Chapter 7
VISION:
An Infrastructure for Semantic Geospatial Web Services

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ABSTRACT

Over the past years, many research projects and initiatives have provided heterogeneous building blocks for the so called Semantic Geospatial Web. The number of proposed architectures and developed components impede a definition of the state of the art, comparisons of existing solutions, and the identification of open research challenges. This chapter provides the missing generic specification of central building blocks. Focusing on service based solutions; VISION (VIsionary Semantic service Infrastructure with ONtologies) is introduced as a means to depict required components at a generalized level. The VISION architecture highlights the most important services for the Semantic Geospatial Web and brings structure to the numerous past and present partial solutions. Model-as-a-Service (MaaS) is introduced as a central concept for encapsulating environmental models. This has great potential to be a major part of future information infrastructures. The German-funded GDI-GRID project serves illustrating examples for MaaS and arising interoperability challenges. This paper will focus on VISION, and compare it with two other recent research projects and conclude by identifying major areas for future research on Semantic Geospatial Web Services and supporting infrastructures.

INTRODUCTION

Envisioning a Semantic Spatial Web, Max Egenhofer coined the notion of the Semantic Geospatial Web as a step-stone, which is topic to the geospatial science community (Egenhofer 2002). The Semantic Web (Berners Lee et al. 2001) already provides means for re-organizing the data offerings of the World Wide Web (WWW). Solutions for sophisticated information retrieval are in place (Manning et al. 2008). Now the geospatial science community has to provide geospatial and temporal ontologies in conjunction with according query mechanisms and tools. Enabled reasoning should enhance information retrieval within and beyond geospatial information communities, as well as human computer interaction.

Many research projects address these challenges by using Web Service technology. In this context, basic data structures and interfaces of central services are standardized for the Semantic Web (W3C 2009, Turhan et al. 2006) and for spatial data infrastructures (SDI) (Nebert 2004). The combination of both provides well developed foundations for implementing the Semantic Geospatial Web (Janowicz et al. 2010, forthcoming). Still, it remains hard to coin the main benefits and drawbacks or to compare different solutions to geospatial decision support with each other. Arising research fields cannot be clearly identified. In order to proceed, we miss a generic functional specification of a Semantic Geospatial Web Service infrastructure.

In this chapter, we present such a description. We promote the VISION (VIsionary Semantic service Infrastructure with ONtologies) architecture, which generalizes over a literature review and applied research in combining Semantic Web, Geospatial Web and service oriented architectures. Core components of the Semantic Geospatial Web are identified and required functionality is grouped on a technology-independent level. The VISION architecture enables us to explain central building blocks of a Semantic Geospatial Web instead of

Figure 1. Overview of the VISION architecture
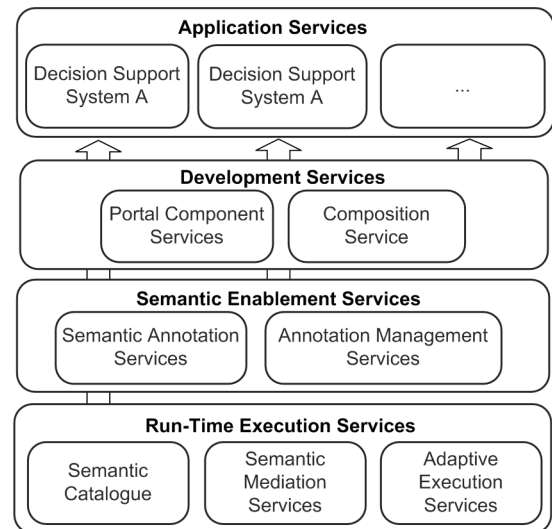
getting lost in implementation details and existing partial solutions. Figure 1 gives first insights.

Application Services, which are (geospatial) decision support systems (Densham 1991), make use of *Deployment Services* for building their required front-ends, services supporting semantic annotations of the required kinds, and execution services. A framework of frequently required components for portal development and a tool for composing basic services is provided at intermediate level. *Semantic Enablement Services* are divided into such tools that support annotating resources and visualizing annotations, and such, which manage annotations optionally including versioning. *(Run-Time) Execution Services* provide the foundation of the architecture, as they serve the most basic functionalities (access to data and processing), means for component retrieval, and execution environment(s) for service compositions.

In order to address the provision, retrieval and execution of environmental models, we integrate recently coined notion of Model-as-a-Service (MaaS) into the VISION architecture (Roman et al. 2009b). MaaS has evolved as a merge of the model web (Geller and Turner, 2007) and

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