Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 15 (2011) 4295 – 4299

Procedia Engineering

www.elsevier.com/locate/procedia

Advanced in Control Engineeringand Information Science

Effect of Semantic Web technologies on Distance Education

Yaqing Shi , Meijuan Wang , Zhenghong Qiao,Lei Mao *

Institute of Science, PLA Univ. of Sci. & Tech., 211101 Nanjing Jiangsu,China

Abstract

We analyze the characteristics of the semantic web and the potential effect on the model of distance education starting with the key technologies of the Semantic Web. The conclusion shows that the development of Semantic Web will leverage the ability of the resources fusion, knowledge discovery and the knowledge retrieval, and finally, the Semantic Web will transform the study mode of the learners, from pulling knowledge from the web to pushing knowledge out of the web.

Key words:distance education; semantic web; ontology;

1. Introduction

Distance Education, also known as distance learning, is the teaching model of using media such as television and the Internet and so on. Adopting advanced forms of information dissemination and information technology solutions has been the main driving force of vigorous development of distance education. Nowadays, the popularization and application of Internet provides a broad implementation

* Yaqing Shi. Tel.: 18951839396
E-mail address: qingyashi_blue@sina.com

doi:10.1016/j.proeng.2011.08.806

space to distance education. From the point of view of development process of information technology, each step of Internet will bring new impact and positive effect to distance education model.

Semantic Web [1] is an extension of the existing World Wide Web, to more effectively express the semantics of information and resources, thus contributing to the synergy work between people and computers. Linked Data, Social Semantic Web, Semantic Web Search and Smart Data Integration of Semantic Web will play a huge role in promoting many of the current Internet-based Infrastructure solutions, and distance education is no exception. Based on this, the paper analyzes the semantic Web technology and its characteristics. And for the implementation solution and process of distance education, the paper puts forward the impact on distance education that Semantic Web is bringing or will bring. And it provides a useful exploration to the development of distance education based on Semantic Web technology.

2. Main Semantic Web technology

The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries. It is a collaborative effort led by W3C with participation from a large number of researchers and industrial partners. It is based on the Resource Description Framework (RDF). The Semantic Web is about two things. It is about common formats for integration and combination of data drawn from diverse sources, where on the original Web mainly concentrated on the interchange of documents. It is also about language for recording how the data relates to real world objects. That allows a person, or a machine, to start off in one database, and then move through an unending set of databases which are connected not by wires but by being about the same thing. Here we summarized as follows:

2.1 Ontology and Knowledge Representation

Ontology plays the key role in the semantic web. In theory, ontology is a "formal, explicit specification of a shared conceptualization". Ontology provides a shared vocabulary, which can be used to model a domain — that is, the type of objects and/or concepts that exist, and their properties and relations. Ontology are the structural frameworks for organizing information and are used in artificial intelligence, the Semantic Web, systems engineering, software engineering, biomedical informatics, library science, enterprise bookmarking, and information architecture as a form of knowledge representation about the world or some part of it. The creation of domain ontology is also fundamental to the definition and use of an enterprise architecture framework.

2.2 The semantic annotation of resources

Ontology makes a precise description to objective things and their relationship in the abstract conceptual level. In the specific Web application layer, you will need precise, formal semantics binding of the resources on the Internet. And this process is known as semantic annotation. Thus, semantic annotation of Web resources is to use some shared ontology to describe web resources, independent concept and relationship between the concepts. Documents and knowledge annotated with ontology form a huge network of knowledge. It is conducive to the network resource identification, extraction, restructuring and share [2].

2.3 Knowledge Reasoning

Logical reasoning in the knowledge base is embodied intelligent Semantic Web. However, different from intelligent reasoning in the "artificial intelligence" field, Semantic Web reasoning is based on Description Logic (Description Logics, DL), and is a machine reasoning. That is, the description logic reasoning main includes two forms: (1) Inclusion reasoning. It is mainly used for the classification of the concept, which is to determine whether a concept is a subset of another concept. (2) Coincident reasoning. It is mainly used for consistency check of concept set to determine whether a concept is compatible with existing concepts, that is whether the knowledge base is in conflict or inconsistent. Knowledge base is invalid and inconsistent with conflict. Description Logic-based knowledge representation and knowledge reasoning system is shown in Figure 1.

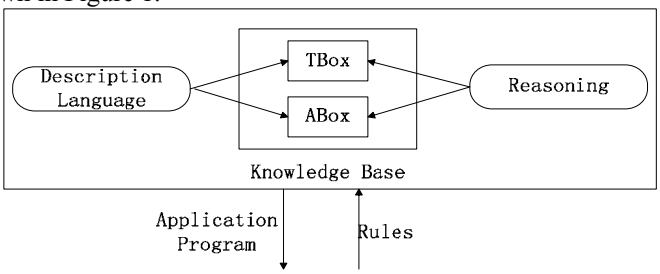

Fig.1 Description Logic-based knowledge representation System

2.4 Services

Compared with traditional Web services, Semantic Web Services has better interpretation of SOA (Service-Oriented Architecture) architecture. The widely used Web service requires too much involvement of people. For example, requiring the user to browse information related to resources and fill out the form. As for the semantic Web services, it focuses on realizing Web service discovery, invocation, composition and automation of monitoring by providing machine-interpretable. Machine understandable and automation of implementation of Semantic Web Services mechanisms rely on semantic annotation of objects in services and knowledge reasoning. Ontology of Web services is the basis of the whole service mechanism. Currently, the main ontology describing Web services is W3C recommended ontology OWL-S [3]. As the view of OWL-S, there are three basic types of knowledge associated with the service: service profile, service model and service grounding. Among them, the service profile is the description of functions and requirements of the services; service model describes how the service is carried out; and services grounding determine details of the agency how to access the service. The relationship between them is shown in Figure 2.

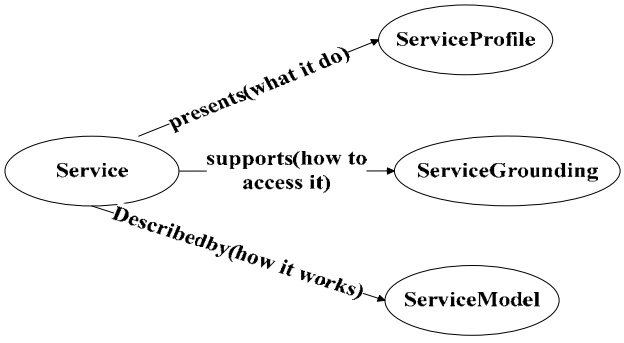

Fig.2 Relationship between OWL-S ontology

3. Semantic Web Technology Applications in Distance Education

As the author of Semantic Web Tim Berners-Lee stated: " The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation."[1] Distance education is different from traditional classroom teaching. Distance education emphasizes learners' active learning. From the perspective of the learner (knowledge requester) point of view, distance education process includes knowledge discovery, knowledge integration, knowledge acquisition, learning program design and so on. As the largest distributed knowledge database, web has a mass of learning resources and teaching resources. As a provider of knowledge resources, Web (knowledge resources providers) should try its best to provide learners accurate and adequate learning services. Based on this perspective, problems to be resolved is the integration of learning resources (integration), the discovery of learning resources, response of learning resources and the automatic generation of referenced learning programs. Semantic Web technology helps change traditional learners pulling out of resources from the Web into Web automatic / semi-automatically pushing out of learning resources based on the learning characteristics of learners. It has greatly improved the learning efficiency of distance education. In this section, some views will be shown on these themes.

3.1 Integration of teaching resources based on semantics

Information integration aims to resolve interoperability of heterogeneous data sources. Teaching institutions and knowledge fields which are Independent of each other may have a lot of heterogeneous data sources which contact between each other but not compatible with. Heterogeneous data mainly include structure heterogeneity, syntax heterogeneity and semantic heterogeneity. The structure and syntax heterogeneity has been well resolved with traditional information integration. But the traditional information integration technology cannot solve semantic heterogeneity. This is because the semantic heterogeneity mainly from the data sources of different systems using different concept describe the same thing or using the same concept describe the different things. The former is called synonym and the latter is called homonym. The ontology helps solve the problem. Ontology in information integration provides a unified standard to teaching resources. It has three common approaches: (1) Annotating data sources needing to integrate with the same ontology. This approach is ideal for practice, but in practice is impossible, because they cannot demand all the relevant Web data sources using a recognized body to markup. (2) The data source using their own local ontology to annotate, and then do the mapping between local ontology. This is problem for ontology mapping to study. (3) The data source using their own local ontology to annotate, and mapping these local ontologies to a recognized common vocabulary. The premise of this approach is a widely recognized vocabulary as a reference, such as WorldNet.

3.2 DBpedia and link data

Wikipedia is a permissive, free, open-content encyclopedia collaborative program. Participants come around the world, which means that anyone can edit any Wikipedia article and entries. Thus, Wikipedia is also becoming the center of the human knowledge source. However, in the traditional Wiki, the term exists in the document, and there are not directly semantic relations between the terms. Simply relying on keywords to link apparently looses the semantic links between all knowledge points. To May 2009, DBpedia knowledge base has described more than 26 million objects, which consists of 274 million RDF triples. The emergence of DBpedia represents two meanings: First, it describes the existing largest free shared knowledge base into RDF triples, and that is the milestone of representation of human knowledge;

another, DBpedia is one of the mainly knowledge Source on the semantic Web. Because it defines the URI of Linked Data of millions of concepts, and other data providers link their data sets to DBpedia, which makes DBpedia become one of the emerging center interconnection Hubs. Therefore, as distance education institutions, when publishing their own learning resources, firstly they should use related terms of DBpedia to annotate the appropriate resources. Linked data is an essential part of the semantic Web. In the W3C's Linking Open Data (LOD) community, more and more system developers post and link the corresponding data which includes geographic information, people, Companies, online communities, movies, music, books and scientific publications on the Web in accordance with principles of Linked Data. The organization form of information will not only help learners to quickly and accurately find the desired learning resources but also help resource providers to quickly promote their possessed resource information to the world and also make for the integration of relevant information with other agencies.

3.3 Organization and management of semantic information

In the Semantic Web environment, there are two ways of information organization and management: (1) the whole new approach. The so-called whole new approach is converting all the information into RDF. This form of information management is more feature-rich, and directly support reasoning and semantic query. However, the cost of information storage and synchronized is high. The fully suitable way of store and the storage platform for large scale RDF tuples is not yet found. (2) The traditional way. The so-called traditional way is to map all of the things to ontology, but the original resources are still stored in traditional databases. Although it does not need to abandon the existing infrastructure of original system, but for response of semantic reasoning and semantic query request, complex query rewrite technology is needed which reduces the expected effect of semantic Web. Currently most of the application systems support the second scenario, and the common conversion platform is D2RQ, Virtuoso and other systems.

4. Conclusions

Semantic Web is an extension of the existing network platform. Its essence is to change the traditional document-based network into the web data with semantics. The core of semantic web is of ontology technology; Semantic annotation technology is its implementation; Semantic search and semantic Web services is their application. Aiming at the increasing development of Semantic Web applications, distance education closely relying on network infrastructure must in the new environment explore the model fully using new technologies and meet the new requirements of users. Through the above analysis, it is easy to find that semantic Web technology has a great in terms of theoretical significance and practical value for distance education, especially has a strong vitality in the establishment and management of resources, discovery and integration of learning resources, intelligent generation of restructuring and learning plan. It can be said, Semantic Web technology builds an efficient people-oriented channel between learning resources and learning providers. It will have a profound impact to the future development of distance education.

References

[1] T. Berners-Lee, J. Hendler and O. Lassila[J]. *Scientific American* 2001, 29~37

[2] RDFa Primer [EB/OL]. http://www.w3.org/TR/xhtml-rdfa-primer/

[3] OWL-S: Semantic Markup for Web Services [EB/OL].http://www.w3.org/Submission/OWL-S/