Chapter 20
Methodologies for Augmented Discovery of Geospatial Resources

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ABSTRACT

Presently, solutions for geo-information sharing are mainly based on Web technologies, implementing service-oriented frameworks, and applying open (international or community) standards and interoperability arrangements. Such frameworks take the name of Spatial Data Infrastructures (SDIs). The recent evolution of the World Wide Web (WWW), with the introduction of the Semantic Web and the Web 2.0 concepts and solutions, made available new applications, architectures, and technologies for sharing and linking resources published on the Web. Such new technologies can be conveniently applied to enhance capabilities of present SDIs—in particular, discovery functionality.

Different strategies can be adopted in order to enable new ways of searching geospatial resources, leveraging the Semantic Web and Web 2.0 technologies. The authors propose a Discovery Augmentation Methodology which is essentially driven by the idea of enriching the searchable information that is associated with geospatial resources. They describe and discuss three different high-level approaches for discovery augmentation: Provider-based, User-based, and Third-party based. From the analysis of these approaches, the authors suggest that, due to their flexibility and extensibility, the user-based and the third-party based approaches result more appropriate for heterogeneous and changing environments such as the SDI one. For the user-based approach, they describe a conceptual architecture and the main components centered on the integration of user-generated content in SDIs. For the third-party approach, the authors describe an architecture enabling semantics-based searches in SDIs.

INTRODUCTION

In recent years, the World Wide Web (WWW) has undergone several important changes in terms of available applications, architecture, and related technologies. The need for a more effective resource sharing through the Web raised awareness on efforts aiming to enable machine-to-machine applications on top of the Web architecture by making semantics explicit. These efforts are currently coordinated in the W3C Semantic Web Activity which "provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries […]. It is based on the Resource Description Framework (RDF)" (W3C, 2011). At the same time, new use cases, new available applications and technologies have made possible the WWW revolution which is known as Web 2.0 (O'Reilly, 2005). This term actually refers to an entirely new paradigm in the use of the Web as a platform for applications characterized by features like: delivery of services instead of packaged software, with cost-effective scalability; control over unique, hard-to-recreate data sources that get richer as more people use them; trusting users as co-developers; harnessing collective intelligence; leveraging the long tail through customer self-service; design of software above the level of a single device; lightweight user interfaces, development models, and business models (O'Reilly, 2005; O'Reilly & Battelle, 2009).

These two main changes jointly make new resources available, and new technologies to discover them through semantic relationships. Unavoidably, these changes would and should affect the geo-information sharing domain that is mostly based on web paradigms and technologies. Recently many efforts aim to provide more powerful tools for the discovery of geospatial information that is made available through traditional or Web 2.0 services, basing on explicit or implicit semantics (Klien, et al., 2004; Smits & Friis-Christensen, 2007; Lemmens, et al., 2006; NASA-JPL, 2011).

Information technology and geo-science are worlds in continuous change. Semantics and Web 2.0 are the present challenges, but new ones will emerge in the future. This raises the conceptual issue of enhancing geospatial information discovery capabilities in order to accommodate present and, possibly, future needs. This chapter describes two approaches based on the methodology of augmenting semantically the discovery process to enhance the search and retrieval of geospatial resources.

Data Discovery in the Geospatial Information Domain

It is estimated that more than 80% of data that human beings have collected so far are geospatial data in a wide sense (Frankling & Hane, 1992; MacEachren & Kraak, 2001), i.e. data with an explicit or implicit spatial/temporal reference. Moreover, this spatial/temporal reference is relevant, and even fundamental, for many applications. Therefore, it is of major importance to be capable of discovering geospatial data according to their content and geospatial characteristics (i.e., spatial coverage and temporal extent), and to effectively describe them.

Presently, solutions for sharing geo-information implement service-oriented frameworks applying open (international or community) standards and interoperability arrangements (Nativi, 2010). Such frameworks take the name of Spatial Data Infrastructures (SDIs). Typically, in service-oriented frameworks such as SDIs, discovery functionalities are provided by catalog components. A formal definition of these components is given by the ISO/TC211-Geographic Information/Geomatics, stating that a catalog service is a "service that provides discovery and management services on a store of metadata about instances. The metadata may be for dataset instances, e.g., dataset catalogue, or may contain service metadata, e.g., service catalogue" (ISO, 2003b). At present,

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