Chapter XXIII
Geospatial Semantic Web:
Critical Issues

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ABSTRACT

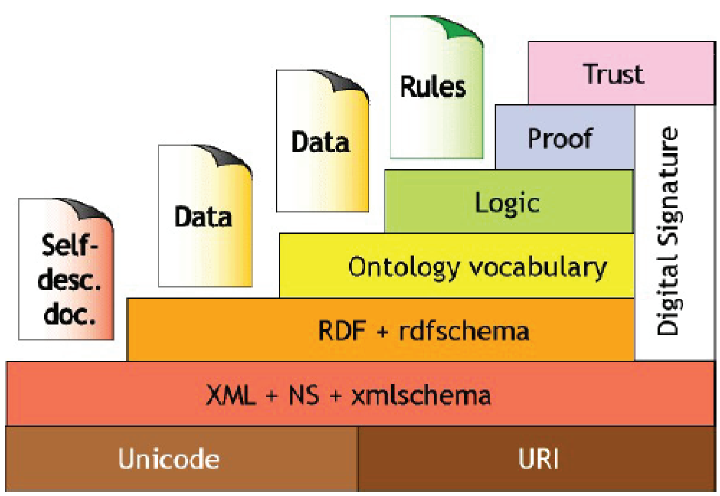
The Semantic Web technology provides a common interoperable framework in which information is given a well-defined meaning such that data and applications can be used by machines for more effective discovery, automation, integration and reuse. Parallel to the development of the Semantic Web, the Geospatial Semantic Web – a geospatial domain-specific version of the Semantic Web, is initiated recently. Among all the components of the Geospatial Semantic Web, two are especially unique – geospatial ontology and geospatial reasoning. This paper is focused on discussing these two critical issues from representation logic to computational logic.

INTRODUCTION

Inspired by Tim Berners-Lee (Berners-Lee, 1998; W3C, 2006), inventor of the Web, a growing number of individuals and groups from academia and industry have been evolving the Web into another level - the Semantic Web. By representing not only words, but their definitions and contexts, the Semantic Web provides a common interoperable framework in which information is given a well-defined meaning such that data and applications can be used by machines (reasoning) for more effective discovery, automation, integration and reuse across various application, enterprise and community boundaries. Compared to the conventional Web, the Semantic Web excels in two aspects (W3C, 2006): 1) common formats for data interchange (the original Web only had interchange of documents) and 2) a language for recording how the data relates to real world objects. With such advancements, reasoning engines and Web-crawling agents can go one step further – and inductively respond to questions such as "*which airfields within 500 miles of Kandahar support C5A aircraft?*" rather than simply returning Web pages that contain the text "airfield" and "Kandahar", which most engines do today.

Figure 1 shows the hierarchical architecture of the Semantic Web. At the bottom level, XML (Extensible Markup Language) provides syntax to represent structured documents with a user-defined vocabulary but does not necessarily guarantee well-defined semantic constraints on these documents. And XML schema defines the structure of an XML document. RDF (Resource Description Framework) is a basic data model with XML syntax that identifies objects ("resources") and their relations to allow information to be exchanged between applications without loss of meaning. RDFS (RDF Schema) is a semantic extension of RDF for describing the properties of generalization-hierarchies and classes of RDF resources. OWL (Web Ontology Language) adds vocabulary to explicitly represent the meaning of terms and their relationships, such as relations between classes (e.g. disjointness), cardinality (e.g., "exactly one"), equality and enumerated classes. The logic layer represents the facts and derives knowledge, and deductive process and proof validation are deduced by the proof layer. A digital signature can be used to sign and export the derived knowledge. A trust layer provides the trust level or a rating of its quality in order to help users building confidence in the process

Figure 1. Semantic Web architecture (Berners-Lee, 2000)



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