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Web Semantics and Services

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Abstract—the next web generation promises to deliver Semantic Web Services (SWS) that are self-described and amenable to automated discovery, composition and invention. The emergence of social web has resulted in tremendous growth on data available in the web and also makes enormous growth on textual electronic data. The web page consists of millions and billions of information that are unarranged and unstructured. So retrieving the exact information is very difficult for the user. In this paper, we survey the state of the art of current enabling technologies for Semantic Web Services. In addition, we characterize the infrastructure of Semantic Web Services along three orthogonal dimensions: activities, architecture and service ontology.

1 Introduction

When it comes to searching for specific results, the semantic web approach is a bit different from the standard search.The web pages with millions of information are accessible only through the humans, because similar information can be repeated and according to the keywords it shows the result. It's quietly impossible to do such works by the machines or robots. But this Semantic Web service allows the machines or robots to access the exact required in the semantic web service is a technology used to get the exact and rapid information of what we need. This Semantic Web service was coined by Tim-burners lee who was also the founder of World Wide Web (WWW) and the director of the World Wide Web Consortium (W3C). The semantic web Services is like common web service connected via WWW. The semantic web service platform uses OWL (web Ontology Language) to allow data and service.

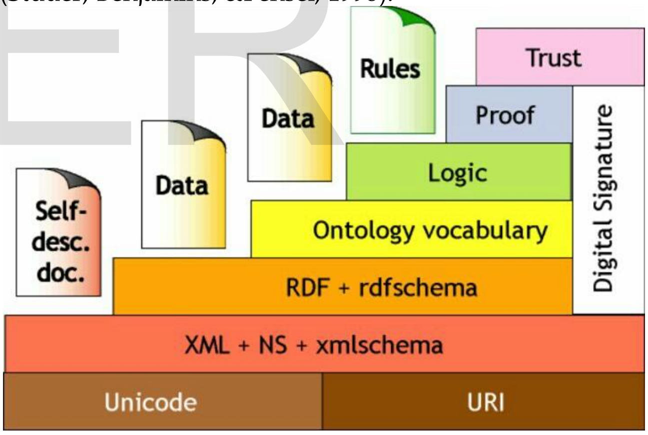
2 SemanticWeb Overview

Semantic Web is not the separate web but it is theextension of the current web which make possibleinformation to share and reuse.SWT provides such environment so that machines can talk with each other tofulfil the needs of the user by providing the rightinformation. To accomplish this task, SWT uses thenumber of techniques like Ontology, RDFs, XML andSPARQL. There is a number of important issues related to the Semantic Web. Roughly speaking, they belong to four categories:

Semantic Web languages, ontologism, semantic markup of Web pages, and Semantic Web services. In order to represent information on the Semantic Web and simultaneously make that information both syntactically and semantically interoperable across applications, it is necessary to use specific languages. It is important for Semantic Web developers to agree on the data's syntax and semantics before hard-coding them into their applications, since changes to syntax and semantics necessitate expensive application modifications RDF is a framework to represent data about data(metadata), and a model for representing data about "things on the Web" (resources). It comprises a set of triples (O, A, V) that may be used to describe any possible relationship existing between the data –Object, Attribute and Value.

2.1 Ontology's

Ontology is defined as a formal, explicit specification of a shared conceptualization. Conceptualization refers to the construction of an abstract model of some phenomenon in the world by identifying its basic associated concepts. Explicit means that the type of concepts used, and the constraints of their use, are explicitly defined. Formal refers to the fact that the ontology should be machine-readable. Shared reflects the notion that an ontology captures consensual knowledge, that is, it is not private of some individual, but accepted by a group.[DOC 1] (Studer, Benjamins, &Fensel, 1998).



In (Neches et al., 1991), a definition focused on the form of an ontology is given. An ontology defines the basic terms and relations comprising the vocabulary of a topic area as well as the rules for combining terms and relations to define extensions to the vocabulary
Ontologies applied to the Web are creating the Semantic Web.Ontology's provide the necessary armature around which knowledge bases should be built , and set grounds for developing reusable Web-contents, Web-services, and applications. Ontologies facilitate knowledge sharing and reuse, i.e. a common understanding of various contents that reaches across people and applications. Technically, an ontology is a text-based piece of reference-knowledge, put somewhere on the Web for agents to consult it when necessary, and represented using the syntax of an ontology representation language

It is important to understand that most of them

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are built on top of XML and RDF. By 2004, the most popular higher-level ontology representation languages were OIL (Ontology Inference Layer) and DAML+OIL.Ontology developed in any such language is usually converted into an RDF/XML-like form and can be partially parsed even by common RDF/XML parsers Of course, language-specific parsers are necessary for full-scale parsing. There is a methodology for converting an ontology developed in a higher-level language into RDF or RDFS.

2.2 SPARQL

The Simple Protocol and RDF Query Language (SPARQL) is a SQL like RDF query language for databases,able to retrieve and manipulate for any data stored inResource Description Framework.

2.3 Meta Data

Metadata means the data about the data which is used todescribe data. It is used to understand more about the webdocument data.

3 Approach

3.1 Owl-Approach

The OWL is a semantic language designed to represent rich and complex knowledge about things,groups of things and relation between things.

OWL-S consists of a set of ontologies designed for describingand reasoning over service descriptions. OWL-S approach originated from an AI-background and has previously been used to describe agent functionality within severalMulti-Agent Systems as well as with a variety of planners to solve higher levelgoals.

OWL-S combines the expressivity of description logics (in this case OWL) and thepragmatism found in the emerging Web Services Standards, to describe services thatcan be expressed semantically, and yet grounded within a well-defined data typingformalism. It consists of three main upper ontologies: the Profile, Process Model andGrounding. The Profile is used to describe services for the purposes of discovery; servicedescriptions (and queries) are constructed from a description of functional properties(i.e. inputs, outputs, preconditions, and effects - IOPEs), and non-functionalproperties (human oriented properties such as service name, etc, and parameters for defining additional meta data about the service itself, such as concept type or qualityof service). In addition, the profile class can be subclassed and specialized, thus supportingthe creation of profile taxonomies which subsequently describe differentclasses of service.

3.2 Iris-Approach

The Internet Reasoning Service - IRS-II [17] is a Semantic Web Services framework,which allows applications to semantically describe and execute Web services.

IRS-II is based on the UPML (Unified Problem Solving Method DevelopmentLanguage) framework [18], which distinguishes between the following categories ofcomponents specified by means of an appropriate ontology:

- Domain models: These describe the domain of an application (e.g. vehicles, amedical disease).
- Task models: These provide a generic description of the task to be solved,specifying the input and output types, the goal to be achieved and applicablepreconditions.
- Problem Solving Methods (PSMs): These provide abstract, implementationindependentdescriptions of reasoning processes which can be applied tosolve tasks in a specific domain.
- Bridges: These specify mappings between the different model componentswithin an application.

3.3 WSMF-Approach

The Web Service Modeling Framework (WSMF) [9] provides a model for describingthe various aspects related to Web services. Its main goal is to fully enable ecommerceby applying Semantic Web technology to Web services. WSMF is theproduct of research on modelling of reusable knowledge components [10].WSMF is centered on two complementary principles: a strong de-coupling of thevarious components that realize an e-commerce application; and a strong mediationservice enabling Web services to communicate in a scalable manner. Mediation is appliedat several levels: mediation of data structures; mediation of business logics; mediationof message exchange protocols; and mediation of dynamic service invocation.WSMF consists of four main elements: ontologies that provide the terminologyused by other elements; goal repositories that define the problems that should besolved by Web services; Web services descriptions that define various aspects of aWeb service; and mediators which bypass interoperability problems. WSMF implementation has been assigned to two main projects: Semantic Web enabledWeb Services (SWWS) [25]; and WSMO (Web Service Modelling Ontology)[28]. SWWS will provide a description framework, a discovery framework and a mediation platform for Web Services, according to a conceptual architecture. WSMO will refine WSMF and develop a formal service ontology and language for SWS.

4 Web services

A Web Service is a software program identified by an URI, which can be accessed via the internet through its exposed interface. The interface description declares the operations which can be performed by the service, the types of messages being exchanged during the interaction with the service, and the physical location of ports, where information should be exchanged. For example, a Web service for calculatingthe exchange rate between two money currencies can declare the operation getExchangeRate with two inputs of type string (for source and target currencies) and an output of type float (for the resulting rate). A binding then defines the machine and ports where messages should be sent. Although there can be many ways of implementing Web services, we basically assume that they are deployed in Web servers such that they can be invoked by any Web application or Web agent independently of their implementations. In addition Web services can invoke other Web services. Service might be defined as a workflow describing the choreography of several operations. Such a workflow may determine: the order of operation execution; what operations may be executed concurrently; and alternative execution pathways (if conditionaloperators are included in the workflow modeling language). Conversely, workflows are required to orchestrate the execution of several simple services thatmay be composed together for forming a more complex service.

5 Challenges

New opportunities impose new challenges. In the following, we focus our discussion on the following challenges that we are facing now: the development of ontologies, and the development of the formal semantics of Semantic Web languages, and the development of trust and proof models.
It is well recognized within the Semantic Web community that ontologies will play an essential role in the development of the Semantic Web. Various effort has been devoted to the research of different aspects of ontologies, including ontology representation languages (Corcho, 2000), ontology development (Jones, et al, 1998), ontology learning approaches (Maedche&Staab, 2001), and ontology library systems (Ding &Fensel, 2001), which manage, adapt, and standardize ontologies.

Management. The main purpose of ontologies is to enable knowledge sharing and re-use, hence a typical ontology library system supports open storage and organization, identification and versioning. Open storage and organization address how ontologies are stored and organized in a library system to facilitate access and management of ontologies. Identification associates each ontology with a unique identifier. Versioning is an important feature since ontologies evolve over time and a versioning mechanism can ensure the consistency of different versions of ontologiesAdaption. Since ontologies evolve over time, how to extend and update existing ontologies is an important issue. This includes the searching, editing and reasoning of ontologies in an ontology library system standardization. Integration and interoperability is always the concern of any open system. This is especially the concern of the Semantic Web, an open system that has to be scalable at the Internet level. Currently, a number of ontology representation languages have been proposed (Corcho, et al., 2000) and various ontology library systems have been built (Ding & Fensel, 2001). The question is what would be the standardized ontology representation language. Each of them seems to have its advantages and disadvantages, and has its proponents and opponents. This might be a feature of our human being society: each of us has his/her preference. Since the Semantic Web is still at its early stage, it might be too early to enforce any standardization. Each representation language can grow on its own and the one or a few ones who win will become the de facto standards. XML might serve as the meta-languages of these representations to facilitate future interoperation and integration.

6 Conclusions

A complete solution for delivering Semantic Web Services is on the way. Although the vision for SWS has been set and many partial solution cases demonstrated (see for example ISWC 2003) for solving particular issues, only now is the area as a whole taking shape. This is evidenced by the fast-paced evolution of the underlying standards and technologies and the proof-of-concept stage of research in the area.

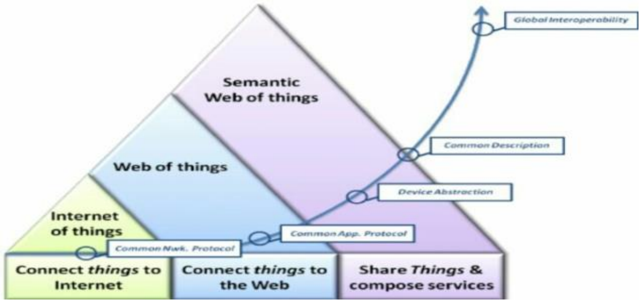
The state of the art of SWS shows that technologies will shape towards accepted enabling standards for Web Services and the Semantic Web. In particular, IRS-II, OWL-S and WSMF promise inter-compatibility in terms of OWL-based service descriptions and WSDL-based grounding. However, an assessment of the delivered results of IRS-II, OWL-S and WSMF approaches show that Semantic Web Services are far from mature. While they represent different development approaches converging to the same objective, they provide different reasoning support, which are based on different logic and ontology frame-works. Furthermore, they emphasize different ontology-based service capabilities and activities according to the orientation of their approaches.

None of the approaches described provide a complete solution according to the dimensions illustrated, but interestingly enough they show complementary strengths.

For example, IRS-II has strong user and application integration support while OWL-S provides a rich XML-based service ontology. WSMF has a comprehensive conceptual architecture, which covers requirements of one of the most demanding web-based application area, namely e-commerce. These requirements reflect the way business clients buy and sell services. Summarizing, Semantic Web Services are an emerging area of research and currently all the supporting technologies are still far from the final product. There are technologies available for creating distributed applications which rely on the execution of Web services deployed on the WWW, however, these technologies require a human user in the loop for selecting services available in registries. Semantic Web technology can be utilized to do the markup and reasoning of Web service capabilities.

We have described the current main approaches to Semantic Web Services: IRS-II, OWL-S and WSMF. These approaches are complementary in many ways and can be compared according to different dimensions of SWS.

Nevertheless, there are still a number of issues concerning Semantic Web Services being investigated in a number of initiatives. These issues range from service composition to service trust and will have the attention of industry and academia for the next few years.



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