Towards Semantic Web-Based Yellow Page Directory Services

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Abstract

This paper describes the ongoing work of IWebS (Intelligent Web Services) project, which studies the possibilities of the Semantic Web technology in creating an yellow page directory service for end-users. We propose an ontology-based mechanism for both advertising and finding the services. The essential parts of the system are ontologies for describing and storing service advertisements, a semantic service finder for the end-user, and a semantic service annotation editor for service providers.

1 Introduction

Yellow page directory services[1] on the Web are a widely used business concept for helping people to find companies providing services and selling products. Despite of the versatility of possibilities, it can still be difficult for the end-user to map a need to the services offered [Guarino *et al.*, 1999; De Roeck *et al.*, 1998; Hyvönen *et al.*, 2002]. On the other hand, for the service provider, it may be difficult to index the service in such a way that the end-users would not miss the service. The problems with yellow page services arise in situations, where the end-user is not able to precisely state what kind of service would serve her needs.

The work presented in this paper represents the ongoing work of IWebS (Intelligent Web Services) project[2], which studies the possibilities of the Semantic Web [Berners-Lee *et al.*, 2001] technology in both annotating the services and delivering the relevant services to the end-users. We propose an ontology-based mechanism for both advertising and finding the services. The idea is to let the various actors in the IWebS system—the end-users and the service providers—to use the terms and concepts that they are familiar with. These concepts are then mapped to the ontologies within the system. The general architecture of the IWebS system is depicted in Figure 1. The essential parts of the system are ontologies for describing and storing the service advertisements (the IWebS knowledge base), a semantic service finder for matching the services for the end-user, and a semantic service annotation editor for the service providers.

[1] e.g., http://www.yell.co.uk

[2] http://www.cs.helsinki.fi/group/iwebs/

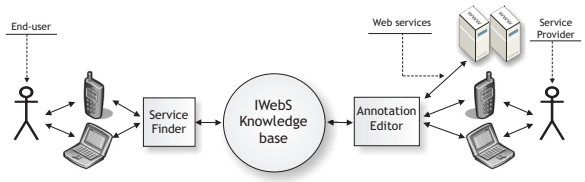

Figure 1: The general architecture of the IWebS system

2 Searching for the Services

In a general user driven information retrieval system the user's input can be collected implicitly (user's context and profile), explicitly by keywords typed by the user, or explicitly by navigation-based input. Based on the input from the user, the system must be able to present the user's problem in such a format that the problem can be solved by the available services.

We propose using restricted terms and relations, described by ontologies, for making the queries and for describing the available services. By using ontologies the user interfaces can be built in such a way that they help and direct the user's action towards semantically sound results.

The user interface is based on the idea of a view-based search [Hyvönen *et al.*, 2004], where the user can make multiple selections from different views on the underlying content. The user can make queries by making selections (restrictions) using one or several views. The results of the query are those resources that match all the restrictions. The view-based search has been extended by a keyword-based search, which provides an additional way to define restrictions to the query.

3 Service Ontologies and Annotation

Service metadata is needed for ontology-based search to function efficiently. The creation of metadata can be done either automatically or manually. Within the IWebS system, the most relevant problems associate to manual annotation; how to get the best possible annotation with a minimal effort from the user, how to automatize the process to its full potential, and how to validate the annotation.

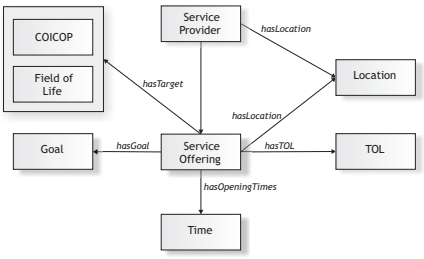

Figure 2: The ontologies and their relationships

3.1 Describing the Services using Ontologies

We are aiming at describing the services as processes, which have goals, targets, and take place in time and location. The services in the IWebS system are described using a set of ontologies, which are goal, target, service provider, service offering, Standard Industrial Classification (TOL) [Statistics Finland, 2002], Classification of Individual Consumption by Purpose (COICOP) [United Nations, Statistics Division, 1999], time, and location. The goal and target ontologies are targeted for specifying the end-users' needs. The service provider, service offering, and the classification ontologies are used for describing the service offerings.

The terms in the goal ontology imply the abstract meaning of several domain specific terms, and aim at giving the user with means to query the services by a common sense. Thus, the user does not have to know any domain specific terms, when querying services from the goal viewpoint.

The product and the "Field of Life" ontologies are used for describing the targets of the service offerings. The product viewpoint is defined by the COICOP.

An instance of a class in the service provider ontology can be anything that is able to provide one or more service. The services in turn are modeled as service offerings. For instance, a barber shop is a service provider, which has two service offerings: making haircuts and selling hair lacquers. The ontologies are bound together using properties, as depicted in Figure 2.

3.2 Using an Annotation Editor for Creating Service Annotations

We are developing a user friendly annotation editor, which uses the multi-view-based user interface to guide the annotator to make correct annotations based on the ontologies. For example, the annotator can start the annotation by classifying the service to some inland location in the location ontology. Then, the other ontologies will be restricted so that the system guides the annotator to a reasonable annotation. In this situation, a service classification ontology would be restricted so that it would not be possible to annotate the service to "waterborne-traffic"-class, since the location is (based on the ontological knowledge) far away from water.

Based on the ontologies, annotation recommendations could be created suggesting services that the annotator would offer. Recommendations are based on ontological rules and existing annotations. For example, a user annotating her service as a barber shop could be asked, if her shop also sells hair lacquers, as most of the other barber shops do.

4 Conclusion and Future Work

In this paper we described the work being done in the IWebS project, which studies the possibilities of the Semantic Web technology in both annotating the services and delivering the relevant services to the end-users. The IWebS system utilizes ontologies in both queries and service annotations. The baseline idea is to let the end-user and the service provider to use the terms and concepts that they are familiar with.

The current version of the IWebS system provides both keyword and navigation-based user interface for querying services. In the future we are improving the query interface so that the end-user does not have to know explicitly what she is looking for. We are aiming at a solution, where the end-user only needs to express her problem to the IWebS system, which in turn infers what kind of services could solve the problem. We will also cover dynamic content, whose availability to the end-user depends on the contexts where both the end-user and the service provider are.

Acknowledgements

This work was funded by the National Technology Agency Tekes, Fonecta, TeliaSonera, and TietoEnator.

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