Chapter 26
Semantic Annotation of Geospatial RESTful Services Using External Resources

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ABSTRACT

RESTful services are increasingly gaining traction over Web Services (WS-*). As with WS-* services, their semantic annotation can provide benefits in tasks related to their discovery, composition, and mediation. In this chapter, the authors present an approach to automate the semantic annotation of geospatial RESTful services using a cross-domain ontology like DBpedia, domain ontologies like GeoNames, and additional external resources (suggestion and synonym services). They use combinations of these resources to discover meanings for each of the parameters of the geospatial RESTful services and perform semantic annotations of them.

INTRODUCTION

In recent years, since the advent of Web 2.0 applications and given some of the limitations of "classical" Web services (WS-*) based on SOAP, WSDL, and Open Geospatial Consortium (OGC) services, Representational State Transfer (REST) services have become an increasing phenomenon.

Machine-oriented Web applications and APIs that are conformant to the REST architectural style (Fielding, 2000), normally referred to as RESTful Web services, have started appearing mainly due to their relative simplicity and their natural suitability for the Web. Nowadays the largest online repository of information about Web 2.0 mashups and APIs is ProgrammableWeb.com. This aggregator site provides information on 5,465 mashups and 2,647 APIs that were registered be-

tween September 2005 and December 2010, as of the time of the writing of this chapter. Mashups tagged as "mapping" represent a 34% mashups (2,411 mashups) of the listed ones, what represents the importance of geospatial information in the generation of these applications. With respect to APIs, GoogleMaps is the most used with a 42%, that is, this API is used on 2,149 mashups. These data show the importance of geospatial information in the context of the REST world.

However, using geospatial RESTful services still requires much human intervention since the majority of their description pages are given in the form of unstructured text in a Web page (HTML), which contains a list of the available operations, their Uniform Resource Identifiers (URIs) and parameters (also called attributes), expected output, error messages, and a set of examples of their execution. This hampers the discovery, composition and mediation between services, which may be required in the development of applications, and which are also important tasks in WS-* approaches.

An approach in order to solve this difficulty is to think of semantic annotation activities of these services.

Besides, it can also play an important role in the Semantic Web by providing data to semantic software agents, as can be seen in (Ferreira, et al.,2009; Alarcon, et al., 2010).

Semantic annotation refers to the task of attaching meaningful descriptions to the service and the served geospatial data or processes (Maué, et al., 2009). Traditionally, semantic annotation approaches for services have focused on defining formalisms to describe services, and have been normally applied to WS-* service description formalisms and middleware. More recently, these (usually heavyweight) approaches have started to be adapted in a more lightweight manner for the semantic description of RESTful services (Maleshkova, et al., 2009a; Kopecký, et al., 2008; Lathem, et al., 2007). However, most of the processes related to the annotation of RESTful

services (Maleshkova, et al., 2009b; Alowisheq, et al., 2009) still require a large amount of human intervention. First, humans have to understand the informal descriptions provided in the RESTful service description pages, and then the semantic annotation of RESTful services has to be automated as much as possible.

In this chapter, we address these two main challenges by: (1) providing syntactic descriptions of geospatial RESTful services that allow their automatic registration and invocation, and (2) interpreting and enriching the geospatial RESTful services' parameters, by means of their semantic annotation.

The main contribution of our work is an approach to perform an automatic lightweight semantic annotation process of RESTful services. This process is implemented in a system, which takes into account a cross-domain and a geospatial ontology (DBpedia ontology combined with GeoNames ontology), its SPARQL Endpoint, as well as different external resources such as synonyms and suggestion services. We use combinations of these resources to discover meanings for each of the parameter of the RESTful services and perform semantic annotations of them. These semantic annotations might provide benefits in tasks related to discovery, composition, and mediation of these services. Furthermore, semantic annotations of RESTful services might help to developers and users in the creation of mashups.

The remainder of this paper is structured as follows: Next, we present background in the context of semantic annotation of WS-* and RESTful services (from a general and geographical viewpoint). Later, we introduce our approach for automating the annotation of RESTful services, including explanations on how we derive their syntactic description and semantic annotation. Finally, we present some conclusions of this chapter and identify future lines of work.

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