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A Review of Ontologies, Ontology Engineering and OWL for Representing Contextual Information

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Abstract— A significant amount of results have been produced recently in the area of ontology research. Ontologies emerged in Artificial Intelligence as an alternative to represent Knowledge. The purpose of this paper is to provide an overview of Ontologies by performing a broad review of the relevant literature. The semantic role of Ontologies is emphasized. Classification of ontological models and languages focusing on their basic features is presented. Examples of applications of Ontologies in different areas are also provided. The theoretical results achieved in the ontology engineering field in the last fifteen years are of incontestable value for the prospected large scale take-up of semantic technologies. This paper gives an overview of ontology and OWL and also concentrates on the Future of Ontology.

Keywords— Include at least 5 keywords or phrases

I. INTRODUCTION

The concept of Ontologies was introduced to overcome the limitations of keyword-based search. It has been put forward as one of the motivations of the Semantic Web since its emergence in the late 90's. Ontology proved to be an essential element in a number of applications like Agent systems, Knowledge management Systems and E-commerce platforms. Ontological commitments are agreements to use the shared vocabulary in a coherent and consistent manner. The agents sharing a vocabulary need not share a knowledge base; each knows things the other does not, and an agent that commits to ontology is not required to answer all queries that can be formulated in the shared vocabulary. Ontology is an explicit description of a domain that includes concepts, properties and attributes of concepts, constraints on properties and attributes, Individuals (often, but not always). Thus, Ontology simply means Reality. The main reason for developing Ontologies is to share common understanding of the structure of information among people and among software agents. One more reason it to enable reuse of domain knowledge.

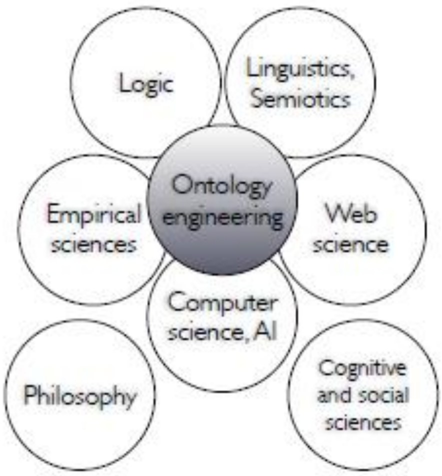

Fig (1). The cultural context of Ontologies

Taxonomies on the Web (Yahoo! Categories), Catalogs for on-line shopping (Amazon.com product catalog), Domain-specific standard terminology (Unified Medical Language System (UMLS) and UNSPSC - terminology for products and services) can be specifically considered as the real world examples of Ontology.

The World Wide Web is currently constituted as a poorly mapped geography. The complete mass of this data cannot be without a powerful tool support. In order to manage this whole data, computational agents require machine-readable descriptions of the content and capabilities of Web accessible resources. These descriptions must be in addition to the human-readable versions of that information. While there have been contributions in this direction in the last few years, most achievements so far either make partial use of the full expressive power of an ontology-based knowledge representation, or are based on Boolean retrieval models, and therefore lack an appropriate ranking model needed for scaling up to massive information sources.

In the former case, Ontologies provide a shallow representation of the information space, equivalent to the taxonomies and thesauri used before the Semantic Web was envisioned.

A simple example for reference to Kashmir by using different classes

```
<owl:Class rdf:ID="kashir">
  <rdfs:subClassOf rdf:resource="#touristplace" />
</owl:Class>
<owl:Class rdf:ID="kas">
  <rdfs:subClassOf rdf:resource="#kashir" />
</owl:Class>

<owl:Class rdf:ID="Kashmir">
  <rdfs:subClassOf rdf:resource="# touristplace " />
  <owl:disjointWith rdf:resource="#kashir" />
</owl:Class>

<owl:Class rdf:ID="kashmirValley">
  <owl:unionOf rdf:parseType="Collection">
     <owl:Class rdf:about="#kashir" />
    <owl:Class rdf:about="#kashir" />
    <owl:Class rdf:about="#kashmir" />
  </owl:unionOf>
</owl:Class>
```

Here , “kashmirValley” is defined to be exactly the union of kashmir and kashir.

Ontology Languages - a step towards Semantic Web:

Ontologies are not only useful for applications in which knowledge plays a key role, but they can also revolutionize current Web contents. This change is leading to the third generation of the Web—known as the Semantic Web—which has been defined as “the conceptual structuring of the Web in an explicit machine-readable way.

1. This definition does not differ too much from the one used for defining ontology: ontology is an explicit, machine readable specification of a shared conceptualization.

2. In fact, new ontology-based applications and knowledge architectures are developing for this new Web.

The main fact for all of these approaches is the need for languages to represent the semantic information that this Web requires—solving the heterogeneous data exchange in this heterogeneous environment.

During the last few years, several ontology languages have been developed.

Some of these Ontology languages [4] are based on XML syntax, such as Ontology Exchange Language(XOL), SHOE (which was previously based on HTML), and Ontology Markup Language (OML),whereas Resource Description Framework (RDF) and RDF Schema are languages created by World Wide Web Consortium (W3C) working groups. Finally, two additional languages are being built on top of RDF(S)—the union of RDF and RDF Schema—to improve its features:

Ontology Inference Layer (OIL) and DAML+OIL.

Other languages have also been used, traditionally, for building Ontologies.

XML-based Ontology Exchange Language

XOL has been designed by the US bioinformatics community for the exchange of ontology definitions among a heterogeneous set of software systems in their domain. Researchers created it after studying the representational needs of experts in bioinformatics. They selected Onto-lingua and OML as the basis for creating XOL, merging the high expressiveness of OKBC-Lite, a subset of the Open Knowledge Based Connectivity protocol, and the syntax of OML, based on XML. There are no tools that allow the development of Ontologies using XOL. However, since XOL files use XML syntax, we can use an XML editor to author XOL files.

Simple HTML Ontology Extension

SHOE, developed at the University of Maryland. It used to develop OML that was created as an extension of HTML, incorporating machine-readable semantic knowledge in HTML documents or other Web documents. SHOE makes it possible for agents to gather meaningful information about Web pages and documents, improving search mechanisms, and knowledge gathering.

This process consists of three phases:

- Define an ontology,
- annotate HTML pages with ontological information to describe themselves and other pages, and
- Have an agent semantically retrieve information by searching all the existing pages and keeping information updated.

Ontology Markup Language

OL, developed at the University of Washington, is partially based on SHOE.
As it was first considered an XML serialization of SHOE, therefore, OML and SHOE share many features. Four different levels of OML exist:

OMLCore is related to logical aspects of the language and is included by the rest of the layers;
Simple OML maps directly to RDF(S);
Abbreviated OML includes conceptual graphs features; and
Standard OML is the most expressive version of OML. We selected Simple OML, because the higher layers don't provide more components than the ones identified in our framework. These higher layers are tightly related to the representation of conceptual graphs. There are no other tools for authoring OML Ontologies other than existing general purpose XML edition tools.

Resource Description Framework and RDF Schema

RDF has been developed by the W3C for describing Web resources. It allows the specification of the semantics of data based on XML in a standardized, interoperable manner. It also provides mechanisms to explicitly represent

- services,
- processes, and
- business models, while allowing recognition of non explicit information.

The RDF data model is equivalent to the semantic networks formalism. It consists of three object types:

- resources are described by RDF expressions and are always named by URIs plus optional anchor IDs;
- properties define specific aspects, characteristics, attributes, or relations used to describe a resource; and
- statements assign a value for a property in a specific resource .

The RDF data model does not provide mechanisms for defining the relationships between properties (attributes) and resources—this is the role of RDFS. RDFS offers primitives for defining knowledge models that are closer to frame-based approaches. RDF(S) is widely used as a representation format in many tools and projects, such as Amaya, Protégé, Mozilla, SilRI, and so on.

Ontology Interchange Language

OIL, developed in the Onto Knowledge project. Its syntax and semantics are based on existing proposals (OKBC, XOL, and RDF(S)), thus providing modelling primitives commonly used in frame-based approaches to ontological engineering (concepts, taxonomies of concepts, relations, and so on), formal semantics and Reasoning support found in description logic approaches (a subset of first order logic that maintains a high expressive power, together with decidability and an efficient inference mechanism).

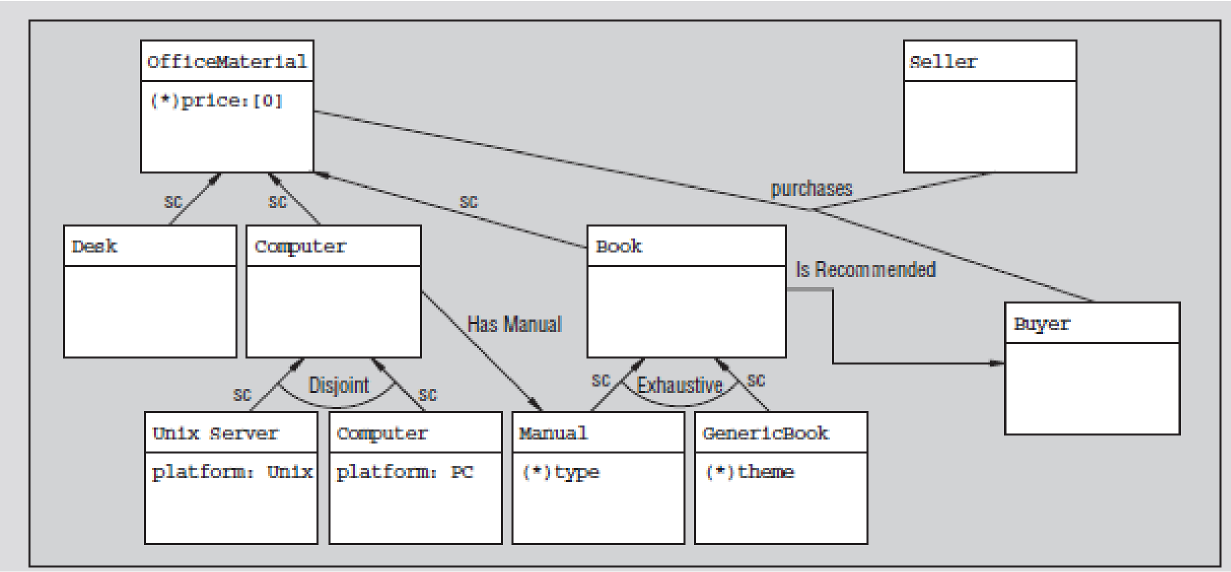

Fig.(2) An example for a sample ontology as shown in the experiment : an ontology for an E-commerce Platform[4].

Evaluation :

In many cases the possibility to efficiently access (retrieve) and reuse the knowledge scattered throughout various documents within organizations and people minds is limited. Research Issues in Ontology Engineering Content

generation Analysis and evaluation Maintenance Ontology languages and Tool Development. As a result of this, most knowledge is not sufficiently exploited, shared and subsequently forgotten in relatively short time after it has been introduced to, invented/discovered within the organization. Therefore, in the approaching information society, it is vitally important for knowledge-intensive organizations to make the best use of information gathered from various information resources inside the organizations and from external sources like the Internet. On the other hand, tacit knowledge of authors of the documents' provides important context to them, which cannot be effectively intercepted. Knowledge management generally deals with several activities relevant in knowledge life cycle : identification, acquisition, development, dissemination (sharing), use and preservation of organization's knowledge. Use of an ontology enables to define concepts and relations representing knowledge about a particular document in domain specific terms. In order to express the contents of a document explicitly, it is necessary to create links (associations) between the document and relevant parts of a domain model, i.e. links to those elements of the domain model, which are relevant to the contents of the document.EC funded project IST-1999-20364 Webocracy (Web Technologies Supporting Direct Participation in Democratic Processes) Model elements can be also used for search and retrieval of relevant documents. In case all documents are linked to the same domain model, it is possible to calculate a similarity between documents using the abovementioned conceptual structure of this domain model. Such approach supports also 'soft' techniques, where a search engine can utilize the domain model to find concepts related to those specified by user. The search engine can thus return every document linked to the concepts, which are close enough to the concepts mentioned in the user's query.
In order to evaluate efficiency retrieval of such an ontology-based approach, a series of experiments with two other, frequently used techniques for information retrieval (vector model with tf-idf weight schema and latent semantic indexing model have been done [1].

Need of Ontology [15]
The answer to this question provides what philosophers call an axiological backdrop for contemporary discussions about ontology's role in knowledge management (KM) [15]. The KM system is designed to anticipate the various confusions the user is likely to bring to the cognitive transaction, disentangle them (perhaps by disaggregating the likely causes of the effects the user perceives), and present a result that will focus the user's efforts, not compound his or her confusion. The languages, according to their proposers, should supposedly overcome some of the big players' limitations. However, they can't compare with semantically based approaches, such as OWL Ontologies written in these languages can only play the role of shared data structures in interoperating applications.

II. Related Works:
Jan Paralic and Ivan Kostial [1] and David Vallet, Miriam Fernández, and Pablo Castells, [3] provides an ontology-based Retrieval model illustrated with sample experiments showing improvements with respect to keyword-based search, and providing ground for further research and discussion. Chris Welty[2], Gómez-Pérez and Oscar Corcho[4] and Natalya F. [5] suggests more regarding Semantic web . Chris Welty illustrates it with OWL while Gómez-Pérez and Oscar Corcho discusses about various languages in semantic web. Lars Vogt [21], Aldo Gangemi, Domenico M. Pisanelli, Geri Steve [17] and C. Roussey[6] provides a detailed discussion of Ontologies regarding biological sciences. While Lars Vogt thrusts upon the establishment of some sort of general data standard in biology and why the development of a set of commonly used foundational ontology, Aldo Gangemi , Domenico M. Pisanelli, Geri Steve provides a review of ONION project meaning Ontological Integration Of Naive Sources thus giving an overview of Ontologies for the integration of Medical terminologies. Also C.Roussey focuses on how Agriculture can be benefited from use of Ontologies.
Leonid Kalinichenko, Michele Missikoff, Federica Schiappelli, Nikolay Skvortsov[10] and Aldo Gangemi[13] emphasizes on the use and classification of ontological models.

Future Scope:
- Initial steps towards better evaluation measures have already been done by proposing semantic versions of precision and recall implemented in Alignment API [20]
- Medical field is also using Ontologies to get benefited from it and will continue to use it for better results as can be seen in the research regarding "The future role of bio-Ontologies for developing a general data standard in biology: chance and challenge for zoo-morphology" by Lars Vogt and also in "Project: Applying Ontologies to the Integration of Medical Terminologies"
- In order to give good estimates regarding larger portions of biological diversity, comparative approaches are required, which at their turn not only depend on the knowledge gained by model organism studies but also require data that is highly comparable across various species. The need for standardization has been recognized in many Welds of biological research by now and all respective activities are gaining credibility [21]
- Gene Ontologies has also came into existence. The Gene Ontology project is a major bioinformatics initiative with the aim of standardizing the representation of gene and gene product attributes across species and databases. The project provides a controlled vocabulary of terms for describing gene product characteristics and gene product annotation data from GO Consortium members, as well as tools to access and process this data.

III. Conclusions
This Paper has been written by keeping in view various researches that have been done in the respective area of Ontologies. The aim of our current work is Collection of available literature published in national and international a

journal which discusses about Ontologies, ontology engineering and OWL also keeping in consideration Semantic Web. The research presented here started as a continuation of the previous work on the construction, exploitation, and maintenance of domain-specific KBs using Semantic Web technologies [1,2]. This provides a summary of the experimental results and suggestions for future work. We performed a literature review covering all the diverse types of ontology change, focusing on classification and breadth of coverage rather than on depth of analysis.

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