Chapter 10

# Ontological and Semantic Technologies for Geospatial Portals

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## ABSTRACT

*A geospatial portal is a repository of distributed geospatial data, tools and services, and supports the publishing, management, search, use and sharing of the resources. Geospatial portals have been developed as clearinghouses, metadata portals, data warehousing, and recently geospatial portals incorporated the Service Oriented Architecture and distributed computing to make service-oriented portals. In addition to software and computational challenges, ontology and semantics play an increasingly important role in geospatial portals due to the demand of interoperability. The interoperation and communication of data, tools and services become critical when heterogeneous resources are consolidated and exchanged on geospatial portals. This chapter provides an updated overview of geospatial portals followed by detailed discussion on how the ontological and semantic technologies are incorporated into geospatial portals. Three recent research and practice of geospatial portals are briefly introduced as the case studies of service-oriented portals.*

## INTRODUCTION

With advanced methods of geospatial data collection and increasing demands of georeferenced data and geoprocessing, sharing and interoperating geospatial resources (data, tools and services) becomes critical and useful. Geospatial portals support the publishing, delivering and thus sharing of geospatial resources. There have been several review articles of geospatial portals in terms of

their software architecture and applications (Goodchild, Fu, & Rich, 2007; Tang, Selwood, 2005). This chapter starts with an updated overview of the concept and practice of geospatial portals, and introduces how the ontological and semantic technologies influence geospatial portals.

## GEOSPATIAL PORTALS

The terms Web-based *portal* and *geospatial portal* have been overused leading to much confusion. A Web portal is a gateway to the distributed Internet-based resources, including Web pages, data, tools, Web Services, etc. Geospatial portals, also called geoportals, may be understood from their architecture as a Web-based system and from their functions.

- The Web system view. A geospatial portal is a Web site that assembles Internet-based resources and provides an entry point to these resources (Tait, 2005; Tang & Selwood, 2005, p. 13).
- The function view. A geospatial portal "organize[s] content and services such as directories, search tools, community information, support resources, data and applications" (Maguire and Longley, 2005), and provides functions such as the "search, evaluation, and downloading, and in some cases licensing or purchase" of geographic information (Goodchild, Fu, & Rich, 2007).

A geospatial portal is a repository of distributed geospatial data, tools and services, and supports the publishing, management, search, use and sharing of the resources. The output of geospatial portals may be the links to downloadable data, Web Services to be integrated into other applications, or just the contact information of resource providers. According to this definition, many client-server Web-based systems that facilitate data storage, browse and query may not be considered as fully functioning geospatial portals in this paper.

The development of geospatial portals was driven by declined cost of data collection and data application, technical development and governmental initiatives. The major technical contributions may include database warehousing, Service Oriented Architecture (SOA), XML and Web Services, etc. Specifically, in geographic information community, the wide adoption of Geography Markup Language (GML), OGC Web Services, ISO geospatial standards, and distributed geographic information systems have significantly influenced the system architecture and the application of geospatial portals. On the other hand, geospatial portals have been promoted by two governmental initiatives: Spatial Data Infrastructures (SDI) and electronic government (or, e-government) (Homburg, 2008; Mayer-Schonberger & Lazer, 2007). Both initiatives, implemented by a majority of the countries in the world, encourage the sharing of (geospatial) data, information and knowledge in order to support transparent and effective decision making.

## THE CLASSIFICTION OF GEOSPATIAL PORTALS

Since 1990s, geospatial portals have been developed at different stages as clearinghouses, metadata portals, and data warehousing. Recently, geospatial portals start to incorporate SOA and distributed computing to make service-oriented portals. This classification is not clear cut and some portals may be a hybrid of several categories of portals. In fact, a newer type of portal usually includes the functions of the older ones, and some portals continue to evolve by augmenting new advanced technologies on the top of current portals.

Initially designed as the major component of the U.S. National SDI (NSDI), a data clearinghouse is defined as "a distributed network of geospatial data producers, managers, and users linked elec-

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