

Specifying Product Line Variability in Requirements Models

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Group 1

Context: Requirements Engineering for Software Product Lines

- How to model variant requirements?
- How to derive a software product line from a software product?

Handling variant requirements in domain modeling - Motivation

UML can be extended to model variants.

However:

- Models become overly complicated
- One variant often reflected in many models
- Any model affected by many variants

→ Purely descriptive domain model only useful for small examples (does not scale up)

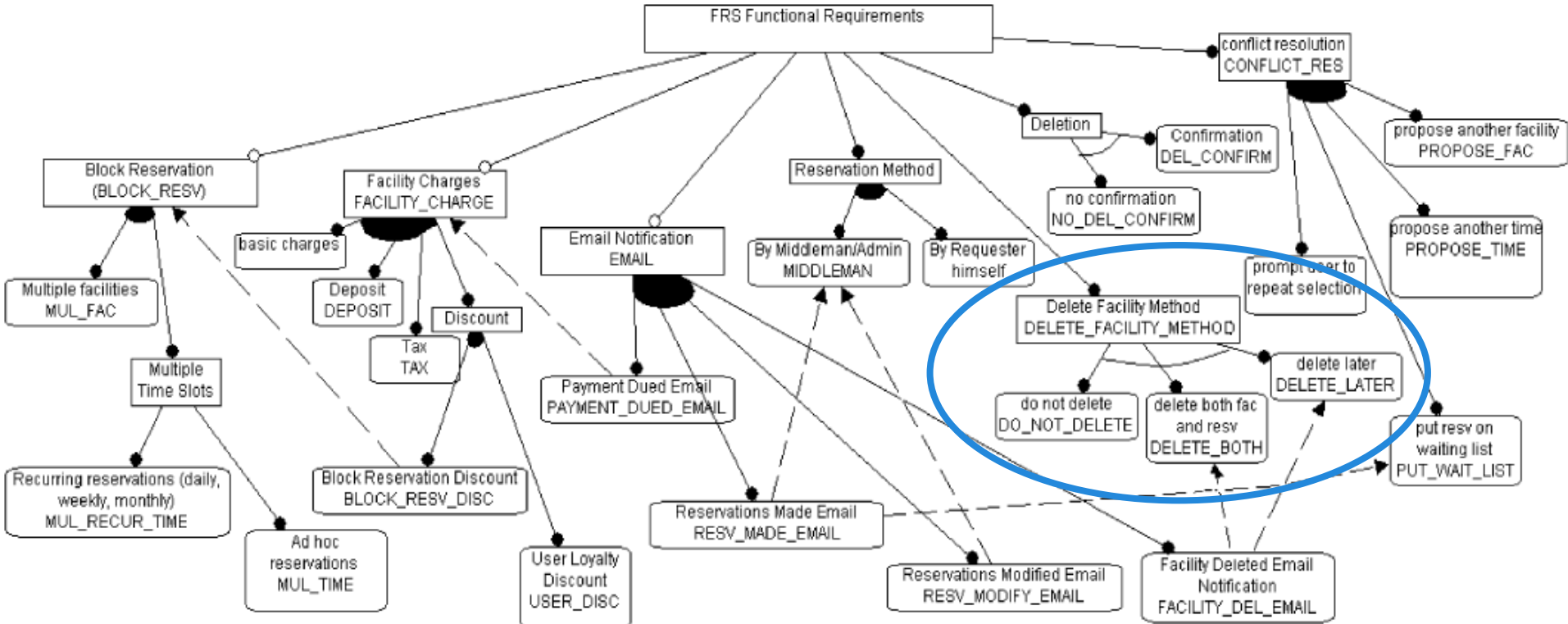
Approach

Modeling Method:

- **Domain defaults:** requirements of typical system in domain (in UML)
- **Variants:** deltas in respect to domain defaults (as customization scripts)

Flexible Variant Configuration tool (FVC):

- Interprets variants to produce customized domain model views for a system



Legend

Group of Variants

Variant x

Internal Node, Group of variants

Leaf Node, one variant

Dependency

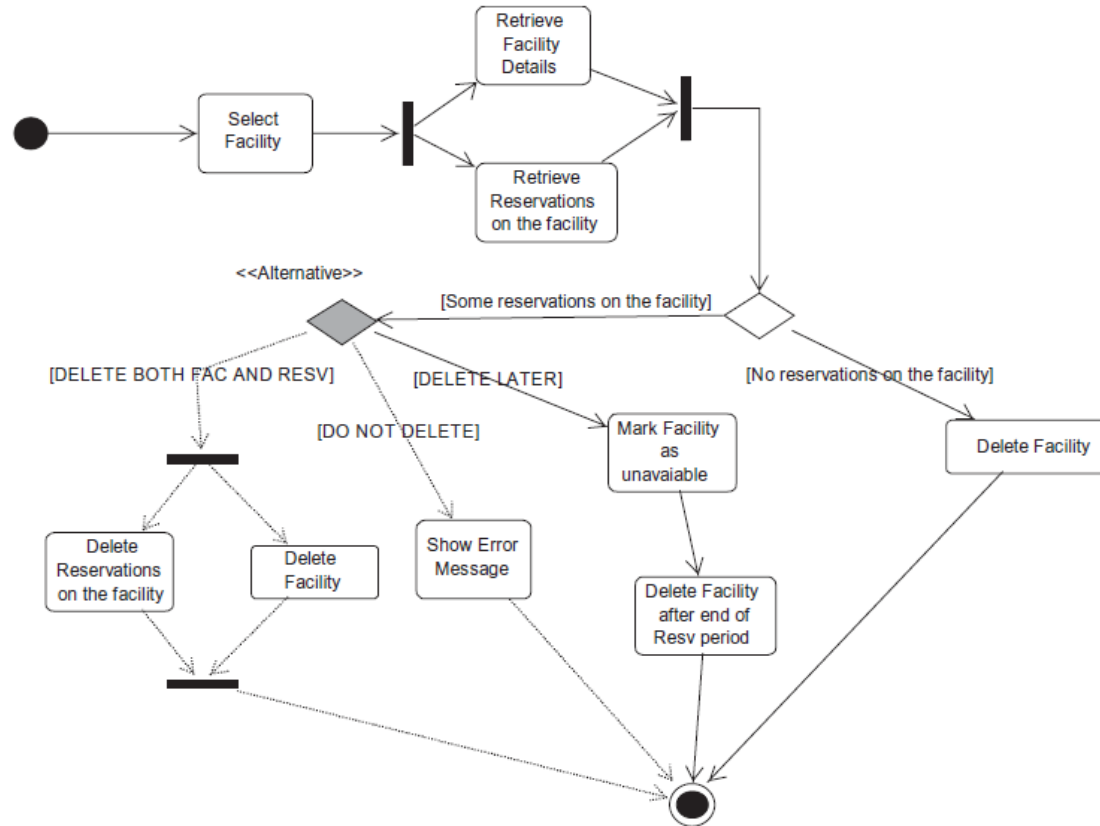
Optional Requirement

Mandatory Requirement

OR Requirement

Alternative Requirement

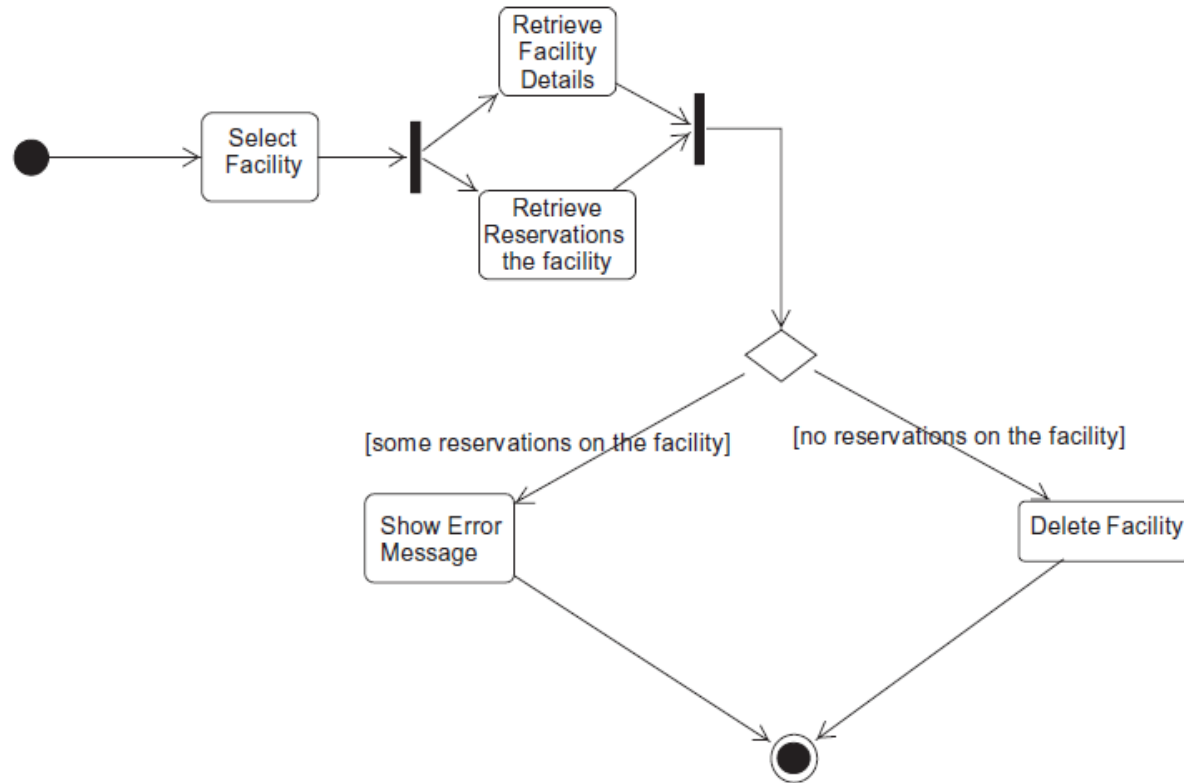
Delete Facility workflow with variation point: Facility Reservation System (FRS) Example



Customization script for DELETE_FACILITY_METHOD variant

```
CS DELETE_FACILITY_METHOD
...
//Customize Delete Facility workflow
.COPY Delete_Facility_wf
.REPLACE DELETE_FACILITY_METHOD BY "DO_NOT_DELETE"
.END-COPY Delete_Facility_wf
...
```

Customized Delete Facility workflow



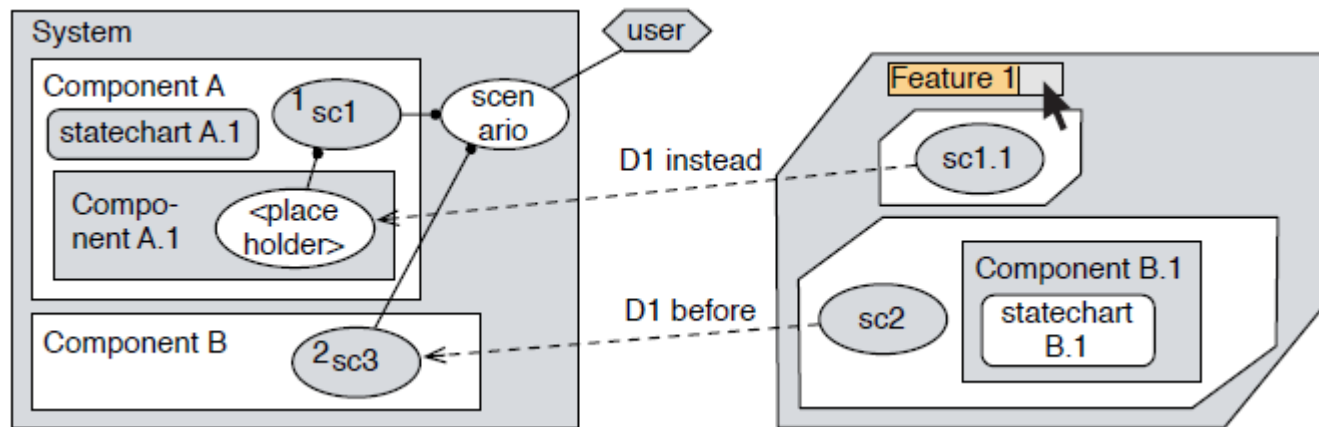
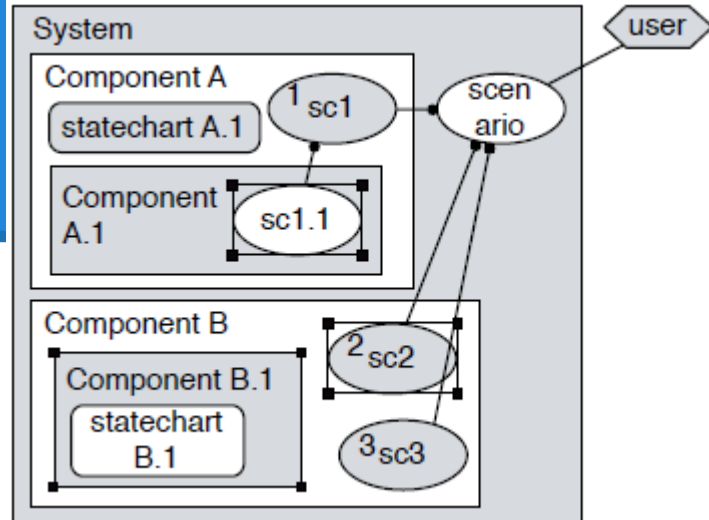
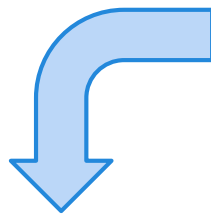
Feature Unweaving - Motivation

- Some products turn out to be very successful and attract additional customers and markets.
 - **Variability** introduced to tailor products to new target environments
 - **Software product lines**
- Other products turn out to be less successful than expected and disappear again. Though variability may have been anticipated, it did not step in.

Approach

- Semi-automatic extraction of variability from an existing product requirements model:
 - Manually identify variable requirements in the requirements model
 - **Feature unweaving** automatically refactors requirements model and specifies selected elements with aspect-oriented modeling
- Simplifies creation of software product lines
- Variability model correct by construction

Simple Example



Conclusions

- The presented approaches simplify the creation of software product lines:
 - Describe **variants** as deltas in respect to domain defaults and produce **customized domain model** views
 - Extract **variable elements** in requirements model

Discussion

- Do you have experience with software product lines?
- How did you model variants?
- Did you use tools that support variability?