Dealing with Unstable Domains in Product-Line Architecture Development

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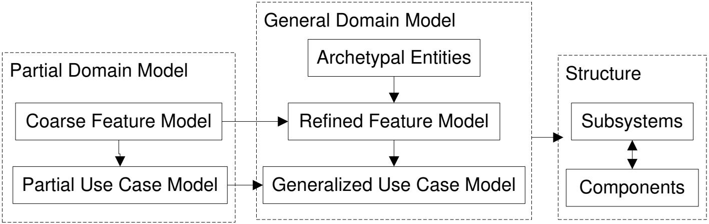
Product Lines and Stability

- Product lines: an organized approach to software reuse
- Domain is an area of knowledge
  - Scoped to needs of its stakeholders
  - Includes a set of concepts and terminology of the respective area
  - Includes knowledge how to build software systems in that area
- A domain is expected to be stable and well-understood
- How to benefit from product lines in an unstable domain?

Overview

1. Approach Overview
2. Specific Product Analysis
3. Domain Generalization
4. Structure View
5. Conclusions

Approach Overview



Partial Domain Model

Coarse Feature Model

Partial Use Case Model

General Domain Model

Archetypal Entities

Refined Feature Model

Generalized Use Case Model

Structure

Subsystems

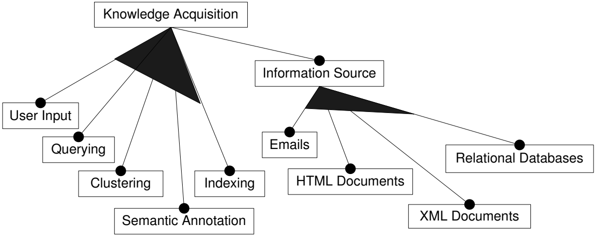
Components

Feature Model

- Concepts expressed by their features
- A feature is an important property of a concept
- Common and variable features
- Focus on configurability

Knowledge Acquisition Concept

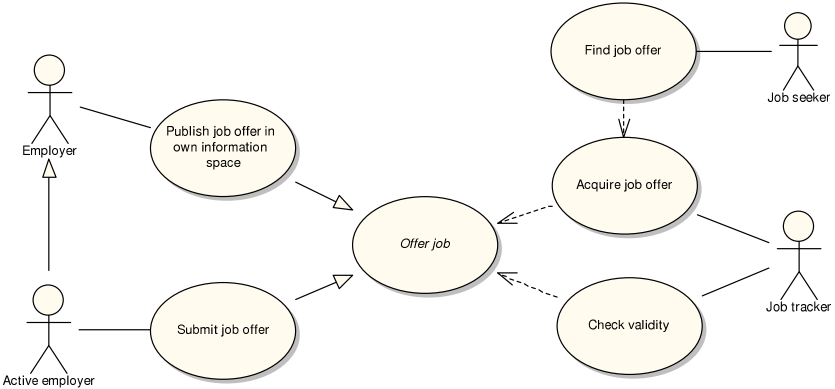
- An example: domain of knowledge management
- Encompasses applications for acquisition, organization, and maintenance of knowledge in the web



Use Case Model

- Captures stakeholders and functional requirements
- Abstracts from realization details
- Variations in functional requirements are captured by the use cases to features mapping
- No need to use specialized use cases or variants

A Domain Exploration Level Use Case Diagram



Domain Generalization

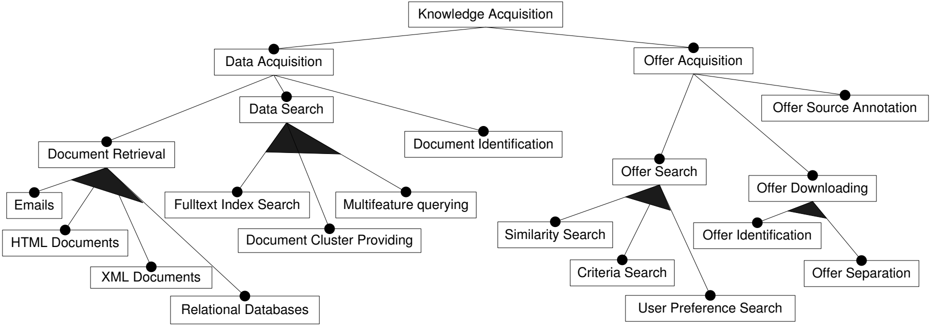
- Based on the partial domain model
- Objectives:
    - Identify archetypal entities of the domain and interactions between them
    - Refine feature model
    - Generalize use cases

Archetypal Entities

- A major transition in a model
- Based on the abstract feature model and concrete use cases
- Knowledge acquisition as an example
  - Knowledge acquisition identified as crucial in the domain
  - The use cases are about job offer acquisition
  - Therefore, the domain has been narrowed to offer acquisition
  - The archetypal entities identified: an abstract offer, its producer, and its consumer

Knowledge Acquisition Concept Refinement

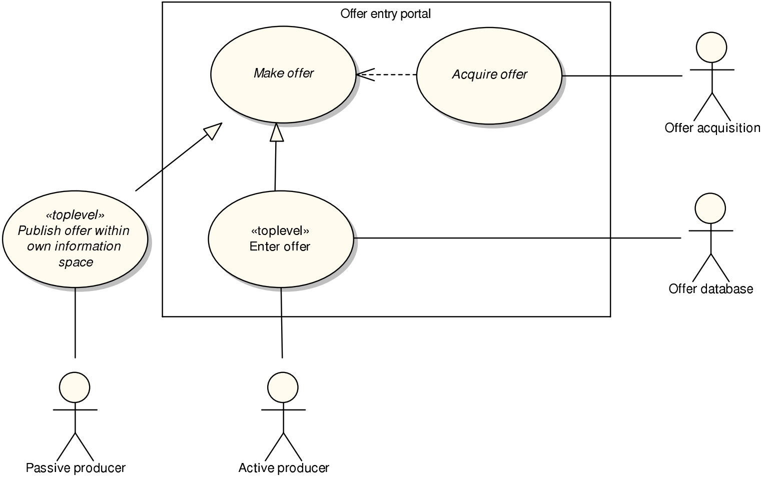
- Separation of the information content independent acquisition from the dependent one based on the archetypal entities



Generalizing Use Cases (1)

- Based on the archetypal entities identified
- Evolved according to the refined feature model
- The objective is to achieve a use case model that can be mapped to the structural view
    - A use case as a collaboration of several actors
    - Some actors represent subsystems

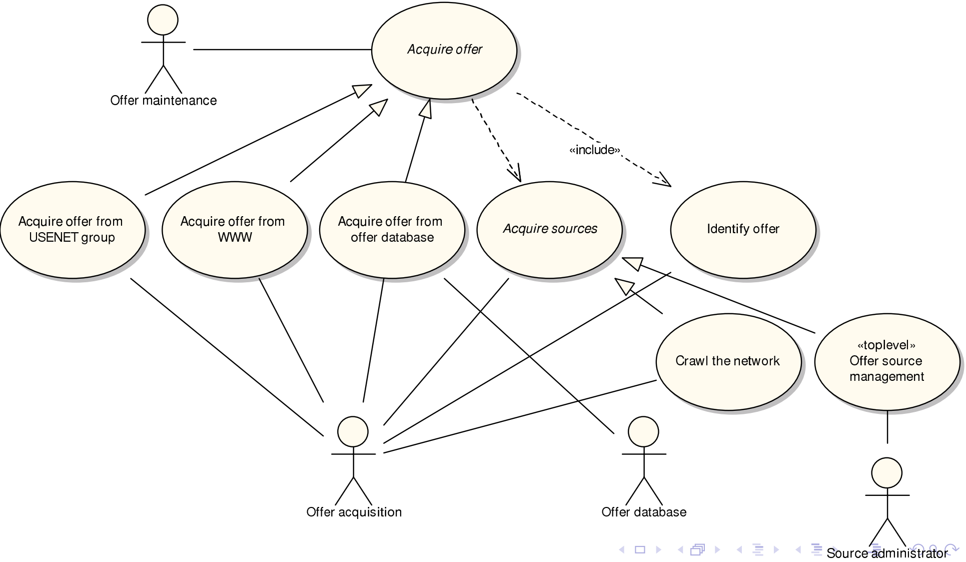
Generalizing Use Cases (2)



Dealing with Variations in Requirements (1)

- Representing variations of requirements as separate use cases should be avoided
- Mapping to appropriate features bears this information
- It is necessary to have separate use cases for variations only if they involve different actors

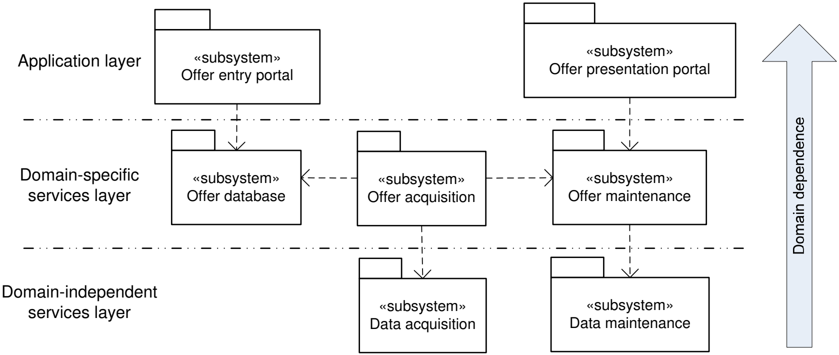
Dealing with Variations in Requirements (2)



Structure View

- Let behavior form the structure: the system structure is derived from the use case model
- Avoid structuring the system according to the developing organization structure (Conway's law)
- Two levels of structural decomposition
  - Subsystem view: logical cohesion
  - Component view: functional cohesion

Subsystem View



Conclusions

- An approach that enables exploiting the benefits of product lines in unstable domains
- Presented on examples from a project on whose development part is performed concurrently with the research activities
- Improved understanding of a specific part of a domain can be translated to the whole domain
- Identification of archetypal entities and their interactions highly dependent on the insight of developers
- However, the partial domain model improves the communication with domain stakeholders—inevitable for the generalization