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Semantic Network Technology and Digital Library

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Abstract

In recent years, the volume of information available on the internet has grown rapidly, leading to the need for more effective ways to manage and access high-quality content. Much of this reliable and well-structured information is stored in digital libraries, which serve as centralized hubs for organized knowledge. However, despite their usefulness, managing and navigating these vast collections of data continues to present significant challenges. To address these issues, the Semantic Web offers a range of advanced technologies designed to improve the organization, retrieval, and understanding of digital content. The SEKT (Semantically Enabled Knowledge Technologies) project focuses on developing and applying these semantic tools to support the next generation of knowledge management systems. One of the core goals of the project is to examine how these technologies perform in real-world scenarios through detailed case studies. A major objective of this research is to explore how digital libraries can gain substantial benefits from integrating Semantic Web technologies into their systems.

Keywords: Digital library, semantic web, technology, web applications, network

INTRODUCTION

Over the last few years, the Internet has become an increasingly abundant source of information. High quality information is often stored in a special digital library, and information searches of these libraries vary mainly to text search engines and free views. The initiative of the Semantic Network of the World Wide Web Consortium (W3C) has been operating in recent years, drawing both attention and criticism. This initiative has been inspired by the vision of founder Tim Berners-Lee, a more flexible and integrated automatic and its own improved website. It offers rich and conversation experience for users. The W3C has developed multiple standards and tools to support this vision, and can now be used after a few years of research and development and can have a practical effect. Despite this, many continue to question how these technologies can be applied to practical, real-world challenges. This study explores how a digital library can take advantage of the semantic web to provide useful solutions. Based on the semantic description of resources, define and evaluate how to search, and the user improves the convenience of using the digital library. It is a way to exchange meaningful explanations by interconnecting digital libraries [1–10].

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Definition of Semantic Web

- Semantic Web is the expansion of the world's web, and Semantic Web is the concept of the system posted on the Internet and provided the MEKHINE metadanes interpreted to the programmer.
- The semantic web provides a framework where software agents can navigate web pages by interpreting their structured content, making it easier to carry out complex tasks on behalf of users.

WHAT EXACTLY IS THE SEMANTIC WEB

The Semantic Web is an extension of the existing World Wide Web. It refers to a system on the Internet that includes metadata, which can be understood and utilized by software developers. In another way, we already complement the data descriptions in the current data, and data on the Internet. There, computers can create important interpretations in a similar way to analyze information and achieve their goals. In addition to the existing document web, World Consortium Web (W3C) helps to develop technology stacks. The ultimate goal of World Data Web is to allow computers to develop more valuable tasks and develop systems that can maintain reliable interactions in the distributed network. The phrase of the semantic web refers to the concept of the World Wide Web for the concept of mutual data network. People can build data storage facilities using the technology of the Semantic Network. The web sets the rules for how to define vocabulary words and process data in various situations. RDF, Sparql, OWL and SKO are some of the technologies that can use the relevant data.

WHAT THE SEMANTIC WEB WILL LOOK LIKE IN THE FUTURE

This can be considered as three categories: information search automation, the Internet of Things and personal assistants. These three groups form the basis of the initial idea behind the semantic network.

WHAT IS LINKED DATA, AND HOW DOES IT WORK

In addition to other data that can be considered on the semantic web, as well as chemical characteristics, as well as dates, names and parts. In other words, this is a data network. A series of technologies of semantic networks (RDFs, owls, SKOs, SPARQL, etc.) creates an environment such as an application requesting data and drawing conclusions in advance. However, in order for the data network to become a reality, the Semantic Web needs to be able to use a huge amount of data on the Internet in a standard format that can access and manage the tool. Semantic web needs access to data, as well as accessing the connection between data to create a data network (unlike clean data set collection). Related data is a term associated with interconnected data set collections found on the web. Access to existing databases that need to be executed (relationship, XML, HTML, etc.) should be able to configure the final point of the request to search for information. To access data, W3C provides a variety of technologies (RDF, GRDDL, POWDER, RDFA, R2EML, RIF and SPARQL) that can be selected [11–15].

USEFULNESS OF SEMANTIC WEB TECHNOLOGY AND ONTOLOGY-BASED APPLICATIONS FOR DIGITAL LIBRARIES

The increasing volume of digital information on the internet is re-shaping methods for accessing digital information. The web presents new ways and strategies for digital libraries to use Semantic Web to enhance the processing and usability of digital contents in more effective ways. The potential of web technology offers an open field for digital library researchers to harness web applications and offer unlimited digital contents for users. Librarians are encouraged to utilize RDF and web ontologies to build semantic-based digital libraries; enabling improved access to web-based information through semantic search capabilities suggests that future digital libraries will rely heavily on interconnected knowledge organization systems, ontology structures, adaptable metadata frameworks, and languages designed for semantic queries. Efforts are underway to repurpose existing data by making it accessible via semantic frameworks and resource discovery systems. Tools such as Dwell, DuraSpace, Fedora Commons, and DuraCloud are among the technologies being adopted to support the evolution of semantic digital libraries and enhance library services.

Several web technologies are also available to help merge digital libraries with Semantic Web tools. The methods for integrating these technologies and discovered that many web applications now offer advanced protocols designed for creating Semantic Web services. These protocols include the Web Service Modelling Ontology (WSMO), Web Service Modelling Language (WSML), Semantic Web Service Language (SWSL), and the Semantic Web Rule Language (SWRL).

JeromeDL, the Semantic Annotator, semantic information mashups and social semantic digital libraries are the major semantic technologies for developing Semantic Web-based information services. The resource description framework (RDF), RDF schemas, simple knowledge organization system, RDF query language (SPARQL), Notation3 (N3), Turtle and web ontology language are the technologies and standards for structuring linked data to develop semantic digital libraries (SDL).

We found that semantic technology has brought a number of benefits for the users of a digital library. The authors presented a case study of a British Telecommunication (BT) archive project and investigated how Semantic Web technologies can increase the functionality of a digital library system. The BT digital library architecture is based on five types of layers to organize the digital contents by using semantic technology; these include the presentation layer, the application layer, the integration layer, the semantic layer and the persistence layer. These layers bring together relevant contents of digital libraries.

Distinct Features and Dynamic Services of Semantic Digital Libraries: Future Vision

Next-generation digital libraries will offer a large variety of informational objects. These objects could be in the form of text, tables, images, scientific data, annotations and videos. Managing emerging types of information will necessitate the use of diverse and varied information sources. In the future, traditional library services and the role of librarians will be replaced by digital tools. Traditional cataloguing will be replaced by automated metadata. Semantic Web shall replace the classification of books. The acquisition of books will be performed through eBay and PayPal. Digital reference services will become more popular as library collections will be preserved in the form of digital archives and library users will be served via online chat. Different software agents and mobile agents will be used in digital libraries to perform different tasks. Semantic Web is introducing semantic search engines and semantic techniques to develop automatic metadata generation to offer effective digital library services.

Semantic digital libraries will offer a vast amount of information by providing interoperability among heterogeneous information systems. These libraries shall offer semantic wikis and semantic blogs. Current examples of semantic digital libraries are SIMILE, JeromeDL and the Building Resources for Integrated Cultural Knowledge System (BRICKS). Semantic search engines have been developed to search for the query in its real context and provide results within that context. Hakia, Kosmix, Exalead, SenseBot, Cognition Search, Lexxe, Swoogle, Factbites and Powerset are the semantic search engines presenting more relevant, precise and accurate results [16–22].

It is obvious from the above review that semantic digital libraries will produce more relevant results. Use of intelligent software and context-awareness applications will increase the use of digital information sources. The review also presented that semantic search engines, that is, SenseBot, Cognition Search, Swoogle and Factbites have been developed to search for the exact piece of needed information in its real context.

Semantic Web Tools and Ontology-Based Applications for Digital Libraries

Next-generation digital libraries apply the functions of semantic technology and semantic networks. Semantic commentator, Semantic Information Mashup, and Social Semantic Digital Library are the main semantic technologies for developing information services based on semantic networks. In other functions, semantic search, gambling expansion, semantic request expansion, concept, assignment and visual commentary, can be controlled by the semantic interaction of mapping in RDFs, the enhanced viewing, social semanticism, data visualization, classification community, interaction and semantic interaction. We provide machine services to obtain Libraries (2006). Since libraries focus on compatibility and provide access to heterogeneous storage, they have been identified as ontology, editing, protein and knowledge management, and information management (Kim) for the development of information services based on semantic networks.

Ontology helps digital libraries to develop more meaningful relationships between the main terminology used for search purposes. Instead of developing an index of this content, we provide standardized methods for managing web. Ontology aims to understand how information is composed, not information configuration. Librarians can explore ways to use ontologies in the digital library environment to organize web contents in sophisticated ways.

The above review shows that the use of ontology-based applications in digital libraries has real potential to fulfil their aims. It will facilitate targeting and retrieving the required information in its real context. It will also be helpful to overcome and disambiguate among similar information and concepts available on the web. This feature will increase accuracy in searching digital libraries. Ontology editors, such as OntoEdit, and Web Service modelling ontology (WSMO) are the applications that can be used for this purpose.

In the future, digital libraries will use a variety of applications of semantic networks and ontology, flexible metadata standards, and semantic requests to find information in the web environment and will provide important results. Information experts who develop metadata for digital content use the RDF system to develop metadata for digital content.

In future digital libraries, various Semantic Web applications will be used. These applications include WSMO, semantic information mashups, Semantic Annotator, resource description and framework (RDF), functional requirement for bibliographic record (FRBR), KIM plug-ins, ontology editors, Dura-Cloud, Onto Edit and so forth.

By using the abovementioned Semantic Web tools, interoperability among various digital library systems will be increased and it will become possible for library users to search information from various heterogeneous information systems available on the web. Use of ontology will improve the hierarchy of relations among similar concepts. It will facilitate user to understand related concepts for any query in a more comprehensive way. Use of intelligence-based software in next-generation digital libraries will definitely improve the information retrieval of digital contents. Semantic Web applications will enhance the performance of computers in the searching process and the computer will search for exact information.

Use of context-awareness technology in digital libraries shall play a dynamic role in providing information services. There will be a use of detecting sensors in the library environment to analyse the user's context and detect their information needs. Detectors will inform information professionals on their systems that these users need a specific type of information and then information professionals will send the required information to that user on their mobile phone. Semantic digital library will use the power of web artificial agents for sharing, searching and organizing information available on the web.

Architecture of Digital Library and The Semantic Web

The Semantic Web based metadata (RDF, FOAF, and ontologies): The main components of the digital library system consists of:

- *Resource management:* Each resource is characterized by a semantic description based on the DL Core Ontology. Along with the BibTeX search, comprehensive indexes of resource contents and Marc21 are made available. Users can contribute resources via the web interface, but to ensure content quality, every resource added through this interface must be approved before it is published.
    - *Search features:* The digital library offers both search and browsing functionalities, which are powered by Semantic Web data.
    - *User profile management:* To provide more detailed semantic descriptions of resources [4], scalable user management is implemented using FOAF.

- *Communication link:* The system facilitates communication with external sources by enabling searches across the digital library network. The digital library's database content is accessible through its web page, as well as via other digital libraries and web applications.

A special web service interface was developed based on the extended library protocol (ELP) [8].

Semantic Description of Resources in Digital Libraries

There are several ways to build a knowledge foundation for description of the resources of digital libraries. General catalogues and full text indexes are the most popular example. You can also use bibliography such as Marc21 or Bibtex. The Marc21 consists of multiple keywords and free text values without control dictionary. Therefore, the machine cannot use most Marc21 descriptions. Text values are not enough to support machine reasoning. To perform more intellectual interactions with the reader, you must have a scimalic based on knowledge. The concept of Ontology, represented by the semantic web, is a significant comment that is promising by expanding the form of digital libraries. It is a waste of empty resources to not use the existing standards in the digital library. Therefore, this is true that it is important to introduce Ontology in the digital library area. Ontology should be compatible with existing formalism in the surge explanation.

CONCLUSION

In future, use of Semantic Web applications in providing web-based information services by librarians will increase. Thus, it is important for librarians to acquire knowledge of the Semantic Web and its uses for a digital library. The use of information technology in librarianship has opened up new avenues for information professionals to harness modern digital tools and offer information services in the highly complex and technology-based information environment. It is the foremost responsibility of librarians to learn the applications of new technology in librarianship and to play a vibrant role in coping with the challenges of modern technological information environment. Librarians must develop cutting-edge IT expertise and web knowledge to stay at the forefront in a changing information landscape. Librarians should concentrate on their continuous professional education by participating in training workshops, conferences and seminars to develop technical skills. Librarians must take advantage of new technology and use it intelligently to perform different library operations.

The use of Semantic Web applications will increase in the next-generation digital library. There would be a use of ontology, intelligent agents, detecting sensors and context-awareness technology to offer various services for their users. It is obvious that librarianship has become an ever-changing interdisciplinary field.

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