

Knowledge Mobilization through Re-addressable Ontologies

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Abstract

Access to stored knowledge is a complex, yet extremely well-studied process. Knowledge management has always concentrated on coding and proposing infrastructures for the explicit storing of knowledge. In this document, we shall study the problems which exist in knowledge mobilization. In turn, we shall present our proposal for dealing with the problems encountered in knowledge mobilization from any low performance device (PDAs, mobiles, etc.). By using ontologies, web services and a multi-agent architecture, we are able to address requests until the desired knowledge is obtained. A study case is tackled in order to examine the advantages that this proposal offers. The new concepts of brief ontologies and re-addressable ontologies are introduced.

1. Introduction

Traditionally, knowledge management tools have not facilitated the dispersion of their contents and it has not therefore been possible to use them contextually in order to improve processes using stored knowledge. This is because all efforts have centered on the codification and proposal of infrastructures for the explicit storing of knowledge, and on refining, managing and distributing this knowledge (Zack. 1999, Hansen, 1999).

In this article, we shall focus on the need to access stored knowledge so that the user can make decisions according to the information received by the system. Knowledge mobilization (KM) is sometimes described as “dissemination,

knowledge transfer, and knowledge translation”. In (Daryl Rock, 2004), KM is defined as “getting the right information to the right people in the right format at the right time so as to influence decision-making”. From this definition, various **needs** can be deduced:

1. Treatment and translation of the information requested by the user
2. Information dependent on the user’s context
3. Translation to the required format
4. Quickly accessible services from various forms

In order to tackle the problem which arises when attempting to solve knowledge mobilization, especially from low performance devices, we shall propose the use of the following techniques and architectures:

- Ontologies: we shall have a formal knowledge representation which users can access
- Web service (Tim Berners et al, 2001): in order to obtain interaction with the user and/or equipment in a totally automated way
- Multi-agent system for the treatment of requests received through web services. This multi-agent system answers requests by accessing the knowledge containers and generating responses.
- Incorporate the necessary treatment in order to meet the needs of the new technologies which will enable the user to connect to the system from anywhere.

The last of the points outlined involves adapting the system to the limitations of the new generation devices (storage limitations and limited bandwidth) for the information to be accessed from any device however limited its resources.

In recent years, mobile communications have grown exponentially, offering a unique opportunity for providing information. Wireless technology and mobile devices (mobile phones, PDAs, etc.) enable information to be accessed from anywhere and at any time regardless of place, time and even the user's context.

In Section 2, a series of necessary concepts are described. In Section 3, we shall show a study case. Finally, in Section 4, we shall present our conclusions and references.

2. Brief and re-addressable ontologies

As we mentioned before, ontologies represent knowledge which will be subsequently used to access information. The size of the ontology shall therefore depend on the field which the ontology encompasses.

We can define a **brief ontology** as the ontology which includes a small amount of knowledge referring to concepts existing in more generic ontologies. Generally speaking, a brief ontology will always refer to a generic ontology, and basically contains a series of keywords which enable all the reference ontology's information to be accessed

In order to provide access to the information in other languages, the translation of these keywords to the required language will be included.

A well-structured and well-defined knowledge base, constructed for the exclusive use of a limited set of people, can be considered a generic ontology on information stored in the knowledge base.

If we were to consider a business situation, we might have the following customer information:

1. Name, address, province, etc.
 2. Client information, history, promotions, etc.
- Access to this information would be restricted to company employees.

In our approach, there will be two different situations: on one side, the ontology which defines

the concepts referring to the clients and the relations which may exist within the company, and on the other side, a smaller ontology, a "**brief ontology**" (Figure 1) with the basic data in order to access the complete company information (ID, client's name, promotion code, etc).

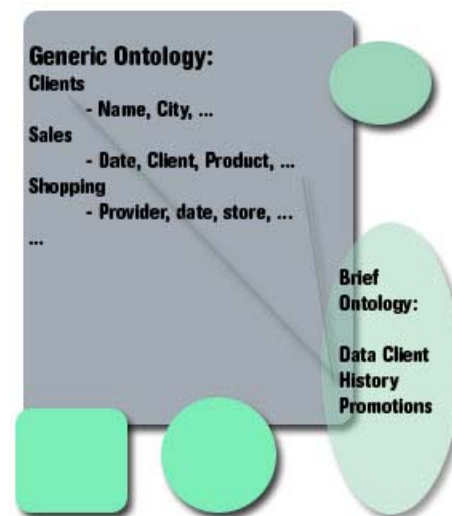


Figure 1. Brief ontology using parts of the generic ontology

The behavior is very similar to indirect addressing whereby there is no direct access to the data but rather to an address which sends us to the address where the data is. This behavior means that users can better filter the information which they wish to access, and it is not therefore necessary for all the information to be transferred. This consequently results in an improvement in the system response time and in the queries which are possible from mobile devices.

We can define a series of operation on the brief ontology such as term or concept translation so that the greatest amount of information possible is obtained; for example, asking for information in one language and obtaining information in another. If the information is stored in a measurement unit and is consulted by another measurement unit, the ontology would perform the conversion between the different values. In turn, operations are included which would enable

the response to be adapted to the user's context (storage limitations, capacity of the means of communications, graphic interface, etc.).

From the user's point of view, a **re-addressable ontology** is used in which a series of concepts and values (keywords) are defined which will be consulted in the corresponding brief ontologies so as to build the system's response to the user. This ontology is called re-addressable due to its mobile nature, since it is used between the system and the user's device in order to communicate between them both (Figure 2).

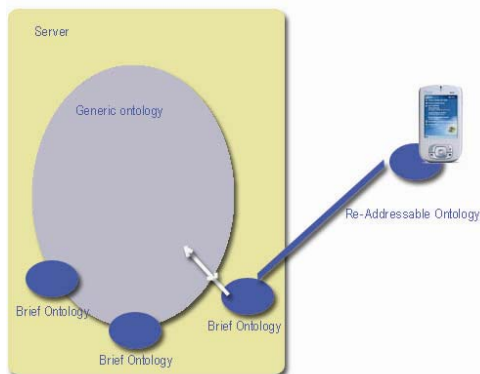


Figure 2. Communication between device with re-addressable ontology

Both ontologies are stored on the server, and the general information is accessed by means of the brief ontology, which can be browsed using the remote device.

2.1. System overview

By using the ontologies defined (brief and re-addressable ontologies), we have proposed a solution for knowledge mobilization with the added value of being able to use mobile devices due to the few feature restrictions of these devices.

The system needs to be able to deal with requests from users and/or equipment so that the treatment is totally transparent and allows integration of different knowledge sources. For this, we shall incorporate a system of web services.

A web service is an accessible application which can be used and consulted by other applications and staff. A web service supports direct interaction with other software agents through the exchange of XML messages via Internet. A web service is described using WSDL (Web Service Description Language) and SOAP (Simple Object Access Protocol) as the protocol for exchanging messages.

In the last twenty-five years, various programming paradigms have appeared for the design of software systems such as procedural programming, which is oriented towards objects and software components. Agents (Weiss, 1999; Wooldridge, 2002) are also being considered such as the new paradigm for designing and constructing complex distributed software systems. In addition to its robustness, scalability and flexibility, an agent-based architecture is also suitable for solving problems which are dynamic, uncertain or which have a distributed nature. In particular, an agent architecture is ideal for developing Internet software.

Once we have the application which deals with the requests (web service), it is necessary for these to be processed and for the responses which will be sent to the user to be constructed. For this, a multi-agent system (MAS) is proposed which, by means of a cooperative strategy, is capable of achieving the established objectives. In turn, the MAS integrates the external sources and presents the information to the user in a very clear way. Together with the brief and re-addressable ontology concepts, we solve the needs for the remaining phases of the system (treatment, translation and construction of the information depending on the user's context).

3. Study case

The study case chosen to implement the proposal presented in this article concerns a dairy product company. In this company, there is a large knowledge base which is extremely important for the development of the sales process. The use of the contents stored in its sources, which can only be accessed by company employees, would enable the sales process to be increased while reducing

the number of products which are past their sell-by dates.

The processing of dairy products is extremely complex due to the fact that products must be consumed within 15 days. A series of vendors take orders for products which the shops expect to use. In the majority of cases, it is the distributor and not the shop that is responsible for product sell-by dates. This is a major problem for distributors as they are the ones who must cover the expenses arising from company vendors' bad sales forecasts.

The main concern for the distributor therefore lies in reducing the number of products past their sell-by dates. The full burden of responsibility falls on the vendor who forecasts how much product each shop needs. Because the distributor is responsible for products past their sell-by dates, it is the pre-sales vendor who predicts what the shop is going to consume before the next visit.

Due to the fact that pre-sales vendors make many visits throughout the day to many different clients, it is impossible for them to remember all the information necessary for the sale from one day to the next. A pre-sales vendor is also in charge of placing the product in the refrigerators so that by taking into account a series of warm areas, the product is arranged in order to encourage sales and reduce the number of products reaching their sell-by date.

In this article, we shall present an architecture with the following characteristics which uses the various technologies mentioned above:

1. Access of the knowledge stored in company sources from mobile devices by pre-sales staff
2. Browsing the various brief ontologies in order to obtain the most debugged and filtered information
3. Obtaining integrated information from different sources in a totally transparent way

This sales help system facilitates the work of the expert and is of benefit to the company since it enables a more active sale to be made and decreases the possibility of products exceeding their sell-by dates.

The system contains a set of brief ontologies using web services which enable the necessary consultations to be made in the system in order to help the decision-making process: client consumption, promotions, client information, documents pending payment, position of the product in the refrigerator, etc.

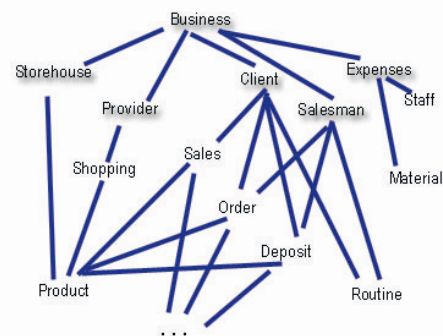


Figure 3. General ontology of the system

The system presents a distributed architecture in which the different mobile devices request information contained in data sources via web services. A multi-agent system will carry out the necessary tasks in order to consult the brief ontologies which will be readdressed to the requesting devices.

Using the device, the expert user will request the necessary information for the sale (re-addressable ontology), for example the last five sales for a particular client, for an area, list of articles which a client consumes from all of the company's products, a client's debt risk, etc. so that the information request will be received via the web service.

The multi-agent system (see Figure 4) is in charge of collecting the information requested using keywords. The brief ontologies are consulted together with the knowledge base

associated with the request. The system responds by sending the re-addressable ontology with the knowledge connected with the request to the device meeting the expert user's needs in order to be able to make the sale with all the necessary information.

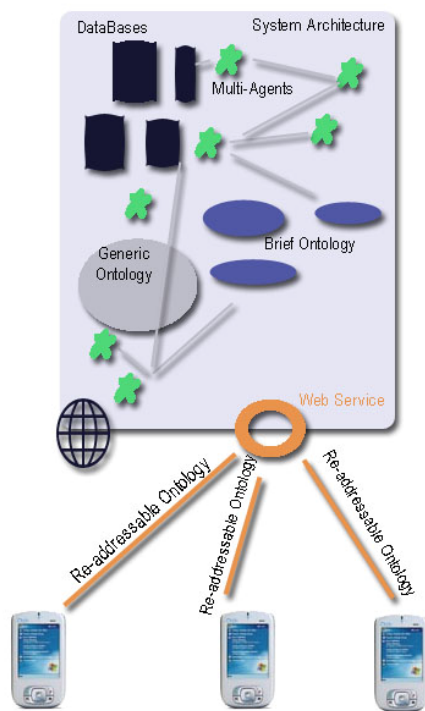


Figure 4. System overview

4. Conclusions

In this article, we have presented a series of concepts (**brief ontology** and **re-addressable ontology**) in order to adapt the architecture of a knowledge mobilization system to the device submitting the requests (generally low performance mobile devices). By using these new concepts, we can adapt the development of our architecture according to user needs. The proposal is sufficiently flexible and adaptable to the user's context.

The proposal uses the latest web technologies so that information can be accessed entirely online.

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