

Browser-based Semantic Mapping Tool for Linked Data in Semantic Web

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ABSTRACT

With the ever growing need of semantically linking data across different domain, organizational and diplomacy boundaries using RDF and OWL, one of the major obstacles impeding the advancement of Semantic Web is the data availability. This paper presents a browser-based semantic mapping tool for converting linked data on the Web to be available for Semantic Web applications. It is aiming at helping users define semantic mapping from relational databases to RDF schemas. This tool provides much easy-to-use functionality to facilitate users in this definition work, such as drag-and-drop mapping, visualization mapping, data source annotation, database server independent, standard mapping language and shared ontology management.

Categories and Subject Descriptors

H.4.m [Information Systems Applications]: Miscellaneous

General Terms

Management, Design, Reliability, Languages, Theory, Aspects.

Keywords

Ontology, Semantic Mapping, Relational Database, RDF, Linked Data, Semantic Web.

1. INTRODUCTION

With the fast development of Web, millions of linked document and linked data are stored in online web applications. As a result, the Web becomes a global information center with not only linked documents, but also linked data. In particular, most of linked data are stored in relational databases that are always adopted as the data storing space by online web applications. Nowadays, one of the major obstacles impeding the development of Semantic Web is the data availability. It is an opportunity to convert these linked data into Semantic Web as the data sources for semantic applications. However, one problem is how to integrate heterogeneous and distributed relational databases. One of the mature solutions of this problem is integrating heterogeneous data sources using ontology based on semantic mapping, which are mappings from database schema to RDF¹ [1]. Therefore, it calls for powerful mapping mechanism and mapping tools to define

semantic mapping from relational schema to RDF schema.

In this paper, we present a well developed browser-based mapping tool for converting linked data from Web to Semantic Web. Before developing the tool, we verified fundamental model difference between relational schema and the RDF schema and specified a set of mapping issues and mapping cases based on the THALIA² Testbed. Based on these advance work, we developed this browser-based mapping engine to help users to define semantic mapping. It provides a lot of powerful functionalities to facilitate domain experts in defining semantic mappings. In particular, the tool is able to deal with complex relational schema with complex joins. Besides, it also provides a functionality of transforming relational data to RDF data.

2. Browser-based Semantic Mapping Tool

This semantic mapping tool is developed based on the OAT (OpenLink Ajax Toolkit) framework and Virtuoso Universal Server³. This tool is a web engine defining semantic mapping from heterogeneous databases to shared ontology namely from relational schema to RDF schema.

2.1 Architecture

This tool aims at helping users to define semantic mapping from relational schema to RDF schema, which needs additional components to support such as data source annotation, shared ontology management, and file management. As the figure 2.1 shows, it is composed of three main components:

- Mapping tool for linked data: This component is the main functional part of this tool, which provides much functionality to define semantic mappings from relational schema to RDF schema by drag-and-drop. In the end, it also supports saving the defined mappings as Meta Schema Language, which is defined as script to transform relational data to RDF data executed on Virtuoso Universal Server.
- Virtuoso Universal Server: This component is charge of interactions with databases, including obtaining Meta schema information, executing queries, and transform relational data to RDF data.

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¹ RDF: <http://www.w3.org/TR/1999/REC-rdf-syntax-19990222/>

² THALIA: <http://esw.w3.org/topic/TaskForces/CommunityProjects/LinkingOpenData/THALIATestbed>

³ OpenLink: <http://www.openlinksw.com/virtuoso/>

- Physical databases: The physical databases stores millions of linked data on the Web.

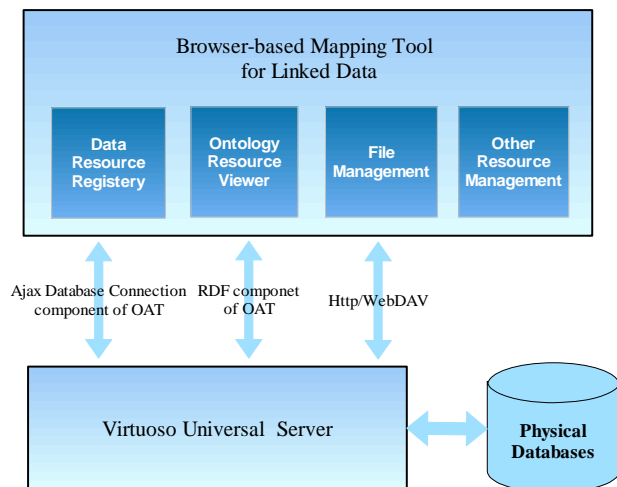


Figure 2.1 shows the architecture of the mapping tool

2.2 Functionalities and Features

The browser-based mapping tool is well developed to help domain experts define semantic mapping from relational schema to RDF schema. In particular, it provides much easy-to-use functionality and has some special technical features. In this section, we describe these functionalities and features in details.

2.2.1 Functionalities

Figure 2.2 depicts the browser-based mapping tool, including resource views, editing domains, and mapping visualization. It consists of three primary functional components as follows:

- ✧ Building **table-to-class** mappings: At first, “table” items are dragged from DbResView and dropped under the edit domain; then ontology classes are dragged from OntoView and dropped under the “table” area. Secondly, users drag properties from OntoView and drop them under ontology class, then drag columns of the “table” from DbResView and drop them under the property areas.
- ✧ Building **complex join** mappings: Taking **table-to-class** mappings as the inputs, the tool determines whether there are joins between the tables based on semantic relationships defined in the shared ontology.
- ✧ Meta Schema Language: This tool use Meta Schema Language as semantic mapping description language. After defining the mapping from relational schema to RDF schema, it provides a functionality to save mappings in Meta Schema Language, which is able to be directly executed on Virtuoso Universal Server to transform relational data to RDF data.

2.2.2 Technical Functionalities

The browser-based mapping tool has many special technical features, which make it outstanding among the other existing semantic mapping tools, such as:

- Database server **independent** – The mapping tool is able to support many usual databases, such as Oracle, Mysql and so on.
- Drag-and-drop mapping – Users are able to just **drag and drop** items to complete the process of defining semantic mappings.
- Mapping **Visualization** – After user dragging and dropping, the items and semantic mappings are visualized and displayed in the edit domain. And this feature makes the engine easier to extend.
- Data source **annotation** – Structures of data sources are displayed in the **view** on the left side, on the other hand, ontology schema are displayed in the **view** on the right side.
- Semi-automatic mapping for complex join – Based on table-to-class mappings, it can semi-automatically define mappings for complex joins.

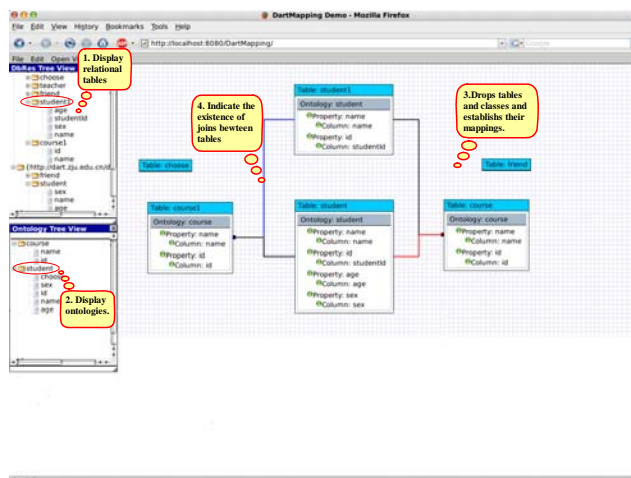


Figure 2.2 shows display of browser-based mapping tool.

3. Conclusion and future work

This paper presents a browser-based semantic mapping tool for linked data in Semantic Web. It has been well designed and accomplished to facilitate users in defining mappings. At present, this tool is under testing stage accessed in <http://ec2-67-202-22-44.compute-1.amazonaws.com:8890/demo/mapper>.

In our plan, the tool will be enhanced with some heuristic rules to automate the semantic mapping task as far as possible, just like the approach proposed by Yuan An and colleagues [2].

4. REFERENCES

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