Chapter XXIV
Geospatial Web Service Chaining

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ABSTRACT

In the context of Geographic Information System's evolution from monolithic systems to personal desktop GIS and then to collections of remote Internet services, we discuss the combination or chaining of distributed geospatial web services. The adoption of web services technology provides remote access to a diverse and wide array of geospatial datasets and allows developers to create web applications (web browser-based or GIS client-based), hiding the underlying server functionalities from their public interfaces. A major challenge in working with these remote services, as opposed to a single desktop application, is to properly integrate ad hoc services to build a coherent service chain; this is especially tricky in real-time scenarios where web applications need to be built on-the-fly. This chapter discusses strategies for geospatial web service chaining and poses some challenging issues, many related to semantics, to be resolved for geospatial web service chaining to become a commonplace activity.

INTRODUCTION

The development of Geographic Information Systems (GIS) has been highly influenced by the overall progress of Information Technology (IT). These systems evolved from monolithic systems to become personal desktop GIS with all or most data held locally and then again to the Internet GIS paradigm in the form of Web services (Peng & Tsou, 2001). The highly distributed web services model is such that geospatial data are loosely coupled with the underlying systems used to create and handle them, and geo-processing functionalities are made available as remote, interchangable, interoperable, and specialized geospatial services.

In recent years the software industry has moved away from complex architectures such as CORBA (Common Object Request Broker Architecture) (Vinoski, 1997) toward more universal and easily defined architecture based on already-implemented Internet protocols (Kaye, 2003). The success factor of Web services technology has been to promote service integration and interoperability among heterogeneous distributed information sources, without leaving the well-known and accepted Internet (Web) architecture. This has led to *de facto* standards for delivery of services such as Web Service Description Language (WSDL) to describe the functionality of a service, Simple Object Access Protocol (SOAP) to encapsulate web service messages, and Universal Description, Discovery, and Integration (UDDI) to register and provide access to service offerings. Alternative service architectures such as Representational State Transfer, or REST, (Fielding, 2000) exist as well; however the former de facto standards have dominated. Perhaps the most beneficial characteristic of Web services technology is to provide not only access to individual Web services but also integrate several services assembling a new value-added service chain. Adoption of Web services technology as an option to fixed, monolithic GIS is an emerging trend, due in part to the diversity and complexity of geospatial data, especially in real-time scenarios such as emergency response, where information systems often need to be built on-the-fly (Lemmens et al., 2006).

CHAINING GEOSPATIAL SERVICES

Interoperability, or the ability of software components to interact with minimal knowledge of the underlying structure of other components, has become a basic requirement for distributed information systems (Sheth, 1999), and so it is also critical to GIS and to geospatial web services. The Open Geospatial Consortium (OGC) has formed working groups within the GIS community to foster interoperability between geodata and geospatial services in order to define well-established interfaces to a wider range of geospatial web services (Whiteside, 2005). Table 1 lists a sample of key geospatial web services interfaces as defined by OGC.

The notion of chaining of geospatial web services (Alameh, 2003) emerged as a mechanism for assembling or combining individual geospatial web services to create customized web applications. A simple chain of the above listed geospatial web services may be that constructed to produce a coverage portrayal service (CPS) that assembles an image retrieved from various web coverage services (WCS) and portrays it to a web coordinate transformation service (WCTS) for the transformation of the composite image into another coordinates reference system for proper alignment with other geodata (Alameh, 2003).

The OGC and ISO Technical Committee 211 (ISO/TC211) have jointly developed international standards for geospatial service architecture and have defined interoperable geospatial web service interfaces (ISO 19119, 2005; Percivall 2002). Transparent, translucent and opaque service-chaining approaches have been defined by these organizations according to the degree of transparency of the web service chain complexity to the client:

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