A Prototype for Integrated ENUM and FOAF Queries

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Abstract

Linking Electronic Number Mapping (ENUM) with the Semantic Web's Friend-of-a-friend (FOAF) application offers advantages to both areas as shown in previous work. ENUM is a protocol for mapping a telephone number to Uniform Resource Identifiers (URI) which can be used to contact a resource associated with that telephone number. ENUM therefore gives access to a person's (communication) identifiers and services. FOAF is a project for machine-readable modelling of social networks by defining statements about persons (based on the Resource Description Framework RDF). In this poster/demo a prototype performing an ENUM query and parsing as well as a FOAF lookup and parsing is introduced. The demo uses the prototype's capabilities in a Voice-over-IP scenario for collecting (ENUM and FOAF) information on the called party based on that person's phone number.

1 Introduction

Introducing ENUM to the Semantic Web potentially brings advantages to both areas, as described by the authors in earlier work [Reichinger and Baumgartner, 2005]. As outlined there a prototype implementation as well as application examples are needed as a proof-of-concept and to identify critical issues to be examined further.

Therefore a prototype was designed and coded in JAVA programming language. The prototype is designated for looking up the ENUM DNS database for a given telephone number, retrieving the ENUM NAPTR data, detecting the location of FOAF RDF data (i.e. a foaf.rdf file) using different methods and parsing the FOAF file found for data needed by the respective application.

The example application presented in the poster/demo session enriches the result of a standard ENUM query as typically performed when setting up a Voice-over-IP (VoIP) communication path. Instead of pure VoIP identifiers like a SIP Address-of-Record or a H.323 address, a query result enriched with information from the Semantic Web brings valuable additional information on a contacted (queried) person during the setup of a voice communication path. Personal details typically available through the FOAF application like the contacted person's depiction, a work item website, a private homepage or information on working groups involved in can be presented to the calling party. Furthermore, intelligent applications can follow links detected and even draw conclusions. The integration of the prototype in Semantic Web Portals [Stollberg et al, 2004] is a further option.

2 ENUM

ENUM is the acronym for Electronic Number Mapping and describes a protocol specified by the Internet Engineering Task Force (IETF) in [Faltstrom and Mealling, 2004], which defines the mapping of a Telephone Number in the international format as specified by the International Telecommunications Union (ITU) in [ITU, 1997] to an Internet Domain Name, which can subsequently be used for supporting a wide range of (communication) services. The introduction of ENUM brings the opportunity to use an ordinary E.164 telephone number as a single, unique identifier for pointing to other (communication) identifiers and services related to the holder (owner) of that telephone number.

ENUM utilizes the Internet Domain Name System (DNS) with the Naming Authority Pointer (NAPTR) DNS Resource Records (RR) holding the information on URIs and services associated with a telephone number. That information can be retrieved by means of a DNS query.

3 Prototype for ENUM/FOAF Queries

To proof the authors' proposed integration of ENUM and the Semantic Web's FOAF and to better evaluate proposed applications a JAVA prototype was developed. The main functionalities of that prototype are looking up the ENUM DNS database, retrieving the ENUM NAPTR data, detecting the location of FOAF RDF data (i.e. a foaf.rdf file) using different methods and finally parsing the FOAF file found for data requested by the respective application.

The prototype allows three different input parameters to start a query (see Fig. 1):

- Start **ENUM DNS NAPTR query** with given phone number – the result would be a list of URIs and services of the queried phone number's owner
- Start **FOAF RDF file lookup** with given web URL – the result would be the exact location of a foaf.rdf file
- Start **FOAF RDF file parsing** with given location of foaf.rdf file – the result would be data available from the foaf.rdf file
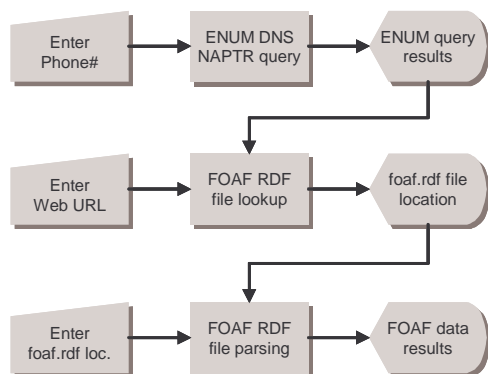

Fig. **1**. Flowchart of prototype main functionalities

In principle, appropriate results of any of these three operations can be used to start any further query. For instance, if an ENUM DNS NAPTR query result contains a Web URL (http URI), that URL can be used as input for a subsequent FOAF RDF file lookup, trying to detect the location of a foaf.rdf file. The same applies to FOAF RDF file parsing results, which also can be used to start another query, e.g. a phone number could be used for a subsequent ENUM DNS NAPTR query or a website URL could be used for another FOAF RDF file lookup.

4 Application Example

The application example presented in the poster/demo session[1] combines ENUM and the Semantic Web by enriching the result of a standard ENUM query as typically performed when setting up ENUM-based voice communication. Instead of providing a VoIP device with pure communication identifiers like a SIP AoR or a H.323 address, an ENUM query result enriched with information from the Semantic Web's FOAF brings valuable additional information on a contacted person or company. This could be that person's depiction, a work item website or information on working groups involved in. Apart from simply presenting information gained by following the links made available by the contacted person in ENUM and FOAF, intelligent applications may compare newly retrieved information with information already available and even draw conclusions. While query and

presentation of data from ENUM and FOAF can be performed on basis of the prototype presented in chapter 3, the usage scenario for drawing conclusions requires further study.
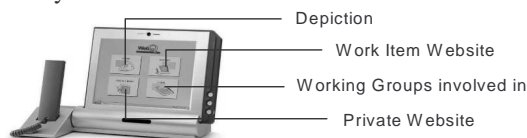

Fig. **2**. VoIP device presenting additional information on a contacted person or company

The query, aggregation and presentation of ENUM and FOAF data can either be executed by a stand-alone client situated on the user's device or by the user's (VoIP) provider finally transmitting the data found (or the data ordered by the calling party) to the customer (push service).

5 Conclusions and Outlook

The introduction of a prototype for integrated ENUM/FOAF query and parsing operations fosters the author's proposal of bringing Telecommunications (ENUM) and Semantic Web (FOAF) closer together for the benefit of both areas. The application example presented is to be seen as a first step towards a growing convergence of the Telecommunications world and the Semantic Web. As work progresses, further application examples will be presented to better evaluate the synergies from combining ENUM and the Semantic Web. A special focus will be on applicability for social network issues [Mika, 2004].

References

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[1] http://www.dbai.tuwien.ac.at/proj/semnum/

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Prototype Demo Explanation

Introduction

The demo uses a telephone number entered by the user (or an agent) to search for relevant data in ENUM and the Semantic Web's FOAF to present that information in aggregated form to the user. This is done by utilising the main functionalities of the JAVA-coded prototype presented in the poster/demo session. Assuming ENUM and FOAF data being widely available on the Web, a real-world application would be the integration of that type of service in a VoIP call set-up, providing the calling party with additional information on the called party. The application demo can be accessed on the Web at http://www.dbai.tuwien.ac.at/proj/semnum/.

Demo Description

The application demo needs a telephone number in the international format as input parameter. This input can be done manually (as in the demo setup) or by an agent importing the telephone from a VoIP client, for instance. After entering a phone number and pushing the "Start query" button, the following steps are internally taken by the demo application without any further user interaction:

- Looking up the ENUM DNS database
- Retrieving ENUM NAPTR data
- Detecting the location of FOAF RDF data
- Parsing the FOAF file for specific FOAF RDF data
- Presenting the aggregated results from ENUM and FOAF, respectively

Figure 3 shows the start screen of the demo application with a field to type in a telephone number and a button to start the integrated ENUM / FOAF query and parsing process.
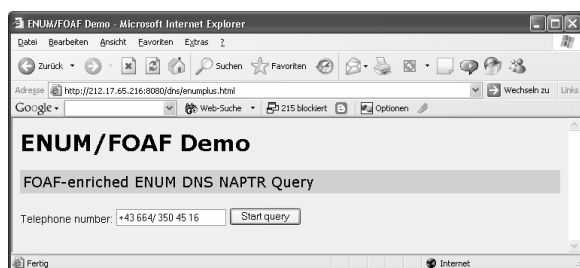

Fig. **3**. Screenshot of start screen for ENUM / FOAF demo with telephone number needed as input and "Start query" button

Figure 4 shows the output screen with the final result of the integrated ENUM / FOAF query and data retrieval as it is presented to the querying user. In order to illustrate the order in which data is retrieved, the steps taken and according results are explicitly mentioned in the aggregated results output screen.

First, an ENUM DNS NAPTR query for the input telephone number is performed and a message generated wether the query was successful. In addition all data found in ENUM DNS is presented and options for further steps as sending e-mail or visiting a website are listed.

Next is a lookup for FOAF data. Therefore the demo automatically extracts the web URL found in ENUM (http://members.chello.at/reichinger/), looks for a link tag pointing to the location of a foaf.rdf file or alternatively tries an "educated guess" for the location of a foaf.rdf file. If no web URL is found in ENUM, the application is terminated at this point. In Figure 4, the FOAF lookup has been successful as a link tag pointing to http://members.chello.at/reichinger/foaf.rdf was found by the application.

Now the FOAF RDF file is parsed by the application for data relevant for the specific application. In our demo basic FOAF properties as name, depiction, phone and homepage are parsed. Additionally, the demo application looks for other persons indicated to be known by the called party (foaf:knows property). Finally, the FOAF data retrieved is listed with options for further steps like visiting a website or looking up a FOAF RDF file of some person found. Should the parsing bring up a link to a depiction of the called party, that image automatically is displayed.
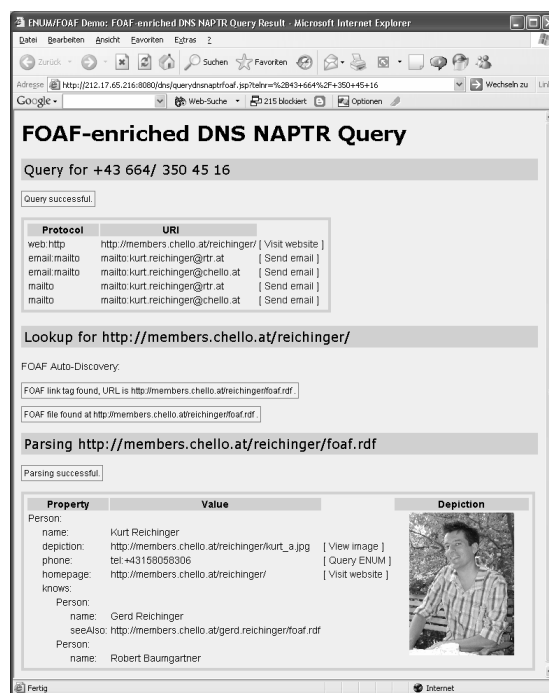

Fig. **4**. Screenshot of aggregated ENUM / FOAF results

Conclusion

The demo shows an application for proposed use in VoIP environments. It uses a JAVA-based prototype for Integrated ENUM and FOAF Queries presenting additional information on a called party in the course of a VoIP call set-up.