Kumbang Modeler: A Prototype Tool for Modeling Variability

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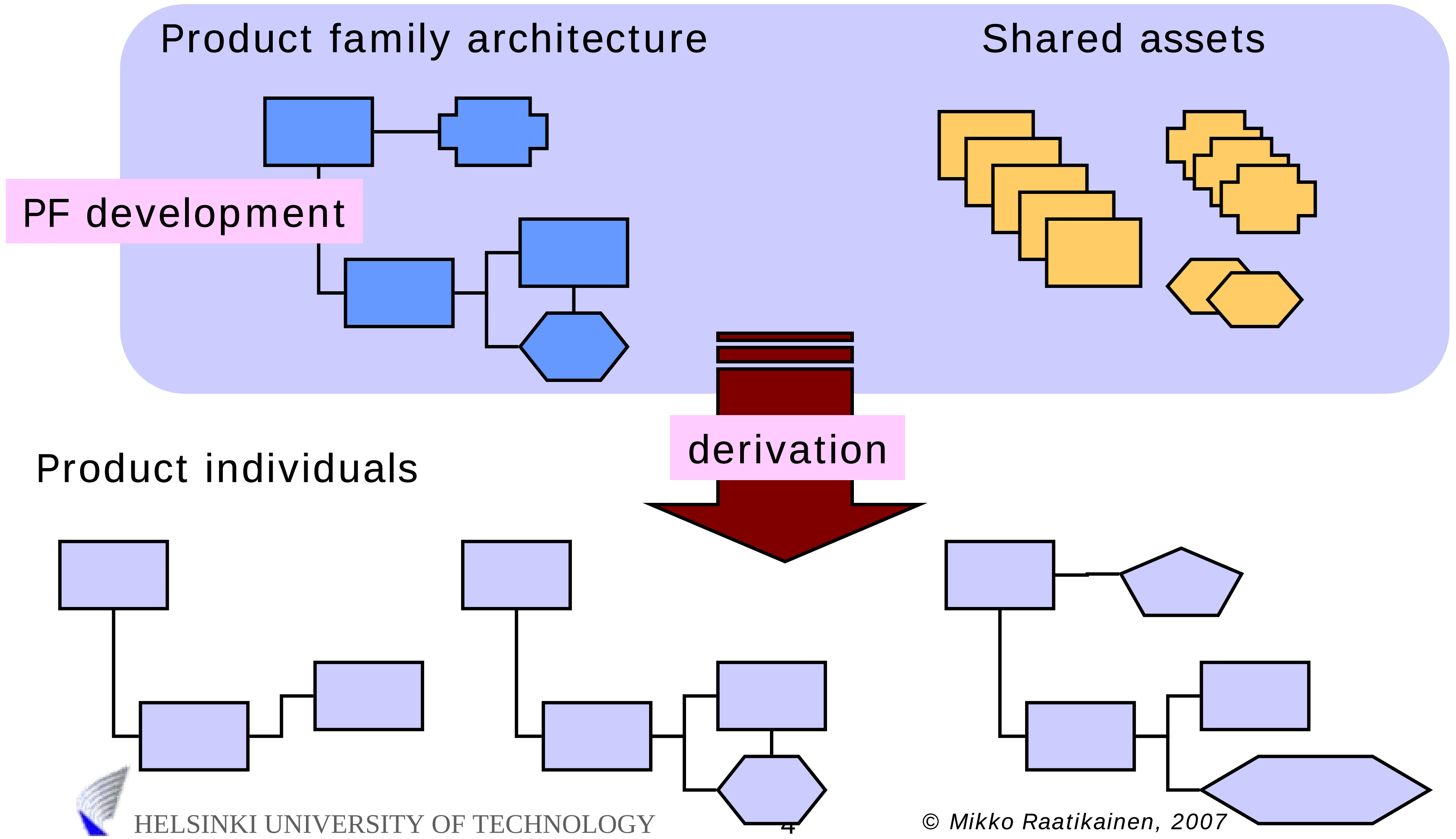
Content

- Background: Kumbang, software product family, and feature-component modeling
- Method: Design Science & User centered design
- Result: A prototype tools to model variability
- Lessons learned: General, usability, variability modeling

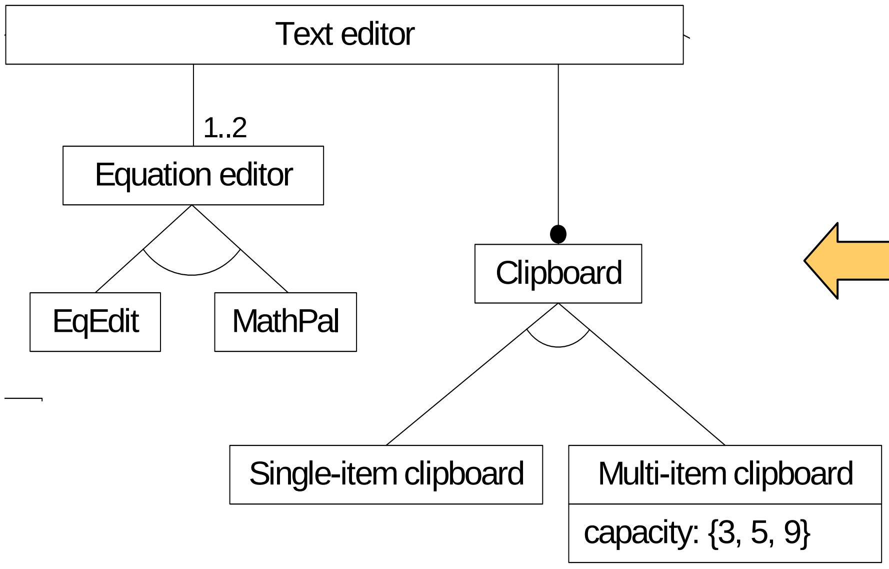
Background: Kumbang

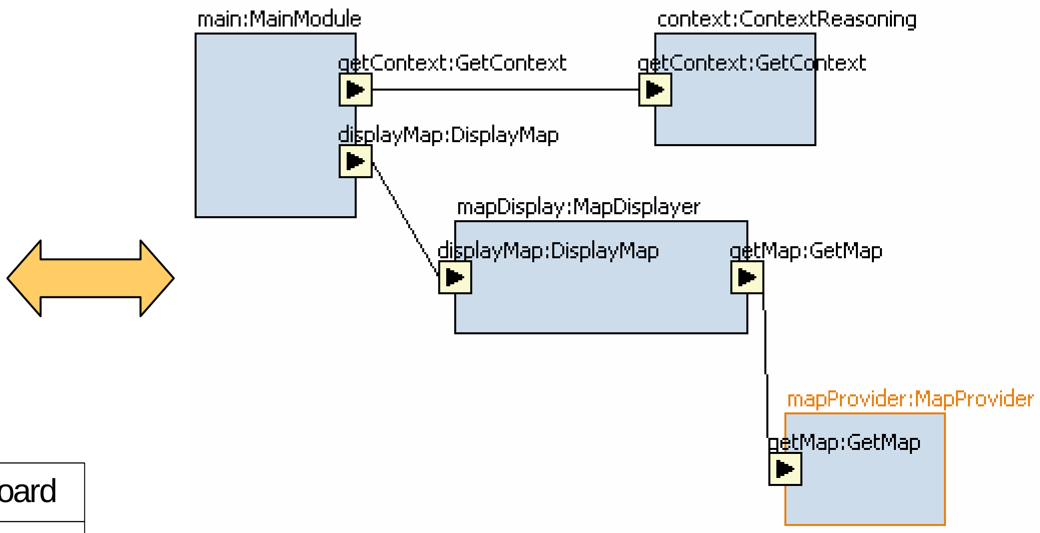
- Kumbang is a *conceptualisation* (domain ontology), a *language*, and *tools* for configurable applications developed at TKK
- Kumbang provides concepts for modeling variability from two viewpoints adhering to IEEE 1471-2000 standard
  - The user-visible characteristics of individual products, i.e., *features*
  - The *architecture* of the products in terms of components etc.
  - In addition, interrelations between the views can be specified
- Differentiates between family and instance
- Kumbang is provided a formal semantics by defining a mapping from the ontology to weight constraint rule language
- Tool support: *Kumbang Configurator* for resolving the variability in a product family to meet the specific set of requirements at hand
- Timo Asikainen *et al.:* SPLC'06 and Advanced Engineering Informatics, 21(1), 2007 (http://www.soberit.hut.fi/svamp/)

Software product family



Feature model and component structure



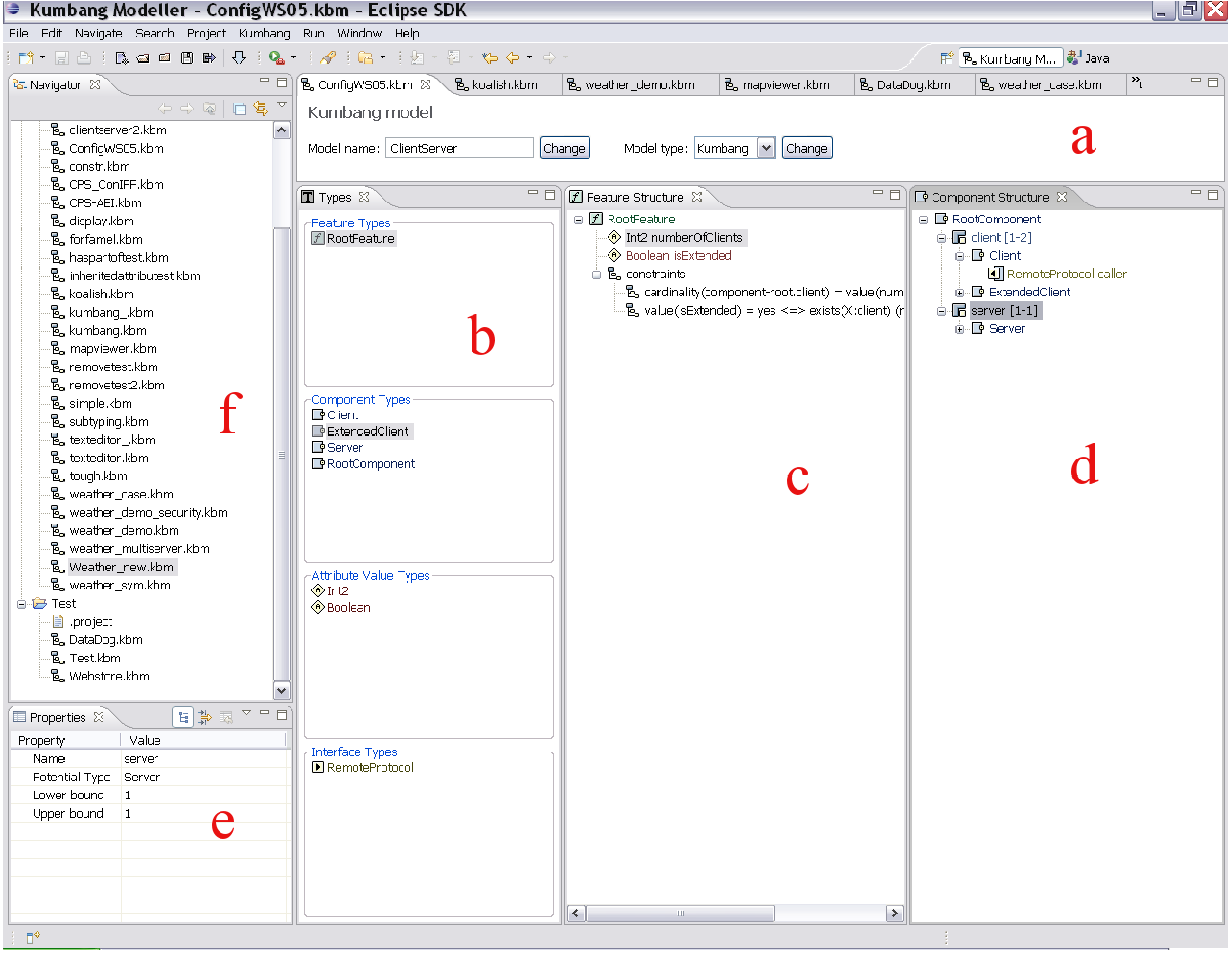


Method

- Design science methodology
  - A research method common in IS research to construct new and innovative artifacts
- User-centered design
  - Goal-directed design, especially Personas
  - Feasibility test and two light-weight usability test

Kumbang Modeler: Eclipse plug-in

- Eclipse is a popular development environment
  - Many developers are familiar with Eclipse
- Eclipse plug-ins
  - Eclipse plug-ins are currently very popular
  - Easy to install
  - Java based; relatively easy to develop



Kumbang model

Model name: ClientServer Change Model type: Kumbang Change

Navigator:

- clientserver2.kbm
- ConfigWS05.kbm
- constr.kbm
- CPS_ConIPF.kbm
- CPS-AEI.kbm
- display.kbm
- forfamel.kbm
- haspartoftest.kbm
- inheritedattributest.kbm
- koalish.kbm
- kumbang_.kbm
- kumbang.kbm
- mapviewer.kbm
- removetest.kbm
- removetest2.kbm
- simple.kbm
- subtyping.kbm
- texteditor_.kbm
- texteditor.kbm
- tough.kbm
- weather_case.kbm
- weather_demo_security.kbm
- weather_demo.kbm
- weather_multiserver.kbm
- Weather_new.kbm
- weather_sym.kbm
- Test
  - .project
  - DataDog.kbm
  - Test.kbm
  - Webstore.kbm

Types:

Feature Types
- RootFeature

Component Types
- Client
- ExtendedClient
- Server
- RootComponent

Attribute Value Types
- Int2
- Boolean

Interface Types
- RemoteProtocol

Feature Structure:

- RootFeature
  - Int2 numberOfClients
  - Boolean isExtended
  - constraints
    - cardinality(component-root.client) = value(num
    - value(isExtended) = yes <=> exists(X:client) (r

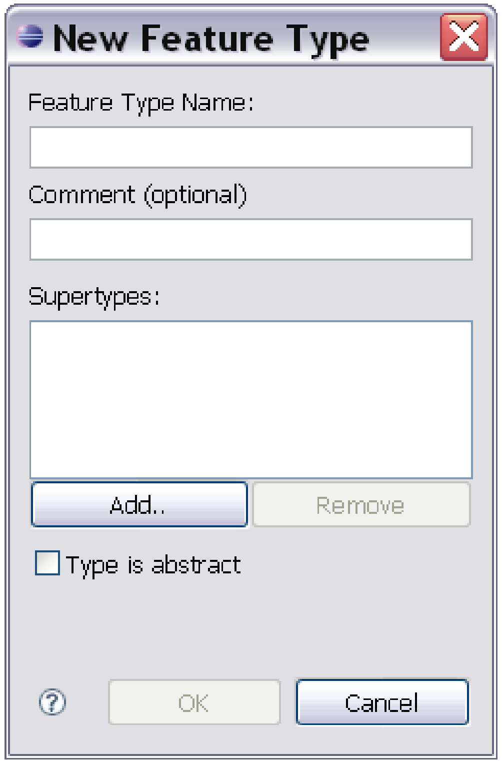
Component Structure:

- RootComponent
  - client [1-2]
    - Client
      - RemoteProtocol caller
    - ExtendedClient
  - server [1-1]
    - Server

Properties:

Property	Value
Name	server
Potential Type	Server
Lower bound	1
Upper bound	1

Example dialogs

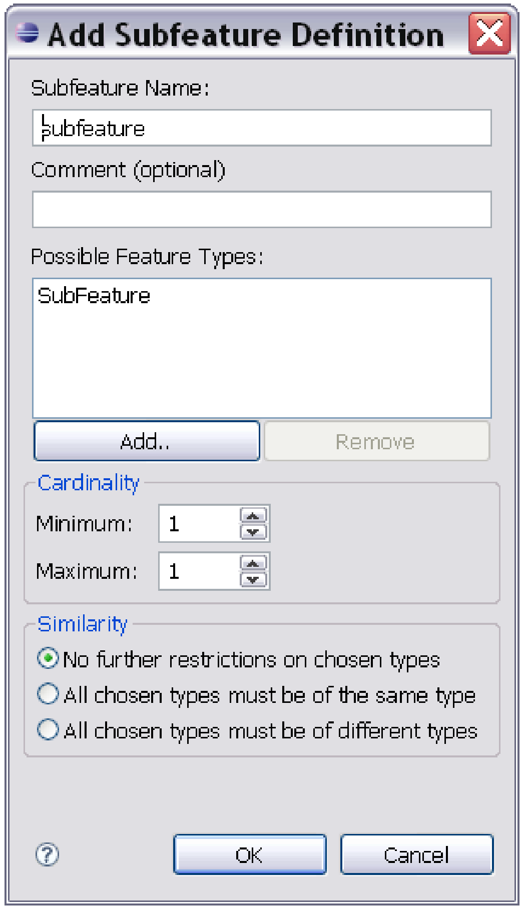


Feature Type Name:

Comment (optional)

Supertypes:

[ ] Type is abstract



Subfeature Name: subfeature

Comment (optional)

Possible Feature Types: SubFeature

Minimum: 1

Maximum: 1

[✓ No further restrictions on chosen types]
All chosen types must be of the same type
All chosen types must be of different types

Usability tests

- Follow a web store scenario to construct a model
- The first user, who knew Kumbang very well, had very little trouble making a model according to the scenario
  - Some suggestions for improving the user interface
- The second, who had no previous knowledge of Kumbang, had trouble understanding the need for relation between types and definitions used for compositional structure
  - Inconveniently repetitive information

  → This led to user interface simplification

Lessons Learned: General

- Eclipse feasible platform for plug-ins
  - Familiar to use, easy to install, and easy to distribute
- Modeler makes easier to construct model
  - New features such as advanced checks for consistency and component diagram are under development

Lessons Learned: Usability

- User-centered design was relatively successful approach
  - New point of view to tool development
  - Not much additional work
  - Difficulties in application such as information for personas could not be directly found
- Strict adherence to all user centered guidelines was not reasonable
  - Most of them valuable although at first seemed a bit awkward such as personas
  - For example, goal differentiation was not feasible for a prototype tool
- The usability tests were relatively light-weight ones
  - More usability tests are needed

Lessons Learned: Variability Modeling

- Balancing between conceptual clarity and easy to use
  - Difficulties in usability tests were mainly because of overly complex modeling constructs for representing simple variability
  - For example, simple optional features should be easy to add
- More empirical studies needed of the nature of variability

Questions?

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