A Semantic Web Service Alignment Tool

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ABSTRACT
This paper presents a framework for the semantic alignment of Web services within the context of ASK-IT project. This alignment heavily relies on ontologies. The main aim of the presented framework is to enable different service providers to map their Web services against a common ontological framework in order to support the discovery and invocation of services.

Categories and Subject Descriptors
H3.5 [**Online Information Services**]: Web-based services.

General Terms
Design, Standardization.

Keywords
Web services, ontologies, service alignment tool.

1. INTRODUCTION
As the Web service (WS) metaphor becomes the *de facto* standard for information exchange on the Web, two main obstacles limit the possibility for efficient use of those resources. The first obstacle is related to the lack of mechanisms that enable efficient search and discovery of the desired content and functionality offered by the corresponding services. The second one has to do with the capacity to gather information from WSs related to a particular application domain, so that more personalized content and functionality can be provided. Ontologies can be used to describe WSs and thus improving service discovery.

In this paper, we present a service alignment tool that has been motivated by the need for improving the accuracy of WS discovery within the ASK-IT project (*www.askit.org*) -mobility and information needs of mobility impaired (MI) users.

Related work includes semantic annotation of WSs and semantic service discovery. Our main aim is to facilitate the integration of WSs, and WS discovery. Two important initiatives have emerged related to ontologized descriptions of Web services: OWL-S and WSMO. OWL-S defines an upper ontology in the form of a generic *Service* concept. In order to make use of OWL-S upper ontology, the lower ontological levels must be defined. In most cases, ontologized descriptions for WSs are used to support WS discovery. For instance, in [2] an inference engine is used to submit queries to an ontology about atmospheric data. In particular, Web services and SOAP-based interfaces are used to submit the query to the inference engine. This approach is very similar to the one we have deployed in our framework. An alternative method in [1] uses a Semantic Web enabled search engine in order to perform discovery of interconnected geographic information resources. Sriharee [3] developed ontologies that describe a rating model improving the discovery of WSs. In [4] an ontology-based knowledge base describing WSs also facilitates the discovery mechanisms.

Although the aforementioned systems use semantic Web technologies in order to facilitate WS discovery, none of them explicitly provide a tool to enable service providers to align their services with an ontology. In this paper we present such a service alignment tool.

2. SERVICE ALIGNMENT TOOL
The *Service Alignment Tool* (SAT), operates on top of a web-based user-friendly interface (Figure 1).

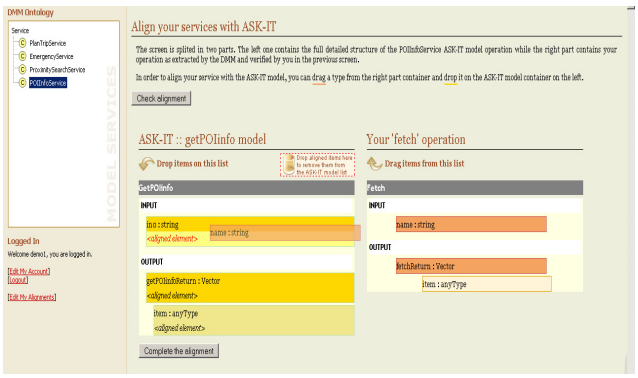

Figure 1. Service alignment tool user interface.

Service providers manage the alignment process of their services being able to establish relationships between the services and the ontologies. WSs are described in the Service ontology by the *Service model* that defines the operations and the structure that should characterize any registered WS.

Before the alignment takes place, SAT collects information about the service providers. A registered provider has the ability to navigate through the supported models as they are defined by the ontology. Service providers co-relate their WSs with the ontologies. By doing so WSs are consistently annotated. The alignment mechanism facilitates a flexible standardization process. In this context, "Similarity" between the ontology and the WS means:

- The inputs of the supported WS operations are identical to the inputs provided by the service model's operations.
- The outputs of the real WS operations are described by the outputs provided by the service model in the ontology.

The service alignment tool allows a service provider to see service operations in the ontology, which are defined in an analogous manner to those in a WSDL file. Furthermore, by clicking on the operation models, the providers can get information about the inputs and outputs that their services must have in order to comply with the model.

Figure 2, illustrates a UML sequence diagram that shows the basic data flow amongst the interacting ASK-IT components when service providers align their services via SAT. Registered services are populated in the ontology and stored in a service repository, becoming in this way visible to the WS discovery software agents. These agents also undertake the responsibility to invoke the requested service through the repository, which is equipped with the appropriate service invocation mechanism using SOAP messages.

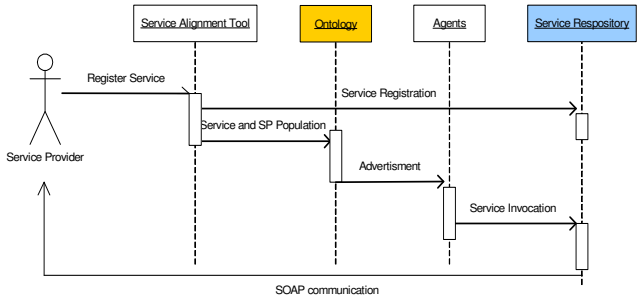

Figure 2. Sequence diagram of the service alignment process.

3. THE DEVELOPED ONTOLOGY

The development of the ASK-IT ontology (available at: *http://askit.iti.gr/ontology/*) was originally motivated by the need to support the access to services and information for elderly and disabled users. A snapshot of the ontology is depicted in Figure 3. It is divided into the following sub-ontologies:

- **Service Ontology**. This includes descriptions about the supported services, the supporting user groups, the supported use cases categories, as well as additional information related to the special needs of MI users.
- **Domain-specific ontologies.** These ontologies deal with the following application domains: a) Transportation, b) Tourism and Leisure, c) Personal Support Services Domain, d) e-Learning and e-Working, e) Social Relations and f) Community Building Domain.

The ASK-IT ontology has been developed by using the Protégé tool and it is available in OWL-DL. The ontology included more than 1400 concepts and 1100 properties.

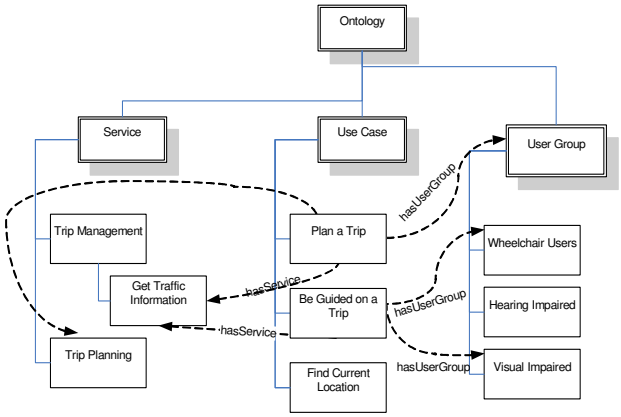

Figure 3. Ontology snapshot.

4. CONCLUSIONS

The need to improve service discovery makes it necessary to have ontologies that support the annotation of WSs; from our pilot studies it has been observed that these ontologies should be highly modular and granular. These requirements are difficult to achieve, not only due to the lack of standards but also because of the diversity of data types. Services like get_route requires not only spatial descriptions but also make use of ambiguous concepts like near_by, before and after. The formalization of these concepts implies an agreement, and the consequent compliance with standards -not yet available. From our initial experiments, pilot tests, our approach worked well; service providers were able to align their WSs. It has also given us evidence supporting the better modularization of our ontologies. Service orchestration could also be benefit from having accurate descriptions for WSs.

5. REFERENCES

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