SOA4All Integrated Ranking
A Preference-based, Holistic Implementation

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Abstract. There exist many available service ranking implementations, each one providing ad hoc preference models that offer different levels of expressiveness. Consequently, applying a single implementation to a particular scenario constrains the user to define preferences based on the underlying formalisms. Furthermore, preferences from different ranking implementation's model cannot be combined in general, due to interoperability issues. In this article we present an integrated ranking implementation that enables the combination of three different ranking implementations developed within the EU FP7 SOA4All project. Our solution has been developed using PURI, a Preference-based Universal Ranking Integration framework that is based on a common, holistic preference model that allows to exploit synergies from the integrated ranking implementations, offering a single user interface to define preferences that acts as a façade to the integrated ranking implementation.

Keywords: Semantic Web Services, Ranking Tools, Systems Integration, Preference Models

1 Introduction

Within the EU FP7 SOA4All project[1], three different ranking implementations were implemented [6], offering users different choices depending on their expressiveness and performance requirements for the service ranking process. Firstly, a simple, yet efficient objective ranking mechanism provides some metrics about the quality of service and its description. Secondly, a multi-criteria non-functional property (NFP) based ranking allows a more expressive definition of preferences on non-functional properties. Finally, a fuzzy logic based ranking implementation offers a highly expressive solution to define preferences, though the ranking process is less performant.

In order to take full advantage of the three developed ranking techniques, a user should be able to express preferences using every facility those ranking techniques provide, at the same time. Therefore, at the final stage of SOA4All project, an integrated ranking approach has been developed, so that a user can define and compose preferences using a generic and expressive model that integrate preference definitions used in the other ranking techniques. This integrated ranking approach can be viewed as a holistic façade to access available ranking techniques using a common, unique access point to them. SOA4All Integrated Ranking is available online at http://www.isa.us.es/soa4all-integrated-ranking/

[1] http://www.soa4all.eu

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2 Preference Modeling

The preference model used in this approach is an adaptation of a comprehensive, user-friendly model described in [3]. Basically, the user can express atomic preferences using different preference terms that are handled internally by the corresponding ranking approach, and then composite preferences can be used to compose those terms, defining the relationship between previously expressed atomic preferences. Figure 1 shows a UML representation of this preference model.

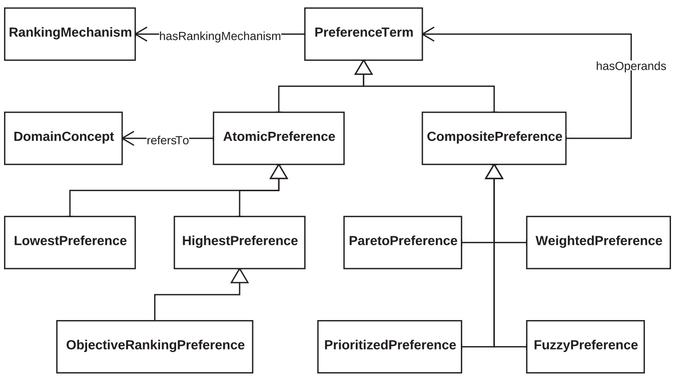

Fig. 1. Simplified UML representation of the preference model.

Essentially, each preference term is handled by a corresponding ranking mechanism, namely objective ranking metrics, multi-criteria NFP-based ranking, and fuzzy logic based ranking, while more generic composite preferences are directly handled by the integrated ranking framework used in the implementation (see Sec. 3). Note that fuzzy preferences representation is simplified in the diagram (see [2] for a more detailed description). The correspondences between preference terms and ranking mechanisms are summarized in Table 1.

Atomic preferences are related to a domain-specific concept that represents a NFP that should be optimized to fulfill the user preference over it. For instance, a `Lowest` (a `Highest`) preference means that the user prefers an NFP value the lower (the higher) the better. These preferences mimic the ascending or descending order defined in the multi-criteria, NFP-based ranking approach, while using `Weighted` preferences the user can define each atomic preference interest value.

The objective ranking metrics approach is actually an optimization of ranking metrics, so it is handled similarly to a highest preference, but the referred domain concept to optimize is one of the available metrics. Finally, users can compose preferences by balancing their fulfillment degree (a Pareto preference) or prioritizing some preferences over others (a Prioritized preference). See [3] for further details.

Table 1. Correspondences between ranking mechanisms and preference terms.

Preference Term	Ranking Mechanism
`LowestPreference`	MultiCriteriaRanking
`HighestPreference`	MultiCriteriaRanking
`ObjectiveRankingPreference`	ObjectiveMetricsRanking
`ParetoPreference`	DefaultParetoRanking
`PrioritizedPreference`	DefaultPrioritizedRanking
`WeightedPreference`	MultiCriteriaRanking
`FuzzyPreference`	FuzzyLogicBasedRanking

3 SOA4All Integrated Ranking Implementation

The developed integrated preference-based ranking approach evaluates preferences defined after the presented model in order to rank a set of discovered services. As described before, each preference term is handled by a particular ranking mechanism. In order to correctly call each mechanism, compose the results, and manage in general the integrated ranking process, the implementation is based on the PURI[2] framework [2]. PURI provides facilities to integrate several ranking mechanisms by using an extended preference model, that can be also used to streamline the previous discovery process [4]. The implemented ranking solution adapts the PURI framework, integrating the three ranking approaches developed in SOA4All [1].

This implementation is published as a web service that provides a method that receives a set of services to rank and the user preference defined after the discussed preference model. Concretely, this method firstly analyses the user preference term. Then, service ranking for each preference term is delegated to the corresponding ranking mechanism presented in Table 1. The adaptation of PURI framework that has been developed is responsible to both the delegation mechanism and the composition of ranked results for each preference term. Finally, the method returns the requested ranked list of services.

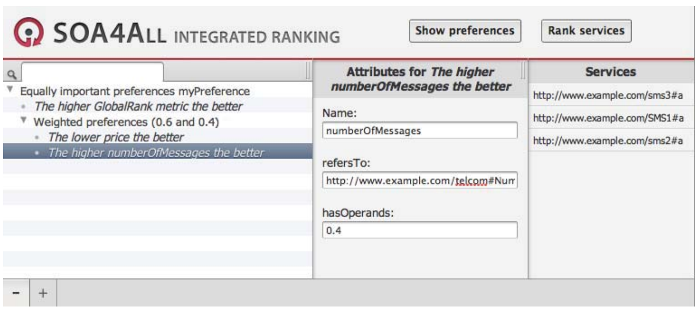

Fig. 2. Screenshot of the preference definition user interface.

[2] An early prototype described in [5] can be found at `http://www.isa.us.es/upsranker`

Furthermore, a user interface to define preferences and rank services accordingly have been developed, using the Google Web Toolkit and based on AcME modeling toolkit[3]. This interface allows the user to easily define preferences based on the discussed model. For instance, in Figure 2, a user has defined a preference that balance the importance of a higher global rank with a multi-criteria preference over a lower price (with an interest value of 0.6) and a higher number of delivered messages (with an interest value of 0.4). Additionally, the interface can also be used to test the integrated preference based ranking implementation, so a set of pre-loaded services can be ranked in terms of the created preferences, using the "Rank services" button.

4 Conclusions

Our presented tool implementation, SOA4All Integrated Ranking, offers a holistic solution to integrate several ranking implementations that provides users with the flexibility to choose and combine any of the preference facilities offered by the other three ranking mechanisms proposed within SOA4All project, making the most of them by exploiting their synergies. Nevertheless, a single user interface for accessing the whole ranking process simplifies the user interaction with the SOA4All discovery and ranking solution. Finally, additional ranking mechanisms may be also integrated with our solution, by identifying corresponding preferences from our common model and implementing an adapter that would be automatically instantiated by PURI.

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[3] `http://www.isa.us.es/acme/`