Improved GRL Modeling and Analysis with jUCMNav 5

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Abstract. jUCMNav is an open-source Eclipse tool for modeling and analyzing stakeholder goals, scenarios, and requirements with the User Requirements Notation (URN) standard. This paper gives a brief overview of this tool, with an emphasis on recent improvements targeting URN's Goal-oriented Requirement Language (GRL) found in version 5.x.

Keywords: GRL, jUCMNav, URN.

1 Overview of the User Requirements Notation and jUCMNav

The User Requirements Notation (URN) integrates (i) the Goal-oriented Requirement Language (GRL) for stakeholder objectives and decision rationales and (ii) Use Case Map (UCM) for scenarios and business processes combined with architectural components. One important feature of GRL is the support for strategies, which define initial satisfaction values (qualitative or quantitative) for some intentional elements in a goal model that are propagated to other elements of the model (including actors) through various evaluation algorithms [5]. GRL and UCM have been used individually and together for more than a decade, in dozens of application areas [2]. The second version of the URN standard was released in October 2012 [6], four years after the first release, with several major improvements to GRL that include:

- *Indicators* to handle real-life values (beyond simple satisfaction values) in goal models. Indicators (symbol: ⟺) convert real-life values into GRL satisfaction values based on linear extrapolation or based on a mapping table.
- *Strategy inclusion* to improve the reuse, consistency, and maintainability of large collections of GRL strategies.
- *Contribution changes* to enable the description of sets of modifications to contribution weights in a GRL model (e.g., from different modelers).
- *Actor importance values* to better enable tradeoffs between strategies.

jUCMNav is an Eclipse-based environment for modeling and analysis with URN. Its development started in 2005, and an overview of version 4.x was given at iStar'2011 [3]. This is a mature tool that has been used in academia (for teaching and research), in industry, and even in government agencies for many years, by thousands of people [2], on academic systems and on real ones. The tool can be installed from its Wiki site [7], where tutorials, examples, and documentation are also available.

Primary features include the editing of URN models with palettes and context-sensitive menus. The tool prevents the creation of syntactically incorrect models, but it also offers users the chance to create, select, and check their own correctness/consistency rules, written in OCL. GRL/UCM elements can also be linked, stereotyped, and grouped, hence enabling the tailoring of the notation to particular domains (e.g., for *i**-like modeling [1], or for legal compliance [9]). Copy/paste of model portions, multiple undo/redo, and many navigation facilities contribute to the usability and scalability of the tool (e.g., models composed of hundreds of diagrams and thousands of elements). On the analysis side, UCM scenarios can be defined, run, and transformed to sequence diagrams. GRL strategies can be defined, evaluated (see Figure 1), and imported/exported to CSV files. Reports (in HTML, PDF, and RTF) can be generated to summarize models and analysis results. Models can also be exported to DOORS. Advanced features for indicators, performance, and aspect modeling can each be disabled to simplify the user interface for beginners.

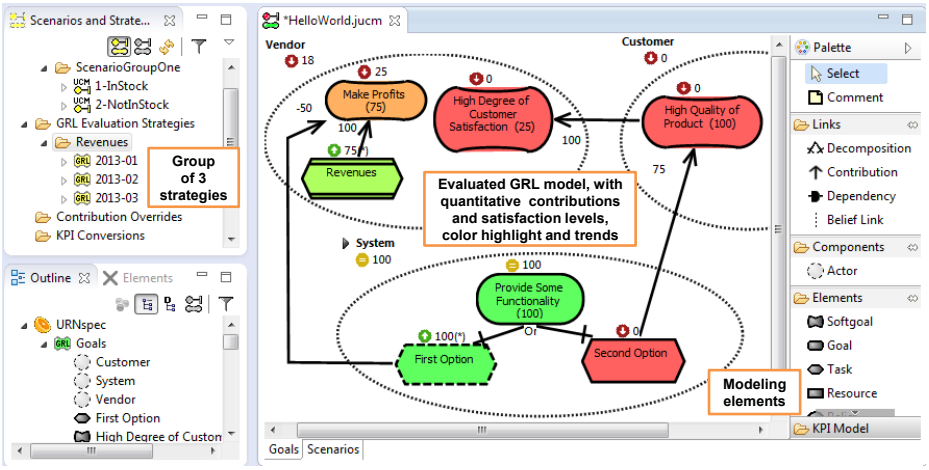

Figure 1, jUCMNav 5, with GRL strategy and GRL trends for group "Revenues".

2 Recent Developments in Version 5 of jUCMNav

The fifth major release of jUCMNav contains many important improvements, especially for GRL. The tool now supports the new concepts introduced in the second release of the standard. While quantitative indicators were already available for modeling and analysis [3], jUCMNav now also supports *qualitative indicators* (illustrated in [9]), which enable modelers to provide a mapping between enumerated domain-specific values (e.g., bad, average, good, excellent) and quantitative GRL values (0,

33, 67, 100) or qualitative GRL labels (e.g., WeaklySatisfied and Satisfied). *Strategy inclusion* and *contribution changes* are well illustrated in [4], together with advanced analysis features such as *strategy differences* (computing and visualizing the differences between the evaluations of two GRL strategies), *model differences* (highlighting the differences between two versions of a model), and *sensitivity analysis* (based on ranges of contribution or satisfaction values in strategies, instead of on specific values). Note that recent experience in using GRL for modeling laws [4,9] also led us to introduce a new *alternative GRL satisfaction scale* ([0..100], in addition to the standard [-100..100] scale), considered as more intuitive by many users. Also, given that laws in Canada are written in French and English, jUCMNav now supports *bilingual models*, where the labels and descriptions of elements can be switched from one language to the other (in addition to having the tool's interface in both languages).

Recent additions also include: i) simpler and more efficient UI to create, delete, and navigate URN links, ii) new capabilities to show the actors or intentional element related (through links or inclusion) to another actor/element (to various depths), iii) the possibility to define possible stereotypes and the type of model elements they can apply to, with appropriate pop-up menus to apply these stereotypes (useful in the context of [1,9]), iv) OCL rules and improved propagation algorithms that support *goal model families*, which enable the modeling and analysis of many variants in one GRL model [8], and v) the computation and visualization of *trends* (up, stable, down, varying, and insufficient data, see Figure 1) based on a sequence of strategies in a strategy group. Trends are also included for GRL elements in reports.

jUCMNav is still evolving. Future plans include further usability improvements, a textual syntax for URN, and better support for aspect-oriented extensions to GRL.

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