Chapter XXXIV
Semantic Web Services for Healthcare

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ABSTRACT

This chapter explores the ongoing efforts to integrate Web services and the Semantic Web for the purposes of sharing knowledge, enabling access to services, and application integration in distributed clinical environments. Combining the Semantic Web and Web services in relation to the healthcare domain, results in Semantic Web services for healthcare, which will enable intelligent interpretation of healthcare data by services such as clinical decision support systems. Critical issues in ontology standardization and security are discussed. The multidisciplinary problem of service composition is presented with emphasis on the role healthcare experts play in identifying value-added medical services.

NEXT-GENERATION INTERNET: THE SEMANTIC WEB AND WEB SERVICES

The Semantic Web and Web services are two complementary and evolving technologies that will change the face of healthcare delivery. Healthcare IT experts predict that in the future, healthcare services will be offered as interchangeable Semantic Web services used in distributed but related medical domains. According to Hoffman (2003, p. 54), "Entire ecosystems of electronic services will be built around specific industries, providing specific processes to solve specific problems for specific types of customers, through specific transaction chains."

Web services constitute an important emerging technology for which potential applications are unlimited. Stafford (2003, p. 27) explains that "if a provider can imagine a way of delivering something of value to a customer to provide some usefulness … they have a viable Web service." Web services are based on a service-oriented system architecture, in which providers assess which applications they can offer as services to different groups of potential users. There are three main roles in a service-oriented architecture: a provider, a consumer, and a directory. In the case of a Web-services system, the provider publishes descriptions of its Web services in a directory, which is accessible by the consumer. Once the consumer selects a service, the consumer and the service are dynamically bound, for example, at run time. The publish-find-bind model of interaction enables the loose coupling of providers and consumers and, thus, increases the agility, flexibility, and adaptability of distributed systems (Tosic, 2004).

Web services facilitate integration and interoperability because the underlying implementation and deployment platform are not relevant to the application invoking the service. There are three key components of Web-service systems with three major corresponding XML- (extended markup language) based standardization initiatives proposed by the World Wide Web Consortium (W3C) to support the interactions among Web services.

- **Delivery:** Comprises all technologies required to transport a service request from the client to the server, including XML for message encoding, and SOAP (previously known as the simple object access protocol, now considered a misnomer) for handling the transmission of XML-formatted data.
- **Description:** A Web-service interface provides a collection of operations accessible through standardized XML messaging. This interface is described using the Web services description language (WSDL), which specifies the operations provided by a Web service (Graham, 2003).
- **Discovery:** The service requestor discovers the Web service via discovery agencies, such as universal description discovery and integration (UDDI), which allows service descriptions to be published and discovered.

Adding semantics to the Web is a necessary component toward realizing Web services' goal of application-to-application integration. To this end, the next-generation Internet will be the Semantic Web. The vision of the Semantic Web is to associate meaning to all Web resources such that they can be discovered and consumed autonomously by applications (Berners-Lee, Hendler, & Lasilla, 2001), making the Semantic Web a meaningful indexed repository of documents and services (Lee, Patel, Chun, & Geller, 2004). Currently, the interpretation of Web-based information requires human knowledge and intuition; both humans and machines could interpret the Semantic Web.

Schweiger, Brumhard, Hoelzer, and Dudeck (2005, p. 274) claim that because the Web and healthcare systems are both "little organized systems of distributed data," innovations in Web technology are particularly relevant to the healthcare industry. As such, the development of the Semantic Web will impact healthcare in numerous ways, such as in retrieving information from multiple disparate databases so that patient mobility will not affect the continuity of individual care and the transfer of patient information (Sun, 2004), and in enabling machines to