An Argumentation-based Support System for Requirements Reconciliation

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Abstract. Requirements engineering is an essential step of the software development process during which the behavior of a software system is defined. A lot of artifacts are created at this stage of the development process, and stakeholders need to be supported in managing requirements' consistency and evolution over time. In this paper, we present ArgRE, an argumentation-based system to be used by stakeholders to structure complex goal-based requirements, and maintain their consistency over time. In particular, we rely on meta-argumentation, where requirements are represented as arguments, and the standard Dung-like argumentation framework is extended with the relations holding among goal-based requirements.

Keywords. Goal-based requirements engineering, meta-argumentation

ArgRE: Argumentation for Requirements Reconciliation

Requirements engineering research has for long recognized the leading role of *goals* during the requirements engineering process. Several goal-oriented requirements engineering approaches have been proposed in the literature [5] for avoiding irrelevant requirements, explaining requirements to stakeholders, structuring complex requirements documents through goals refinement, supporting decision making through alternative goals refinements, etc. However, given the large number of artifacts created during the requirements engineering process, and the continuous evolution of these artifacts, managing and *organizing requirements* artifacts is a challenging task. The rising complexity of the target domain under consideration during the requirements engineering process also increases the number of collected requirements as well as their inter-dependencies, making this task even more challenging. Some support is required to allow stakeholders achieving a common understanding of a large and complex set of requirements, in consolidating it and in keeping it consistent over the whole project life cycle. Dedicated tools to highlight inconsistencies and support stakeholders who handle the resolution process are particularly needed. Following the idea proposed in [1,4], we propose a system to support stakeholders in requirements reconciliation. The use of abstract argumentation is reasonable because it does not need the requirements to be formally defined and only needs the relationships between them to be defined [1]. Therefore, we rely on

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meta-argumentation [2], which has been proposed as a general methodology to handle the introduction of new relations among the arguments (as we are required to) by reusing Dung's results and semantics.

System description. We designed and developed a tool called ArgRE[2] for supporting stakeholders in *(i)* visualizing the set of goal-based requirements and their relations, and then, by using meta-argumentation and the fuzzy labelling algorithm proposed in [3], *(ii)* computing consistent sets of requirements (i.e., expressed under the form of arguments) to support the decision-making process aiming at avoiding inconsistencies in the final set of selected requirements specifying a system. Different kinds of relationships hold between goals [5]. More precisely, goal decomposition relationships are distinguished from goal dependencies, i.e., two kinds of decomposition are possible depending on the fact that all subgoals are required to satisfy a super-goal (*AND-decomposition*) or at least one sub-goal is required (*OR-decomposition*). Three kinds of full dependencies as well as two kinds of partial dependencies are identified [5]: *equivalence* (the satisfaction of one goal implies the satisfaction of the other goal), *conflict* (the satisfaction of one goal entirely excludes the satisfaction of the other goal, and vice versa.), and *require* (the satisfaction of one goal is a prerequisite for satisfying another goal) aim at modeling full dependencies; *obstruction* and *support* aim at eliciting *partial* dependencies between goals. ArgRE takes as input the set of binary relations between goal-based requirements. These rules have the form `A requires B`, where `A: Participant availability known` and `B: Availability entered` are two requirements. Such relations constitute an extended argumentation framework for reasoning about requirements [4], and their instantiation into a meta-argumentation framework is achieved thanks to a number of *argumentation patterns* flattening each relation in terms of a standard abstract attack relation. In the meta-argumentation framework, meta-arguments are connected exclusively by a Dung-like attack relation, in the perspective of the meta-argumentation methodology [2]. The resulting meta-argumentation framework highlights the possible conflicts arising between the expressed requirements, and the set of accepted requirements. The current implementation is written in Java, exploiting the Graphviz library for the graph support. ArgRE considers at time being full and goal dependencies only, the extension to include partial ones as well is ongoing. It is structured as a client-server application where the client provides requirements and their relations, and the server *translates* the extended argumentation framework into a meta-argumentation framework and computes the consistent sets of requirements, using the fuzzy labelling algorithm [3].

References

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[2]More details about the application, and a video of the demo are available at `http://bit.ly/argRE`