiding the need of creating derivative features
 - implementation of optional extension within the genuine feature \Rightarrow maintain locally

Conclusion

- optional weaving is a promising approach
 - optionality is important for software product lines
 - derivative approach will scale according to the derivatives
- within FeatureC++ optional weaving implemented for two features
- with AspectJ optional weaving leads to code replication and unnecessary code for runtime semantics \Rightarrow improvements to the language must be made

Thank you for your attention!