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A Knowledge Repository

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A REVIEW ON SEMANTIC WEB

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Abstract:

Semantic web is a concept that enables better machine processing of information on the web, by structuring documents written for the web in such a way that they become understandable by machines. This can be used for creating more complex applications (intelligent browsers, more advanced web agents), etc. Semantic modeling languages like the Resource Description Framework (RDF) and topic maps employ XML syntax to achieve this objective. New tools exploit cross domain vocabularies to automatically extract and relate the meta information in a new context. Web Ontology languages like DAML+OIL extend RDF with richer modeling primitives and a provide a technological basis to enable the Semantic Web. The logic languages for Semantic Web are described (which build on the of RDF and ontology languages). They, together with digital signatures, enable a web of trust, which will have levels of trust for its resources and for the rights of access, and will enable generating proofs, for the actions and resources on the web.

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1. Introduction

Web was designed as an information space, with the goal that it should be useful not human-human communication, but also that machines would be able to participate and help. One of the major obstacles to this has been the fact. The that most information on the web is designed for human consumption, and even if it was derived from a database with well-defined meanings for its columns, that the structure of the data is not evident to a robot browsing the web. Humans are capable of using the Web to carry out tasks such as finding the Finnish word for "car", to reserve a library book, or to search for the cheapest DVD and buy it. However, a computer cannot accomplish the same tasks without human direction to be read by people, not machines.

The Semantic Web is a vision of information that is understandable by computers, so that they can perform more of the tedious works involved in finding, sharing and combining information on the web. For example, a computer might be instructed to list the prices of flat screen HDTVs larger than 40 inches with 1080p resolution at shops in the nearest town that are open until 8pm on Tuesday evenings. Today, this task requires search engines that are individually tailored to

every website being searched. The semantic web provides a common standard (RDF) for websites to publish the relevant information in a more readily machine-processable and integratable form.

1.1. What is Semantic Web?

The Semantic Web is an evolving extension of the World Wide Web in which the semantics of information and services on the web to defined, making it possible for the web to understand and satisfy the requests of people and machines to use the Web Content. It derives from W3C director Tim Berner - Lee vision of the Web as a universal medium for data, information and knowledge exchange.
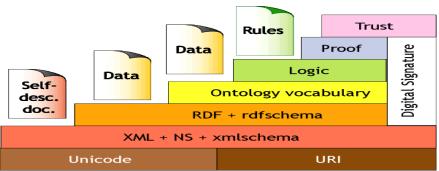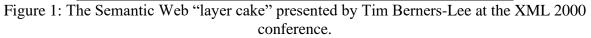
1.2. WWW Vs Semantic Web

Current web contains a hypermedia, a digital library, a library of documents called (web pages) interconnected by a hypermedia of links, a database, an application platform, a common portal to applications accessible through web pages, and presenting their results as web pages, a platform for multimedia, a naming scheme and Unique identity for those documents.

The World Wide Web is based mainly on documents written in Hyper Text Markup Language (HTML), a markup convention that is used for coding a body of text interspersed with multimedia objects such as image and interactive forms. The semantic web involves publishing the data in a language, Resource Descriptive Framework (RDF) specifically for data, so that it can be manipulated and combined just as can data files on a local computer. The HTML language describes documents and the links between them. RDF, by contrast, describes arbitrary things such as people, meetings, and airplane parts.

2. Components of Semantic Web

Several formats and language form the building blocks of the semantic web. Some of these include Identifier (URI), Documents: Extensible Markup Language (XML), Statements: Resource Description Framework (RDF), variety of data interchange formats (e.g. RDF/XML, N3) and notations such as RDF Schemas (RDFS) and the Web Ontology Language (OWL), all of which are intended to provide a formal description of concepts, terms and relationships within a given knowledge domain, Logic, Proof and Trust.

Figure 1: The Semantic Web "layer cake" presented by Tim Berners-Lee at the XML 2000 conference.

2.1. Identifiers: Uniform Resources Locator (URI)

To identify items on the web, we use identifiers. Because we use a uniform system of identifiers, and because each item identified is considered a "resource", we call these identifiers "Uniform Resource Identifiers" or URIs for short.

The URI is the foundation of the Web. While nearly every other part of the Web can be replaced, the URI cannot: it holds the rest of the Web together. One familiar form of URI is the URL is an address that lets you visit a web page, such as: http://www.w3org/Addressing/.
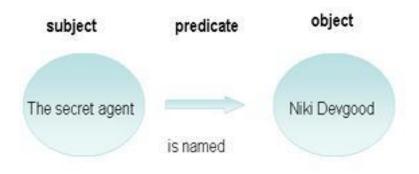
2.2. Documents: Extensible Markup Language (XML)

XML was designed to be a simple way to send documents across the Web. It allows anyone to design their own document format and then write a document in that format. These document formats can include markup to enhance the meaning of the documents content. This markup is "machine-readable", that is, programs can read and understand it. By including machine-readable meaning in our documents, we make them much more powerful.

2.3. Statements: Resource Description Framework (RDF)

The most fundamental building block is Resource Description Framework (RDF), a format for defining information on the web. RDF is a markup language for describing information and resources on the web. Putting information and RDF files, makes it possible for computer programs ("web spiders") to search, discover, pick up, collect, analyse and process information from the web. The Semantic Web uses RDF to describe web resources, RDF provides a model for data, and a syntax so that independent parties can exchange and use it. It is designed to be read and understood by computers. It is not designed for being displayed to people.

RDF triples can be written with XML tags, and they are represented graphically as shown below.

2.4. Schemas and ontologies: RDF Schemas, DAML+OIL, and WebOnt

A "schema" (plural "schemata") is simply a document or piece of code that controls a set of terms in another document or piece of code. It's like a master checklist, or definition grammar.

RDF Schemas
First three most important concepts that RDF and RDF Schema give us are the "Resource" (rdfs:Resource), the "Class" (rdfs:Class), and the "Property" (rdf:Property). These are all "classes", in that terms may belong to these classes

DAML+OIL
DAML is a language created by DARPA as
an ontology and inference language based upon RDF. DAML takes RDF Scheme a step further, by giving us more in-depth properties and classes.

Inference
The principles of "inference" is quite a simple one: being able to derive new data from data that already know. In a mathematical sense, querying is a form of inference (being able to infer some search results from a mass of data).

2.5. Logic

For the Semantic Web to become expressive enough to help us in a wide range of situations, it will become necessary to construct a powerful logical language for making inferences.

2.6. Proof

Once we begin to build systems that follow logic, it makes sense to use them to prove things. People all around the world could write logic statements. Then your machine could follow these Semantic "links" to construct proofs.

2.7. Trust: Digital Signature and Web of Trust

Now we can say that this whole plan is great, but rather useless if anyone can say anything. Who would trust such as system? That's where Digital Signature come in. Now it's highly unlikely that you'll trust enough people to make use of most of the things on the web. That's where the "Web of Trust" comes in.

3. Projects

3.1. FOAF

A popular application of the semantic web is Friend of a Friend (or FOAF), which describes relationships among people and other agents in terms of RDF. FOAF project is about creating a Web of machine-readable homepage describing people, the links between them and the things they create and do.

3.2. SIOC

The SIOC Project - Semantically-Interlinked Online Communities provides a vocabulary of terms and relationships that model web data spaces. Examples of such data spaces include, among others: discussion forums, weblogs, blogrolls / feed subscriptions, mailing lists, shared bookmarks, image galleries.

3.3. SIMILE

Semantic Interoperability of Metadata and Information in un Like Environments Massachusetts Institute of Technologies. SIMILE is a joint project, conducted by the MIT Libraries and MIT CSALE which seeks to enhance interoperability among digital assets, schemata/vocabularies/ontologies, meta data and services.

3.4. Linking Open Data

The Linking Open Data Project is a community lead effort to create lead openly accessible, and interlinked, RDF Data on the Web. The data in question takes the form of RDF Data Sets drawn from a broad collection of data sources.

4. Browsers

A semantic web Browser is a form of Web User Agent that expressly requests RDF data from Web Servers using the best practise known as "Content Negotiation". These tools provide a user interface that enables data-link oriented navigation of RDF data by dereferencing the data links (URIs) in the RDF Data Sets returned by Web Servers.

Example of semantic web browsers include: Tabulator, DISCO, Open Link DF Browser Onto Wiki Browser Crowbar – SIMILE.

5. Application Areas

The Semantic web offers many real-world applications that arise from the direct from the direct impact it has on the World Wide Web. Real Time "Scientific Publishing" is being considered to be the most important area to benefit from "Semantic Publishing". This directly transforms collaboration trends in Life Sciences and Health Care. Besides other areas expected to go through the wave are:
- Ambient Intelligence
- Semantic Search and Indexing
- Cognitive Systems
- Data Integration
- Multimedia Data Management

6. Agents and Services

I describe a vision of intelligent web agents using the analogy of travel agents - rather than doing everything for a user, the agents would find possible ways to meet user needs, and offer the user choices for their achievement. Much as a travel agent might give you a list of several flights you could take or a choice of flying vs. taking a train, a web agent should offer a slate of possible ways to get you what you need on the web.
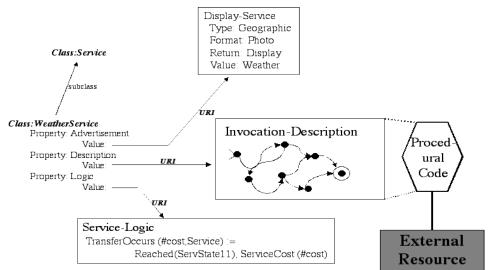
Figure 2: A potential service class and its properties on the Semantic Web

7. Benefits of The Semantic Web

- Information is captured in a language agnostic format.
- A central repository for knowledge is created.
- More precise, relevant information is captured.
- Processes and procedures are mapped to data sources.
- One collective view of knowledge across enterprise application is created.

As a Result

- Point-to-point integration becomes obsolete.
- Application integration is easy and efficient.
- Superfluous data decreases.
- Knowledge across applications becomes consistent.
- Upgrades and maintenance are simplified.

8. Conclusion

Human Reasoning is a result of certain relationships amongst objects, processes etc. that we have in our minds. The Semantic Web can be said to perform similar reasoning based upon the relationships that we define in web data through RDF. These relationships that we have are also more or less common to many others in the society, which makes our reasoning of practical sense to others.

Similarly, a "common vocabulary of relationships" is established for interoperable use through Web Ontologies. The OWL provides a way to enhance this vocabulary. With these and many other basic principles, the Semantic Web, the web of data (in its rightful sense), users amazing new ways in which we would use the web.

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