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APPLICATION FOR SEMANTIC E-MAIL ADDRESSING

TANJA RASOVIC
Employment Agency of Montenegro, tanja.rasovic@zzzcg.me

ZELJKO ZORIC
Employment Agency of Montenegro, zeljko.zoric@zzzcg.me

Abstract: *Today, the most effective method of marketing is e-mail marketing. Any company, who wants to achieve business success, can not ignore the marketing potential of the e-mail marketing. Due to specific kind of work, and necessity of automating communication with employers, in the Employment Agency of Montenegro has been made its own system for conducting e-mail campaign, in which, due to the latest trends in the development of e-mail marketing and the needs of the Employment Agency, semantic e-mail addressing was applied.*

This document presents architecture of the applied system for semantic e-mail addressing. It explores the possibilities for creating and updating the knowledge base system about employers and job vacancies, which is created based on domain ontologies. It also describes in details the process of publishing database on the Semantic Web and plans for further updating and improving the existing knowledge base system.

Keywords: *Semantic Web, Semantic e-mail addressing, mailing lists, RDF, FOAF*

1. INTRODUCTION

E-mail marketing is the process of sending commercial messages via e-mail messages to users who have been approved to receive them. Made by the rules of making high quality e-mail marketing messages, this type of advertising can be very simple but very effective marketing techniques. It is a powerful tool in the marketing of the company, business analysis and in creating image of the company and its products in public.

In the Employment Agency of Montenegro, by using Application for Semantic E-mail Addressing (ASEA), e-mail marketing is the process of sending information, news and newsletters to all employers who are interested in receiving this information, based on their application to the mailing list, and based on categories of their interests which they chose themselves during signing up on mailing list and which can be changed at any time. This is how employers are kept informed about needs on the labor market, news and benefits in hiring workers.

Using the latest technologies of the Semantic Web, by presenting specific information about employers from our database in the form of a Resource Description Framework (RDF) file, this data becomes a part of the global knowledge base, enabling this data to be reused in other applications by the rules which are defined by ontology reasoning. This paper describes the procedure and the importance of the publishing this data on the Web, possibilities for reusing them and expectations for further improvement of the ASEA.

2. SEMANTIC WEB

The Semantic Web is the next phase of the Web development that will enable understanding and processing of information by the content, not only by people but also by computers. This is a "Web of meaning" which consists of semantically enrich data that are understandable to people and machines which will process the received information, allowing the operation of the intelligent information services, and semantically enriched search engines. "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. [Tim Berners-Lee, May 2001]." Semantic Web is a network that allows data to become divisible and reusable in all applications.

In general, the development of a Web is based on the following technological and organizational principles [18]:

- simplicity
- modular design
- decentralization (distribution)
- tolerance

The first two principles are related to software engineering, and the other two principles are directions for development of the Semantic Web. Distribution is not only relate to the contents of the documents published on the Web and its decentralized location, but also on technological development of the Web - software developers and providers of various services on the Web

can include in Web their own technological solutions. The tolerance implies that new technologies cannot prevent the use of old technologies. The Semantic Web is a vision of the future that develops in the direction that supports the requirements mentioned above.

The idea of the Semantic Web to be fully implemented it is necessary to provide adequate infrastructural support that is based primarily on the use of ontologies and semantic description of the Web resources.

The basis of the ASEA should be well-designed ontology, which includes all concepts in the field of employment. Since application is about sending semantically addressed e-mail messages, it is necessary to classify the users' interests and activities and present them thru the concepts and relationships within the ontology. This will enabled their interpretation and integration with other machine-readable data from other Web location in the field of employment. For this reason the following ontologies in employment has been formed: ontology of employers, ontology of vacancies and ontology of persons who are seeking for a job.

Ontology in the field of employment is an essential component of the system, and it presents "common language" in the form of precisely defined groups of vocabulary that describes the vacancies. This is a set of local ontologies for describing data. Semantic description of the Web resources from the database of the ASEA is described in Chapter 5.

3. SEMANTIC E-MAIL ADDRESSING

Semantic e-mail addressing is sending particular e-mail messages to people from the mailing list who are recognized to be interested in receiving information that is sent on that occasion. Essentially, semantic e-mail addresses are logical (declarative) descriptions of recipients rather than static lists of strings. Therefore, they allow sending (with the same description) e-mails to highly dynamic groups of people and at the same time ensuring, that the "right" people (at this specific moment in time) are addressed. Therefore semantic e-mails addresses are stable, whereas the group might change very frequently. To members of the mailing list this enables easy administration of their applications to various mailing lists. The essence of this way of addressing consists in breaking the complex applications to simple factors, a better understanding of the set of requirements, according to the rules defined by the ontology. In this way the knowledge we have about a particular element has been disassembled for the purpose of reuse data [26].

Since the employers in the evidence of the Employment Agency of Montenegro are characterized by different forms of organization, number of employees, organizational structure and interests about the cooperation with the Employment Agency, ASEA is the ideal solution to automate communication in the direction Employment Agency - employers. A model of this application is described in [31].

4. APPLICATION PROGRAMMING INTERFACE

ASEA, developed in the Employment Agency of Montenegro for our own purposes of doing e-mail marketing, is a Web based Active Server Pages (ASP) solution with on-line database creation tool for MS SQL Server 2000/2005, Skins using Cascading Style sheets. ASEA has many powerful and easy setup tools and options, making it simple to create Newsletters, E-mail Marketing Campaigns, Templates, RSS News Feeds, and lots more. Below are just a few of the main features of the ASEA:

- Sending unlimited number of e-Newsletters and e-mails;
- Unlimited number of subscribers and categories;
- RSS News Feeds;
- E-mail marketing;
- Personalised Newsletters;
- Subscriber import tools - import lists from CSV/Text files and databases;
- Website login page;
- Rich Text Editor - WYSIWYG e-Newsletter and Template Writing Editor
- E-mail activation of new subscriber account (optional);
- Personalized e-Newsletters with member name, e-mail, company name, address, etc.;
- Web-based Subscriber Management Centre for changing members settings and subscriptions;
- Paste From Word Tool;
- Opt-in e-mail confirmation (optional);
- Create, save, edit and delete, unlimited number of e-Newsletter Templates;
- Image and file uploads supported
- Admin Control Panel;
- Online web frontend for viewing News Bulletins and Newsletters (optional)
- Change the look and feel by creating new skins, or select from a number of built in Skins;
- E-Newsletter Statistics.

Main characteristic of the Subscriber Management Centre are:

- Category Subscription Management to change which categories the user is subscribed to;
- Subscribe to unlimited number of Newsletter Categories;
- Update Name, E-mail Address, Password, Company Name, Address, etc.;
- HTML or Plain Text e-Newsletter option (only if admin has allowed plain text e-Newsletters);
- Resend activation confirmation e-mail, if subscriber has not confirmed their opt-in subscription;
- Remove account option.

ASEA is designed for the Windows hosting environment, and use the Windows IIS web server with ASP enabled. Database is SQL Server 2000. TCP/IP connections to the SQL Server must be enabled. One of the following e-mail components needs to be installed on the web server in order ASEA to send e-mails: *CDOSYS*, *CDONTS*, *W3 Jmail*, *Persist AspEmail*, *SeverObjects AspMail*. SMTP server that ships with MS IIS also needs to be installed.

5. RELATIONAL DATABASE AND SEMANTIC WEB (RDB2RDF)

Mapping relational databases is essentially a presentation of these databases for machine-readable data processing. RDF/XML is an XML syntax for RDF data. Today, there are many programs for database direct mapping, depending on the type of the database, compatibility and the need for certain capabilities of the program that performs the mapping. The process of mapping relational databases in the ASEA was conducted using D2RQ platform, components from which it consists. D2RQ platform enables treating non-RDF Databases as virtual RDF graphs.

As Semantic Web technologies are getting mature, there is a growing need for RDF applications to access the content of non-RDF, legacy databases without having to replicate the whole database into RDF. D2RQ is a declarative language to describe mappings between relational database schema and OWL/RDFS ontologies. The D2RQ Platform uses these mapping to enables applications to access a RDF-view on a non-RDF database through the Jena and Sesame APIs, as well as over the Web via the SPARQL Protocol and as Linked Data. The D2RQ Platform consists of:

- the D2RQ Mapping Language, a declarative mapping language for describing the relation between an ontology and an relational data model.
- the D2RQ Engine, a plug-in for the Jena and Sesame Semantic Web toolkits, which uses the mappings to rewrite Jena and Sesame API calls to SQL queries against the database and passes query results up to the higher layers of the frameworks.
- D2R Server, an HTTP server that can be used to provide a Linked Data view, a HTML view for debugging and a SPARQL Protocol endpoint over the database.

The D2RQ Engine is implemented as a Jena graph, the basic information representation object within the Jena framework. A D2RQ graph wraps a local relational databases into a virtual, read-only RDF graph. It rewrites Jena or Sesame API calls, find() and SPARQL queries to application-data-model specific SQL queries. The result sets of these SQL queries are transformed into RDF triples or SPARQL result sets that are passed up to the higher layers of the framework. The D2RQ Sesame interface wraps the D2RQ Jena graph implementation behind a Sesame RDF source interface. It provides a read-only Sesame repository interface for querying and reasoning with RDF and RDF Schema.

The figure below depicts the architecture of the D2RQ Platform:

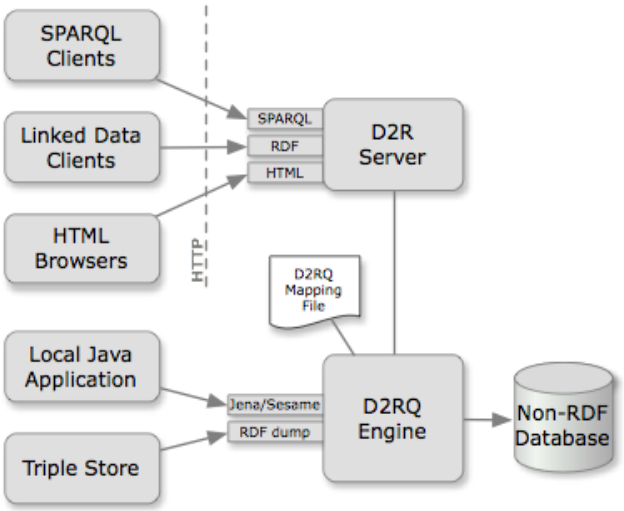

Image 1:D2RQ platform

D2R Server is a tool for publishing relational databases on the Semantic Web. It enables RDF and HTML browsers to navigate the content of the database, and allows applications to query the database using the SPARQL query language. D2R Server builds on the D2RQ Engine [32].

The reasons for the mapping certain data from the database of the ASEA in this program was that to use a D2R server it is enough to have installed Java 1.4 or newer, then the ease of mapping SQL database, and compatibility with other databases, as SQL database is not only in the company, detailed instructions on the use of this program, and many forums dedicated to the topic about D2RQ platform.

For starting D2RQ Engine it is necessary to have [32]:

- Java 1.4 or newer on the path,
- A supported database. D2R Server works with Oracle, MySQL, PostgreSQL, Microsoft SQL Server, and any SQL-92 compatible database. Microsoft Access can be used with some restrictions.
- a modern browser like Firefox, Opera or Safari for using D2R Server's AJAX SPARQL Explorer. Internet Explorer can only browse the HTML pages, but not use the SPARQL Explorer.

The process of obtaining an appropriate RDF file is the following [32]:

- Download and extract the archive into a suitable location.
- Download a JDBC driver from your database vendor. Place the driver's JAR file into D2R Server's /lib directory. A list of JDBC drivers from different vendors is maintained by Sun.

Also take note of the driver class name (e.g. org.postgresql.Driver for PostgreSQL or oracle.jdbc.driver.OracleDriver for Oracle) and **JDBC** URL pattern (e.g. jdbc:mysql://*servername*/*database* for MySQL) from the driver's documentation. Drivers for MySQL and PostgreSQL are already included with D2R Server.

- Generate a mapping file for your database schema. Change into the D2R Server directory and run: *generate-mapping –o mapping.n3 –d driver.class.name –u dbuser –p dbpassword jdbc:url…* (*mapping.n3* is the name for the new mapping file)
- Start the server: d2r-server mapping.n3

D2R Server uses the D2RQ Mapping Language to map the content of a relational database to RDF. A D2RQ mapping specifies how resources are identified and which properties are used to describe the resources. The generate-mapping script automatically generates a D2RQ mapping from the table structure of a database. The tool generates a new RDF vocabulary for each database, using table names as class names and column names as property names. The mapping file can be edited with any text editor. D2R Server will automatically detect changes to the mapping file and reload appropriately when you hit the browser's refresh button [32].

Besides, mapping of the certain data of employers and vacancies that they have announced is the first step towards using Semantic Web application in the IT system of the Employment Agency of Montenegro. As there are several private agencies for employment mediation in Montenegro besides Employment Agency of Montenegro, with appropriate published documents in RDF file about employers and job vacancies advertised by all agencies, it is possible to make a semantic search engine which will support searching of this data. Relief in the formation of this browser is that the employer ontology and occupations are clearly defined, and thus greatly facilitated search of certain data.

To begin this initiative in the RDF employer file are published only those data that are also available through the website of the Central Registry of the Commercial Court: Name, Address, PostCode, Municipalities, ActivityCode, Activity, DateEstablishment, E-mail. Since the vacancies are advertised three times a week, the service will start in the same terms and it will publish newly created RDF file on the Internet. In this way data about employers and advertised vacancies from Employment Agency of Montenegro database become part of the global knowledge base, ready for reuse as a part of the Semantic Web.

ASEA bases its operation on a predefined mailing list because the group to whom e-mails are sent is already known and registered in the local database. These are employers registered in Montenegro, which still do not have a FOAF file published on the Internet. So, their first appearance on the Semantic Web will be by mapping database of the ASEA.

ASEA is open in the sense that it can be easily upgraded with option to send an e-mail to certain persons who have announced their FOAF file on the Internet. The further development of ASEA would be adding the ability to send a semantic addressed e-mail using the FOAF mailing lists, which provides an opportunity to send e-mail to anyone on the Web by not knowing his e-mail address, and whose attributes defined in the FOAF file suit selected attributes of the sender. FOAF is a document in which a person keeps some personal information such as name, e-mail address, homepage and friends. This file links to other FOAF file and so the network expands. The new upgraded procedure would be: read the FOAF data, imports into a repository, and by selecting create the mailing list, which would be imported into the database server.

6. CONCLUSION

ASEA which is applied in the Employment Agency of Montenegro, identified employers in the way that they were offered to chose their own attributes from the group of attributes. The main advantage of this automation process of communication with employers is to save time, ease and effectiveness in informing employers of different interests, send personalized messages to selected clients, all aimed at accelerating the process of recruitment of persons from the register of unemployment. Within this program there is a statistic for monitoring the status and interests of the employers on the mailing list, which for the Employment Agency presents the direction in which to develop and improve their services. Because of the possibility that the e-mail is sent only to registered persons with known attributes, the possibility of spamming is practically reduced to a minimum. Semantic e-mail addressing is especially important in business communication, as in this case the recipient does not need to think whether he received spam or not.

The main contribution of this paper is in the popularization of the Semantic Web, in the way of displaying data on the Web as a RDF file, which will allow the data to be readable for RDF and HTML browsers. Publication of certain information from database of ASEA on the Internet in the form of RDF file presents the first step toward improving the existing structure of the Web to the Semantic Web. It is planned that the next step will be the publication of advertised vacancies in form of RDF file on the Web. In that way certain information about employers and vacancies from the database of ASEA will became a part of the global knowledge base, aimed at data does not belong only to one application or database, but to be given in such a format that can be reused for other applications or system. Semantic Web technologies are a powerful in a sense that ontology enables the creation of semantically enrich data about the user's behavior and its interests. Successfully adapt system to user needs reflecting positive for both employers and Employment Agency.

Standardization of methods and systems of automatic matching between employers who advertise vacancies and persons who create their own profile on the Employment

Agency website for job seekers is a good basis which by translating this data in the language of the Semantic Web and forms, creates the future basis for the further use of these data in terms of connecting them with other applications for advertising vacancies and other records of the unemployed.

The further development of the application will be in the direction of improving the search for FOAF files application to upgrade application so it can send messages addressed to someone who has published his FOAF file on the Web. Since this is the first application applied in Montenegro dealing with semantic e-mail addressing, it is expected that this method of sending personalized messages popularize ASEA, as also the process of publishing information on the Internet in the form of Semantic Web.

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