Implications of Semantic Web technologies in Virtual Organizations

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Abstract
The purpose of this study is to highlight the opportunity offered by Semantic Web technologies in knowledge representation and automatic processing of economic virtual organizations. We refer to Semantic Web as the technology to create metadata for e-business applications. Knowing that information and understanding it - therefore knowledge - is the key to fulfilling any vision, how to make computers "understand" information is the problem discussed in this study having as practical implementation the representation of specific metadata for e-commerce activity.

Keywords: Semantic Web, Ontology

Introduction

Slowly, people tend to move on the Internet, changes occur in the lives of individuals; people socialize on the Internet, develop their own economy on Internet and therefore develop a different life. The Web is a local or global distribution hypermedia information system (Berners-Lee, 1999). It was originally established to facilitate rapid access to technical information contained in the computer manuals (Berners-Lee, 1989). The Web provides a comprehensive and standardized system of communication media, information is organized associative, operating upon the client/server model and enjoying the facilities provided by structuring the resources in the form of hypertext.

Present data on the Web have not yet a **well-defined semantics** so that the computer can "understand" it and therefore automatically process. The search operation is still made upon keywords, so it founds only those resources that contain exactly those words from the query, without being able to understand the semantic context of the query. Knowledge that could be extracted and processed can likely to remain "hidden" having no significance for the computer. That is way the need for modeling knowledge in the form of standards that are "understood" by computers and also to reveal the relations between web resources. These standards offer flexibility and portability between different systems and software.

As the search based on textual content have limitations regarding resources with little or no textual content, web resources (identified by Uniform Resource Identifiers - URI) were annotated with semantic statements about aspects of their conceptual content. These statements represent metadata or data about data.

The vision of the Semantic Web or Web 3.0, as Tim Berners-Lee says, is to become an extension of the current web in which information has a well defined meaning and can be understood and processed by computers. Semantic Web is a vision for future Web, where information is given in an explicit way for machines to automatically process it and integrates it on the Web.

With the development of information technology was possible the emergence of a new form of organization, called virtual organization (Ghilea-Micu, 2004, p.7). Forecasts made on business applications that will be created from now on, presumes the use of today Semantic Web formats.

Members of organizations interact with one another, share knowledge inside and outside the organization by building a common knowledge base. Therefore we need to create a common vocabulary to describe and represent the knowledge, using W3C standards.

Semiotic foundations of virtual organizations

Any organization can be seen as a system with certain concepts and terms. Using modeling languages together with the study of semiotics we can capture all aspects of knowledge representation.

Semiotics is the science of signs and the concept of sign is the basis for defining information (Ghilea-Micu, 2004, p.38). Signs contain data, information and knowledge that reflect different levels of representation (Andone I. et. al., 2004, p.331). Representation of reality can be performed using signs or symbols, and based on this signs behaviors can be triggered.

To model an information system using semantic languages first we must identify the entities and relationships between them. This actually implies the establishment of clearly defined concepts. These concepts have a particular significance for the wider community of interests whose actors or participants may be humans or intelligent agents.

Because we define concepts we need a language to do this, a standard recognized and accepted by a community able to define both the concepts and relations between them after a certain set of rules. Such languages are Semantic Web languages.

If we were to solve a problem using software, we must first consider how humans solves this problem and following this review and attempt to simulate human intelligence we find that humans have a considerable stock of highly structured knowledge with which they will make abstraction, classification, customizations. Therefore we need explicit representation of knowledge in field of interest (Trausan-Matu, 1994, p. 4).

The question that arises is how we can model reality from computer perspective to describe the way things really are? How can we create an environment of human speech, or in other words how can we represent knowledge, so the computer can understand, can be able to automatically process and share it on Web?

For this we need specialized web programming languages able to describe concepts and systems of concepts. Creating vocabularies/Web-based models of knowledge representation languages no matter the domain and use them in semantic processing applications, are viable solutions for problems related to interoperability and portability between different systems and programs.

Web documents in this way can become not only human-readable but machine-readable. Knowledge representation on the web is done using different tags to mark words and then enrich them with a specific exactly meaning.

Creating metadata for an e-commerce site

One of the major areas of use semantic web technologies is e-business which offers different services such as data exchange between enterprises, processing orders electronically, handling customer service, and provide rationale for decision making by helping managers in activities of e-business area.

In the following we study the possibility of knowledge representation in the context of electronic commerce. Representation refers to semantic encoding information on the e-commerce website and connections between them.

This is done by associating metadata with the identification of products on site and relations between products. Metadata will be associated with SKOS language. It will automatically generate a SKOS document regarding the code, description, price, category of products sold. To generate SKOS insertions we use PHP scripting language.

Next is an example in pseudo-code for generating a SKOS document.

```
Connect to database
Selected database records

//making SKOS document
create principal node (rdf:RDF)
set node attributes // declare namespaces (e  )
create adjacent nodes
while (not end of database)
                read fields
                //for every product we create SKOS assertions
                create SKOS element (skos:Concept)
                set attribute nod (rdf:about="http://www.e-shop.ro/cod_produs)
                create child nodes
                        create SKOS element (skos:prefLabel)
                        create element (e:pret)
                        create element  (e:categorie)
                        create element  (e:marca)
                        create element  (skos:narrower)
                                create element (skos:Collection)
                                        create child nodes (skos:member)
```

An example of a SKOS document automatically generated, that associates metadata related to the products description is shown below:

```
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:skos="http://www.w3.org/2004/02/skos/core#"
xmlns:e = "http://www.e-shop.ro#" <!-- namespaces for syntactic construction of XML language to
express associated metadata with each product  -->

<skos:Concept rdf:about="http://www.e-shop.ro/1”>
<skos:prefLabel> Dell Inspiron 1525 </skos:prefLabel>
<e:price> 2000 </e:price>
<e:category> Laptop </e:category>
<e:brand> Dell </e:brand>
<skos:narrower>
        <skos:Collection>
                <skos:member rdf:resource=" http://www.e-shop.ro/2"/>
        </skos:Collection>
</skos:narrower>
</skos:Concept>

<skos:Concept rdf:about="http://www.e-shop.ro/2”>
<skos:prefLabel> HP 1510 </skos:prefLabel>
<e:price> 2200 </e:price>
<e:category> Laptop </e:category>
<e:brand> HP </e:brand>
<skos:narrower>
        <skos:Collection>
                <skos:member rdf:resource=" http://www.e-shop.ro/1"/>
        </skos:Collection>
</skos:narrower>
```

```
</skos:Concept>

<skos:Concept rdf:about="http://www.e-shop.ro/3”>
<skos:prefLabel> CPU Pentium III</skos:prefLabel>
<e:price> 55 </e:price>
<e:category> Procesoare </e:category>
<e:brand> Pentium </e:brand>
<skos:narrower>
        <skos:Collection>
                <skos:member rdf:resource=" http://www.e-shop.ro/4"/>
                <skos:member rdf:resource=" http://www.e-shop.ro/5"/>
        </skos:Collection>
</skos:narrower>
</skos:Concept>

<skos:Concept rdf:about="http://www.e-shop.ro/4”>
<skos:prefLabel> AMD Athlon 64 5000+</skos:prefLabel>
<e:price> 50 </e:price>
<e:category> Procesoare </e:category>
<e:brand> Athlon </e:brand>
<skos:narrower>
        <skos:Collection>
                <skos:member rdf:resource=" http://www.e-shop.ro/3"/>
                <skos:member rdf:resource=" http://www.e-shop.ro/5"/>
        </skos:Collection>
</skos:narrower>
</skos:Concept>
</rdf:RDF>
```

The file can be queried for results using SPARQL query language for semantic web. We will present also an example of a query results over the SKOS file. We will query the file from the previous example to find all the products described there. The query in SPARQL is:

```
PREFIX rdf:<http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX skos:<http://www.w3.org/2004/02/skos/core#>
PREFIX e:<http://www.e-shop.ro#>

Select ?nume
Where {
?entitate  skos:prefLabel ?nume
}
```

The query will have as results all the products described in the SKOS file as it shows in the figure1.

Produs
Dell Inspiron 1525
HP 1510
CPU Pentium III
AMD Athlon 64 5000+

Fig 1: Query results

The results can be then integrated into a HTML file and presented in a form that can be read and interpreted by humans.

Conclusions

As can be seen using Semantic Web technologies as the communication system is the best method to exchange information in a distributed system because they are interpreted both by humans and machines, are capable of self-validation, are easily converted and adapted to change.

The difference between a classical type organization and a virtually one is only at the technological level and not at the human level. The difference between the two levels is performed using semiotics, the science of signs. Signs are the bases for defining information, the primary resource to both organizational and individual level. Certainly the signs, symbols, could be interpreted if they had certain significance, a certain semantic.

Without this we can not able to communicate information, principle underpinning the Web also. Any organization with a web identity creates its own electronic market and has its own virtual community of interest and technical infrastructure requires creating an appropriate semantic context to standardize the entire process of supply and demand.

It requires different rules of organization and functioning within the organization. Through standardization are eliminated misunderstandings that may arise between those who are part of the virtual organization (the seller) and those who interact with it (buyer). With the knowledge representation languages we can shape the content of any Web pages created in the World Wide Web space.

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