WEBCON: An Ontology Engine Based Conference Organiser

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Abstract

With the development of the World Wide Web, conference management can be further elevated by using a powerful and intelligent tool that provides a borderless communication. This can be realized with a conference management tool using ontology functionality. Ontology provides diverse capabilities in terms of functionalities and flexibility. Defining a detailed conference specification via ontology allows easy, seamless access and passing of information. This research proposes the concept of synergizing ontology and conference management in order to elevate conference management to another level.

Keywords: Semantic, Ontology, Conference Tool, Conference Organiser

Introduction

Web conference, a seamless mode of information sharing, has attracted attention as a means of benefiting communication among professionals. It provides fast, efficient, and cost effective way to reach a large audience quickly and effectively. There has been significant progress in the area of Web conference. A Web conference brings prospects, customers and employees together online for events that are interactive and engaging improved communication and collaboration across their organization. It drives greater productivity, rapidly reduces operational costs and accelerates business process.

Web conferencing is a service that enables instant presentation and sharing information with multiple users over the Internet. It also allows effective and economical communication.

The current Web is aimed for human readers. Machines are unaware of the customised information thus unable to distinguish from a personal Web space from a corporate Web space. This incapability hampers the machines' functionalities in the current Web environment. To address such hindrance, many organisations have established research based initiatives with commercial enterprises to enrich information availability with machine processable semantics. The outcome of this initiative is Semantic Web.

The vision of Semantic Web aims at creating a Web where information can be "understood" by machines as well as by humans. Machine represented information will have semantics accessible by other machines. Dublin Core (DC) Ontology and Resource Description Framework (RDF) are designed to represent machine accessible semantics of

information on the Web. This paper shows how DC will be integrated in RDF to develop a Web based application in a way that is understood by machines as well as by humans. WebCon is a conference participation and management tool that uses ontology maps to generate information. It enables users to work together online, share knowledge and information as well as acquire the skills needed to achieve their business goals faster and more cost effective.

The purpose and features of a conference could be defined in the following points:

- Exchanging knowledge and experience on subject matters

- Conduct and manage live demonstrations

- One stop conference center that allows one to do end-to-end booking

- Freedom of choice in choosing the type of conference to participate.

- Bringing about informal networking.

WebCon is developed based on existing Web technologies like XML and HTML as well as using ASP.NET and the next generation technology, Dublin Core (DC) and Resource Definition Framework (RDF). DC is chosen among others as the markup language in developing WebCon because it is an expressive logical language that is built on top of XML and RDF to enable markup and manipulation of more taxonomic and logical relations between entities on the Web. While RDF, standard for Web metadata, defines syntactical convention and a simple data model for representing machine processable semantics.

Why an Ontology Engine Based Conference Organiser

Today's Web is designed primarily for human interpretation and use. The current Web is oblivious to the semantics of information, repository, text and images. It is unable to combine information from multiple sources, and it is not a unified service provider. These limitations hinder the functionality of the current Web. For instance, when a user searches for something on the Web, the Web is unable to find exact hits on the information, and therefore, the information is usually described in different terms. It often returns information that uses the same words with different meanings.

Since the early days of Web development, research has been conducted to unveil a heterogeneous system that allows diverse information and knowledge sharing. The attraction of automation and rich text processing rather than raw data has surfaced in different appearances to encode knowledge in machine–understandable and communicable form rather than a machine–readable form.

To alleviate the limitations of the current Web, reliable large-scale interoperations of Web services, such as flight information providers, hotel booking services as well as a variety of e-commerce and B2B applications are needed to make the Web usable rather than only readable. Semantic Web represents an enormous opportunity to solve problems in an interoperable environment, as it provides services whose properties, capabilities, interfaces and effects are encoded in an unambiguous machine interpretable form.

Tim Burners-Lee, the founder of Semantic Web, has regarded it as one of the most promising Web technologies for the next generation, which may be able to promote the second information technology revolution. There has been significant excitement over the promise of Web services. As a matter of fact, the fundamental component of Semantic Web is realized in the markup of the Web services to make them computer interpretable and semantic understandable.

The development of WebCon will showcase the power and credibility of Dublin Core (DC) Ontology and RDF in being a milestone for representing information on the Web in a machine-accessible and understandable form. WebCon combines existing Web Technologies with knowl-

edge representation formalism in order to provide an infrastructure allowing data to be processed, discovered and filtered more effectively on the Web. This will lead to the representation of Web application where information can be "understood" by both machines and humans.

Technology and Theories in Ontology

Extensible Markup Language (XML) is a simple, very flexible text format derived from SGML. Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and other areas as well (Paolucci & Sycara, 2003).

XML is used to define syntax within the ontology. It allows elements or attributes to be nested within an element or attribute thus reducing line of codes and allows quick processing. XML can be represented in a tree format as in Figure 1.

Besides XML, RDF is also widely used in ontology definitions. RDF has an abstract syntax that reflects a simple graph based data model, and formal semantics with a rigorously defined notion of entailment, providing a basis for well founded deductions in RDF data (McGuinness & da Silva, 2004).
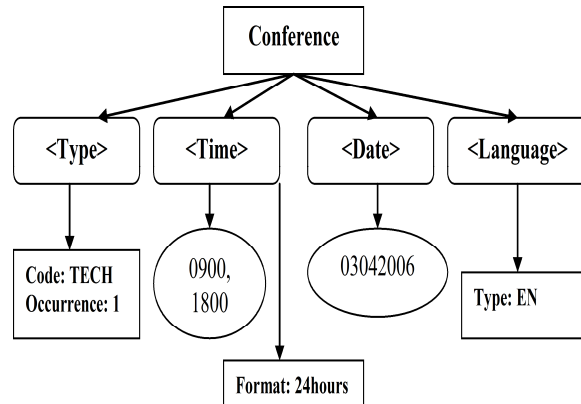
Figure 1: Sample of XML tree diagram

The main motivations for the development of RDF are:

• Web metadata that enables providing information about Web resources and the systems that uses them.

• It allows information accessed in an open environment rather than constrain-driven environment that requires more coding.

• To do for machine processable information that allows data to be processed outside the particular environment in which it was created to work on Internet.

• Integration among applications where it combines data from several applications to derive new information.

RDF is designed to represent information in a minimally constraining, flexible way. It can be used in isolated applications, where individually designed formats may be used and also shared (McGuinness & da Silva, 2004).

RDF is coupled with an international metadata structure known as Dublin Core (DC). The Dublin Core Metadata Initiative Element Set has been approved by the American National Standards Institute (ANSI) and assigned the number Z39.85 (Powell & Johnston, 2003).

Research Approach

The main purpose of developing an ontology based system is to reflect how Dublin Core Ontology, the key technology for the next generation Web that helps both people and machines to communicate more effectively, can be integrated in RDF.

Lack of research on RDF usage for conference management suggests that the former is not widely used (Klyne & Carroll, 2004). RDF at this juncture, has been widely used in library systems, B2B and artificial intelligence based systems. Taking previous usage into consideration, implementing RDF into conference management will be possible, since all the other implementations have proven 80% success rates (Barstow & Beckett, 2001). By using RDF in implementing a Conference Management tool it will:

❖ Make the system more user friendly and ease of use

❖ Give more accurate options such as search are more semantic based than full text and giving best hit rates instead of giving just the most compatible hit rate.

❖ Enhance flexibility especially in adapting third party components.

❖ Allow classification of similar objects as a single category

Looking at a conference management system as a whole, at a later stage of this system, RDF can be used to extend the functionality of the conference organiser tool to even run conference calls and audio presentation simultaneous as the conference is conducted.

WebCon is a Web application tool developed based on the Semantic Web techniques, to ease conference management by allowing organisers to add and delete all information pertaining to the conference ranging from event description, event date and time, as well as the list of speakers who will speak at the conference. As far as we know there is no such conference Web application tool available for open access except for tools that are inter-organisational based.

One of the research techniques used to gather information is face-to-face type of interview. An interview was conducted with the staff of Marcus Evan conference and event organizer. An insight about the advantages, disadvantages and the way of conducting and organising a conference has been gathered. Another well established technique used for gathering demographical information and users' opinions is through questionnaire. The questionnaire was designed and given out to respondents who vary from students, software developers and managers. In addition, information was gathered from other sources such as Websites, books, articles and journals which include the current and past literatures on Web application development approaches using Ontology and RDF as well as those developed purely on HTML and ASP.Net.
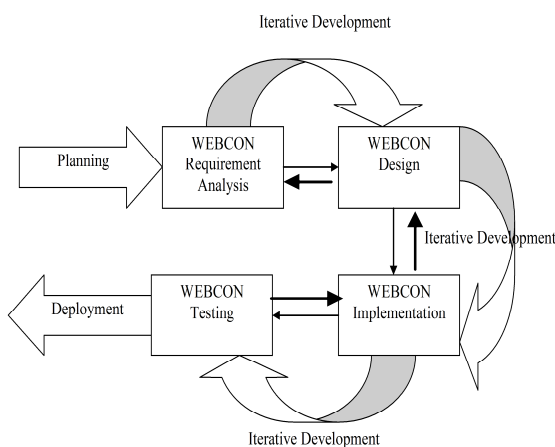
Development Methodology

A development methodology is a route map that will be followed in the development of WebCon. Based on the research conducted, Rapid Application Development (RAD) was identified to be the best method adopted to develop WebCon. The advantage of using RAD methods in development is that RAD compresses the analysis, design, implementation and test phases into a series of short iterative development cycles. The other main advantage of RAD is the ability to iterate between the phases which allows effectiveness and self correction in case of small refinements and improvements. The RAD method workflow is as described in Figure 2.

Figure 2: WebCon-RAD Model's Development Methodology

The development activities of WebCon consist of requirements capture, analysis, design, implementation and testing phases. In the requirement analysis phase, the system was analysed and information was collected to find out whether users were satisfied with the current way of conducting conferences as well as with the level of functionality that the current Web presents. Based on the requirements specification, use cases were identified.

The second phase is designing the WebCon, where the use cases, sequence diagrams and RDF charts were drawn out as guidelines for the full fledge development and implementation stage. The Implementation phase is where the RDF charts were physically translated into RDF syntax using Dublin Core. The last phase is the Testing phase, where a user acceptance test was done to verify the user and system requirements were met. If a defect was detected, the design and implementation phases were repeated until the application was consistent and well defined.

The Design – UML Representation

The development work of the WebCon, started with defining what the system should do. To capture user requirements and to ensure the completeness and correctness of WebCon, Unified Modelling Language (UML) was used. The main activity consisted of identifying use cases and actors, the people who will be interacting with the system, and describing the details of each use case. After identifying the actors, use cases were created to identify how actors interact with the system. It simplifies the process of software engineering by providing a blueprint for development. Use case diagrams describe a sequence of events that are performed by external actors to accomplish a given task within the system.
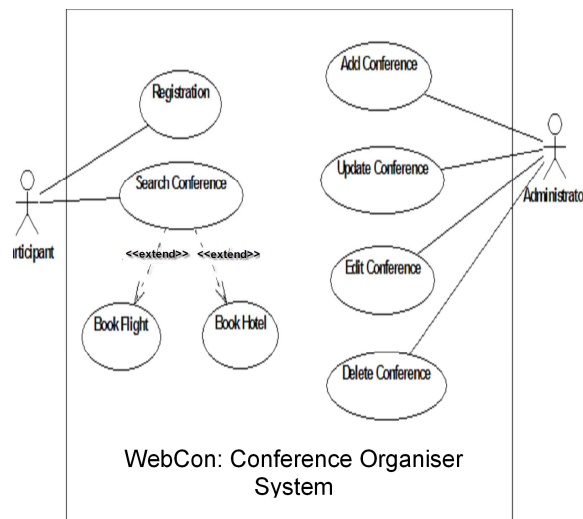
The use case model was used to define the main components of the conference management system, whereas the analysis and design model was used to define the architectural structure and subsystems relationships of the system. Part of the requirements capture of conference management was documented in a UML use case diagram as shown in Figure 3. Each of the use cases was documented with text, describing the use case and its interaction with the actors in detail. The actors of WebCon were identified as Administrator, and Participant. The Administrator is the key person who manages the main conference Website, the conferences as well as the participants, while the participant is the user of the system who registers to WebCon and participates in any new upcoming conference.

Figure 3: WebCon Use Case Model

As shown in Figure 3, the participant has to can participate in the conference and proceed further in the conference system. The participant's main activity will be to register to WebCon, and participate in the conference. The participants can only use the system once the registration details are accepted. Upon successful registration, participants can participate and search for a conference that could be organised in various geographical locations. The conference module includes two sub modules, which are the flight and hotel booking. A participant can book lodging or travel via the system. The administrator can add, update, delete and edit the conference's details. The administrator will perform all the above actions individually as illustrated in Figure 3.

The Design – RDF Representation

An RDF graph is represented as a set of RDF triplets where each triplet contains a subject node, predicate and object node. Nodes are RDF URI references, RDF literals or are blank nodes. Blank nodes are usually non-RDF URI references identifier. Predicates are RDF URI references and can be interpreted as either a relationship between two nodes or as defining an attribute value (object node) for some subject node. Each pair of nodes is linked by labeled directed arcs.

An RDF graph is used to describe the Ontology based Conference Management structure. The RDF graph is a Web graph where the nodes represent Web pages and the edges represent hyper-links between these Web pages. RDF provides a means for publishing both human readable and machine processable vocabularies. We use the Dublin Core (DC) vocabulary to add properties to the nodes. The properties associated with the resources are identified by property-types, and each property-type has corresponding values, such as dc:title, dc:format, and dc:date.

A UML model is RDF compatible. RDF class and property system is similar to the type systems of Unified Modelling language. But RDF differs from UML in that instead of defining a class in terms of the properties its instances may have, the RDF describes properties in terms of the classes of resource to which they apply. This allows mixing and extending UML models and the language elements of UML itself on the Web in an open manner. The UML/RDF mapping suggested here is not a special encoding for UML, rather it is achieved by creating a URL for every identifiable UML entity, as defined in the previous section.
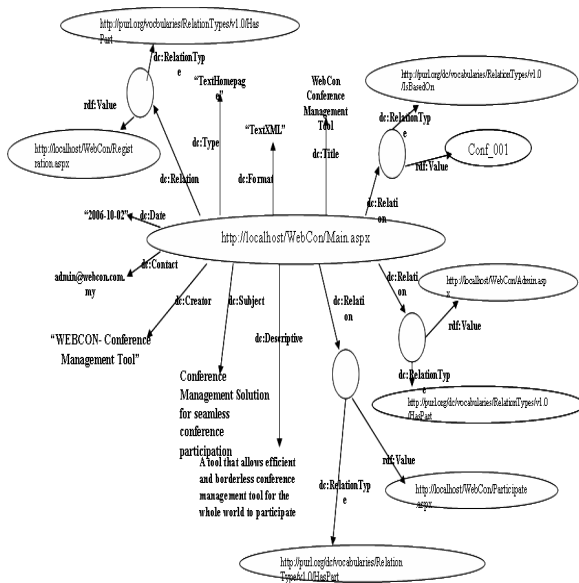

Figure 4: RDF Syntax of Main Engine of WebCon

The RDF graph as shown in Figure 4 represents the main engine of the system. The administrator has the authority to add in new conferences to the system, delete an outdated conference that has been registered to the system, edit and delete registered users and send an email alert to all the registered users to notify them of any upcoming live conference. The RDF graph shows the attributes of the main engine of WebCon. Each attribute has been defined by using Dublin Core elements, by putting each of the DC elements with the dc: namespace prefix before it, to be represented in a natural way that is understood by both humans and machines. For instance, the dc:title indicates the title of WebCon, the dc:format indicates the mime type of WebCon, and the dc:date indicates the date of the creation of WebCon Web page. To express the relation and value of the resources, DC **IsBasedOn** relation type has been used. It shows that every new conference registered to the system is based on a unique conference ID. **HasPart** DC relation type is used to illustrate the main functionalities of WebCon such as user registration, adding a new conference and administration section.

The Pyramid Layer Implementation

The Pyramid Layer concept that is being used in WebCon development is divided into 3 main components below:

i. *Data* – Information, knowledge, and conceptions, related to the conference or participants, obtained by observation, investigation, interpretation, visualization, and mental creation. Data are intangible and include numbers, words, symbols, ideas, concepts, and oral verbalization.

ii. *Metadata* - Information about a particular data set which may describe the conference and participant, for example, who, when, and by whom it was organised, created, accessed, and/or modified and how it is formatted.

iii. *Ontology* - a network of relationships that describes the conference and is used to track how items or words relate to one another. For example, a "conference location" link or "flight" link in ontology would be used to track these types of relationships and their corresponding values for listed individuals.

Based on Figure 5, the functionality of Web Con is as follows:

1. Users can access the system through a Web device, e.g. browser.

2. Data received will be recognized using the relevant metadata that resides within a specific ontology. This metadata are stored in the form of RDF Logic Rules.

3. The RDF Logic Rules at the metadata level maps this query into query for WebCon SQL traditional structured data and relates it back to the ontology.

4. The Ontology later organizes the data into relevant sections based on the metadata structure. XML level in this juncture will be the main mechanism that manages the data with accordance to the users request.

Figure 5: Webcon Pyramid Layer

5. The data integrated within the Ontology will then be sent to the specific Web device to display the information in Ontology Based Interface.
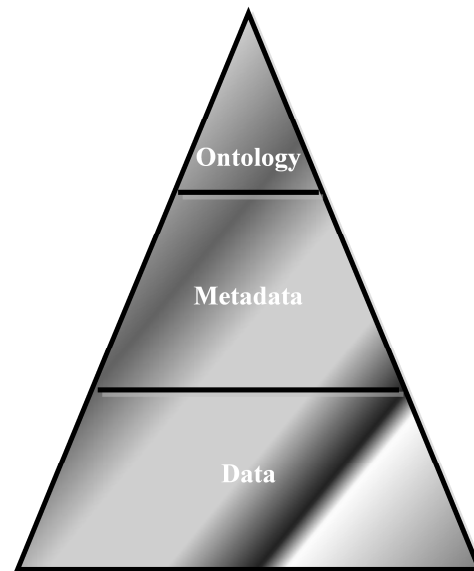
User Interface Design

The quality of system input determines the quality of system output. It is vital that input forms and screens be designed with the critical relationship in mind. Well-designed input screens should meet the objectives of effectiveness, accuracy, ease of use, consistency, simplicity and attractiveness.

Effectiveness means that a form's input and screens serve specific purposes in the management information system, while accuracy refers to the design that assures proper completion. Ease of use means that forms and screens are straightforward and require no extra time to decipher. Consistency in this case means that forms and screens that group data similarly from one application to the next, while simplicity refers to keeping forms and screens purposely uncluttered in a manner that focuses the user's attention. Attractiveness implies that users will enjoy using, or even be drawn to using, forms and screens through their appealing design.

Figure 6 shows the first page of WebCon that the user views when the system is loaded. This page explains a brief introduction about WebCon. It also shows the main functionalities of the

system, which are the participant login, new user registration, administrator login and contacting the administrator of Web-Con.

Conclusion

The limitations of the current approaches are overcome by the ontology-based approach. The increased expressive level allows formalising a greater part of the domain ontology. WebCon was developed to allow conference organizers to host an online conference. WebCon also has adapted some of the strengths from Document Driven Approach such as the map-ping mechanism from data to formatted Web page. Nevertheless, the transformation rules have been modeled using RDF and Dublin Core concepts for reusable purposes.
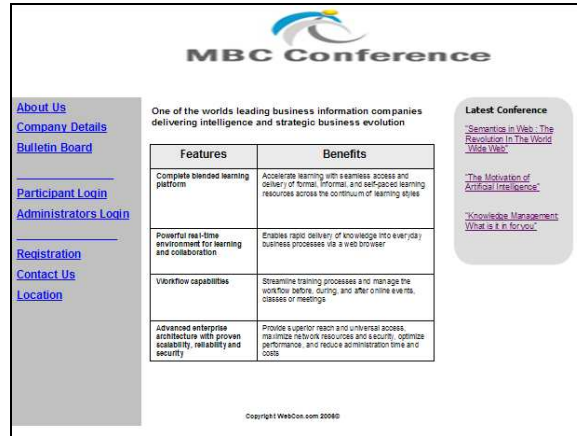

Figure 6: WebCon Main Page

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Biographies

Bavani Subramaniam is the Regional Technical Trainer for LHS Systems Asia Pacific. Previously, she was the Training Specialist for the Celcom VADS Call Centre Project. Her job entails delivering training programs to all customer service in a Call Centre environment. The lively and energetic presenter has 7 years of experience in various fields. She was involved in Contact Centre Training; a System Engineer for Semiconductors and Food Industry, a Trainer for a Software House and was the SAP Trainer and Coordinator for Telco Hardware producer. Bavani Subramaniam holds a Masters in Software Engineering majoring in Software Development and a Degree in Computer Science from University Malaya. She also as acquired a Diploma In Electronic Engineering majoring in Computer Technology from Ungku Omar Polytechnic.

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