CS565
Simulation, Verification and Composition of Web Services

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Semantic Web

Introduction

Semantic Web currently is contained in more than four million Webdomains based on a survey done in 2013. But what is exactly the Semantic Web? The Semantic Web is an extension of the web though standards defined by the World Wide Web Consortium (W3C). These standards promote common data formats and exchange protocols on the Web, most fundamentally the Resource Description Framework (RDF). According to the W3C, "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries". The term was coined by Tim Berners-Lee for a web of data that can be processed by machines. While its critics have questioned its feasibility, proponents argue that applications in industry, biology and human sciences research have already proven the validity of the original concept.

Standards

As we said before, the standardization of Semantic Web in the context of Web 3.0 that was defined by Tim Berners-Lee is under the care of W3C. When we talk about standardization we mean the standardization of the formats and the technologies that enable the Semantic Web. These technologies include:

- Resource Description Framework (RDF), a general method for describing information
- RDF Schema
- Simple Knowledge Organization System (SKOS)
- SPARQL, an RDF query language

- Notation3 (N3), designed with human-readability in mind
- Turtle (Terse RDF Triple Language)
- Web Ontology Language (OWL), a family of knowledge representation languages
- Rule Interchange Format (RIF), a framework of web rule language dialects supporting rule interchange on the Web

Applications

All these standards enabled us to enhance the usability and the usefulness of the Web and its interconnected resources through.

- Servers which expose existing data systems using the RDF and SPARQL standards. Many converters to RDF exist from different applications. Relational databases are an important source. The semantic web server attaches to the existing system without affecting its operation.
- Documents "marked up" with semantic information (an extension of the HTML <meta> tags used in today's Web pages to supply information for Web search engines using web crawlers). This could be machine-understandable information about the human-understandable content of the document (such as the creator, title, description, etc.) or it could be purely metadata representing a set of facts (such as resources and services elsewhere on the site).
- Common metadata vocabularies (ontologies) and maps between vocabularies that allow document creators to know how to mark up their documents so that agents can use the information in the supplied meta-data.
- Automated agents to perform tasks for users of the semantic web using this data
- Web-based services (often with agents of their own) to supply information specifically to agents, for example, a Trust service that an agent could ask if some online store has a history of poor service or spamming.

Take notice of the last bullet because we are going to analyze Web-based services much more and all the challenges its simulation, verification and composition of these services might bring. But before that a quick introduction about what exactly a web service is.

Web Services

Introduction

A Web service is a method of communication between two electronic devices over a network. It is a software function provided at a network address over

the Web with the service always on as in the concept of utility computing. The W3C defines a Web service generally as:-

> a software system designed to support inter operable
> machine-to-machine interaction over a network.

Web services have automated tools to help generate them. There are approached both bottom-up and top-down oriented. Web services can exist without the necessary presence of the semantic web. Though, combining both the technologies provided by the web services and the semantic web it can give a major advantage and enrich the experience of the users.

Semantic Web Services

Semantic Web Services, like conventional web services, are the server end of a clientserver system for machine-to-machine interaction via the World Wide Web. Semantic services are a component of the semantic web because they use markup which makes data machine-readable in a detailed and sophisticated way (as compared with human-readable HTML which is usually not easily "understood" by computer programs).

The reasons that we were not satisfied with the already existing services is that we have yet problems to address that could be solved using the principles of the semantic web.

The mainstream XML standards for inter operation of web services specify only syntactic interoperability, not the semantic meaning of messages. For example, Web Services Description Language (WSDL) can specify the operations available through a web service and the structure of data sent and received but cannot specify semantic meaning of the data or semantic constraints on the data. This requires programmers to reach specific agreements on the interaction of web services and makes automatic web service composition difficult.

Semantic web services are built around universal standards for the interchange of semantic data, which makes it easy for programmers to combine data from different sources and services without losing meaning.

Currently, Semantic Web services platform use Web Ontology Language(OWL) to allow data and service providers to emantically describe their resources using third-party ontologies like Simple Semantic Web Architecture and Protocol (SSWAP) But the creation and usage of OWL is based on other languages like DARPA Agent Markup Language (DAML) or Ontology Inference Layer (OIL). DAML and OIL were combined and DAML+OIL was created.