Feature Transition Charts for Visualization of Cross-Project Scope Evolution in Large-Scale Requirements Engineering for Product Lines

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What is the problem we are working on.

- Providing a comprehensive overview of the complexity and dynamics of scoping decisions in large-scale multi-project environment.
- This paper presents a visualization technique called Feature Transition Charts (FTC) that gives an overview of scoping decisions involving changes across multiple projects. The work is based on previous work on within-project visualization of feature survival (Feature Survival Charts).
Case Study Motivation

- Feature Survival Charts can only show a single project during analysis.
- Previous results indicate that many features were de-scoped from the analyzed projects.
- Find ways of visualizing across projects scope changes.
- Find ways of visualizing timing and magnitude of across-projects transitions.
Case Study Introduction

• Empirical data from two industrial projects at a large company using a product line approach
• Has approximately 5000 employees
• Develops embedded systems for a global market
• The company uses a stage-gate model for requirements projects
Requirements Management Process

- Requirements Teams (RTs) and Design Teams (DTs)

1. Roadmap
2. MS 1
   - High-level features
3. MS 2
   - Effort estimate per feature
4. MS 3
   - System requirements and design
5. MS 4
   - Final scope ready requirements and design finished.

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Methodology

STEP 1: Research questions definition

STEP 2: Features transition types definition
- Three types of transitions considered to be the most important.

STEP 3: Empirical investigation of previously derived assumptions in the given company context
- Selecting projects for the analysis
- Finding transitions
- Creating Feature Transition Charts for the selected projects

STEP 4: Initial validation with practitioners
- Discussing the phenomenon
- Analyzing the results
- Collecting opinions and critique
Feature Transitions Types

• Cross-project Feature Transitions
• Within-project Feature Transitions
• Multi-step Feature Transitions
Cross-project transitions on the Industrial Example

4 backward and 21 forward transitions

<table>
<thead>
<tr>
<th>LEGEND:</th>
<th>Ankle points</th>
<th>Departure points</th>
<th>In scope for R1</th>
<th>In scope for R2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In scope for R3</td>
<td>In scope for R4</td>
<td>In scope for R5</td>
<td>Removed from the scope of the current release</td>
</tr>
</tbody>
</table>
Within-project transitions on the Industrial Example

LEGEND:
- Green: In scope for R1
- Cyan: In scope for R2
- Pink: In scope for R3
- Yellow: In scope for R4
- Orange: In scope for R5
- Black: Removed from the scope of the current release
- Square: Arrival points
- Triangle: Departure points

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Multiple transitions on the Industrial Example

Legend:
- □ Arrival points
- / / Departure points
- ↔ Interim transitions
- Green: In scope for R1
- Blue: In scope for R2
- Pink: In scope for R3
- Yellow: In scope for R4
- Orange: In scope for R5
- Red: Removed from the scope of the current release
Initial Validation

- Practitioners expressed their interest in visualizing cross-project transitions
- Feature transitions may sometimes heavily influence the market value of affected features
- It is crucial to visualize the transitions because of so called *enablers*
- Usefulness and applicability of each type of transition
  - Cross-project visualization turned out to be ranked the most useful
- Size and magnitude symbols
  - Useful in providing an effective overview in timing and magnitude
Conclusions

• The FTC can scale to large projects
• The practitioners believe that FTC can give a comprehensive overview of scoping dynamics that have not previously been made explicit.
• FTC can be used by both requirements engineers and process managers to gain valuable information about the presence and nature of scope changes across projects or projects’ releases.
• The proposed visual symbols for departure and arrivals of feature transitions can be useful in providing an effective overview of the timing and magnitude of feature transitions.
Future work

• Enhanced tool support with the possibility of zooming interactively.
• Other means of marking the departure and arrival points.
• Additional work should be performed to address the applicability of FTC in other contexts (information systems domain or single product development).
Questions?