OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

INF FAKULTÄT FÜR INFORMATIK

Current state and future challenges in Optional Weaving

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Agenda

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 ⇒ one feature ↔ 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

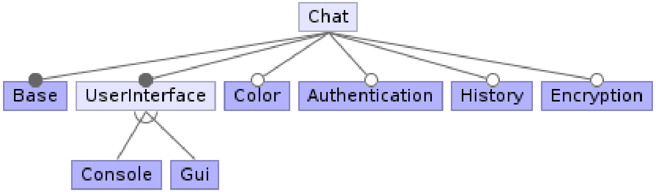
FOP/AOP

- 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

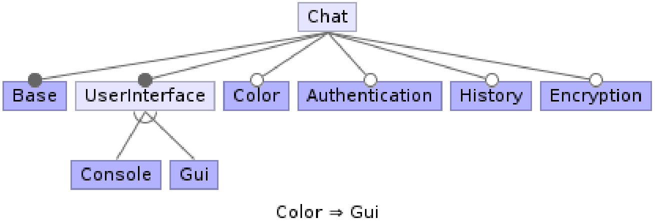
- features in software product lines are often optional and interact with / depend on each other
- leads to the feature optionality problem when features interact and are optional
- often interacting optional features were implemented mandatory

Feature optionality problem

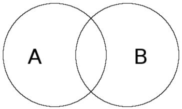


Color ⇒ Gui

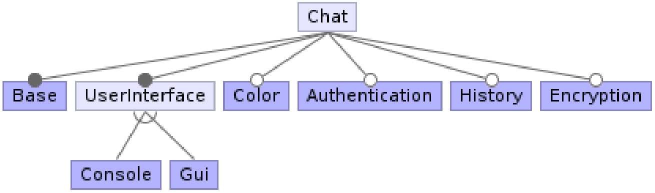
Feature optionality problem



- occurs when features that interact are optional



Feature optionality problem



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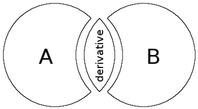
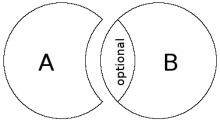
- occurs when features that interact are optional
- first idea: encapsulation of interacting code as derivative feature



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 ⇒improvements to the language must be made

Thank you for your attention!