Representing and Reasoning with Preferences in Requirements Engineering: A Goal-Oriented Approach

Sotirios Liaskos
School of Information Technology
liaskos@yorku.ca

Sheila A. McIlraith
Department of Computer Science
University of Toronto
sheila@cs.toronto.edu

John Mylopoulos
Department of Computer Science
University of Toronto
jm@cs.toronto.edu

At A Glance
A method for exploring problem variability in Requirements Engineering based on preference specification

I. Goal decomposition models represent alternative solutions to requirements problems
II. Rankings over LTL-formulae express stakeholder priorities over properties of desired solutions
III. A preference-based planner is used to find alternative solutions that best match stakeholder priorities

1. Requirements, Goals and Variability
Goal modeling is an effective way to analyze requirements for software-intensive systems. Goal-oriented requirements engineering techniques specify requirements as stakeholder goals that are recursively refined in order to derive alternative sets of actions/tasks.

2. Drawing Goal Models
Goal models consist of goals, that is, states of affairs that stakeholders want to hold true. Goals are hard goals or soft goals. Hard goals (the ovals) form AND/OR decomposition tree representing alternative ways to fulfill the root goal. Soft goals (the circles) are quantifiable factors that are influenced by the fulfillment of goals. We use soft goals to assess the impact of different goal alternatives.

3. The Preference Specification Language
The building block of preferences are the Optional Condition Formulae (OCFs). OCFs are written in Linear Temporal Logic (LTL). Through OCFs we describe both temporal constraints and constraints over the satisfaction of soft goals.

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5. Reasoning About Goals and Preferences
To find goal plans that best satisfy the specified preferences an AI preference planner based on called Plan2Plan (P2P), is tweaked and used. The planner takes as input the goal model, the preference formula and a set of initial conditions. It returns a set of plans that best satisfy the given preferences.

6. Exploring and Using the Result
In the resulting ranking analysis can see groups of alternatives that satisfy the preference with a good score. By tweaking the weights of the preference constituents they can explore the impact of individual stakeholder desires to the total score.

7. In Practice
We tried the approach on a number of domains in addition to the nurse one, such as the ATM domain, the Meeting Scheduling problem and a simple On-Line Store problem. We found preferences to be useful for exploring how different stakeholders impact the selection of the best alternative.