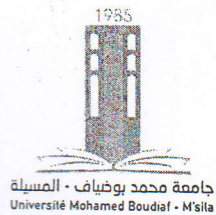


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UNIVERSITY OF MOHAMED BOUDIAF M'SILA
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TOPIC

**Automatic transformation of OWL ontologies to relational
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CONTENTS

General introduction.....	1
Chapter 1: Ontologies and description logic	
1. Introduction.....	3
2. Introducing the notion of ontologies.....	3
2.1 Definitions.....	3
2.2 Origin and history.....	4
2.3 Components of ontology	4
2.4 Ontology application	5
3. Description logics.....	6
3.1 Definition	6
3.2 Basic building blocks of DL ontologies	6
3.2.1 Asserting facts with ABox axioms.....	7
3.2.2 Expressing terminological knowledge with TBox axioms.....	8
3.2.3 Modelling relationships between roles with RBox axioms.....	8
4. Ontology Web Language.....	9
4.1 Definition	9
4.2 Owl basics	9
4.2.1 Class.....	9
4.2.2 Properties	9
4.2.3 Property restrictions.....	10
4.3 OWL sublanguages.....	11
4.3.1 OWL Lite.....	11
4.3.2 OWL DL.....	12
4.3.3 OWL Full	12
5. Protégé: ontology editor.....	13
6. Conclusion.....	13

Chapter 2: Relational databases and SQL

1.Introduction.....	15
2.Database in general.....	15
2.1 Database definition.....	15
2.2 Database types.....	16
2.3 Database advantages.....	17
3.Relational databases.....	17
3.1 Definition.....	17
3.2 Relational model.....	18
3.3 Relational database concept.....	18
3.4 Relationships types.....	18
3.5 Codd's Rule.....	19
3.6 A database management system.....	22
3.6.1 Function of DBMS.....	22
4.Structured Query Language.....	24
4.1 Definition.....	24
4.2 History.....	24
4.3 SQL language statements.....	25
4.3.1 Data definition language.....	25
4.3.2 Data manipulation language.....	26
4.3.3 Data control language.....	26
4.3.4 Transaction control language.....	27
5.Integrity constraints.....	27
6.Conclusion.....	29

Chapter 3: XSL language

1. Introduction.....	30
2. General presentation of XSL.....	30
2.1 XSL definition.....	30
2.2 XSL structure.....	30
3. XPath language.....	31

3.1	Definition.....	31
3.2	XPath base syntax.....	32
3.3	Research axes.....	32
3.4	XPath operators.....	34
3.5	XPath functions.....	35
3.5.1	Node set functions.....	35
3.5.2	Boolean functions.....	36
3.5.3	Number functions.....	36
3.5.4	String functions.....	37
3.6	XPath predicates.....	38
4.	XSLT language.....	39
4.1	XSLT definition.....	39
4.2	History and specification.....	39
4.3	XSLT functioning.....	40
4.4	Basic syntax.....	41
4.5	Essential elements of XSLT.....	41
4.5.1	<xsl:template>.....	41
4.5.2	<xsl:apply-template>.....	42
4.5.3	<xsl:value-of>.....	43
4.5.4	<xsl:for-each>.....	44
4.5.5	<xsl:if>.....	45
4.5.6	<xsl:choose>.....	46
5.	Conclusion.....	46

Chapter 4: Implementation

1.	Introduction	47
2.	Transformation principle.....	47
3.	Transformation rules.....	49
3.1	Properties types.....	49
3.2	Transformation rules.....	49
3.3	Data type conversion.....	51

4. Development tools.....	52
4.1 Hardware environment.....	52
4.2 Software environment.....	53
4.2.1 Protégé 5.....	53
4.2.2 Oxygen XML editor 16.1.....	54
4.2.3 Microsoft SQL server 2008.....	54
4.2.4 Microsoft visual studio 2012.....	55
5. Ontology example.....	56
6. Ontology RDF/XML format.....	58
7. XSLT code.....	64
8. Transformation results.....	68
9. C sharp interfaces.....	70
9.1 Authentication interface.....	70
9.2 Transformation interface.....	71
10. Conclusion.....	71
General conclusion.....	72
Table 3.4: XPath predicates.....	37
Table 3.5: <xsl:template> elements.....	42
Table 3.6: <xsl:template> properties.....	42
Table 3.7: <xsl:apply-template> elements.....	43
Table 3.8: <xsl:apply-template> properties.....	43
Table 3.9: <xsl:value-of> elements.....	44
Table 3.10: <xsl:value-of> properties.....	44
Table 3.11: <xsl:for-each> properties.....	45
Table 3.12: <xsl:if> properties.....	45
Table 3.13: <xsl:choose> syntax and properties.....	46
Chapter 04:	
Table 4.1: Data type restrictions.....	52
Table 4.2: Classes data properties of the Medical ontology.....	56
Table 4.3: Object restrictions of the Medical ontology.....	57

GENERAL INTRODUCTION

The semantic web (or web 3.0, the linked Data Web...) represents the next major evaluation in connecting information. It enables data to be linked from a source to any other source and to be understood by computers so that they can increasingly perform sophisticated tasks on our behalf.

The difference between semantic web technology and other technologies related to data such as relational databases or World Wide Web is that the semantic web is connected with the meaning and not just the structure of data, the document or the high level links between applications but to connect the data at a lower level. The idea is instead to have interfaces between documents, you get interfaces between facts at lower level than documents and applications. The great advantages is that you no longer have to think about a specific document, you just have to think about data and information. [3]

The current Web is transformed from being machine-readable to machine-understandable. In fact, Ontology is a key technique with which to annotate semantics and provide a common, comprehensible foundation for resources on the Semantic Web. Moreover, Ontology can provide a common vocabulary, a grammar for publishing data, and can supply a semantic description of data which can be used to preserve the ontologies and keep them ready for inference.

Ontology is a description of entities of a problem domain and their semantic relations. The short definition of the ontology is as the "explicit specification of conceptualization". The ontology clearly defines fundamental concepts and relationships used in a particular problem domain. [18]

There are different methods for storing ontologies, one of them is flat files. But flat-files do not support flexibility and diverse functionalities that can be provided by database system. Ontology management system can store ontology in ontology repositories. However querying ontology is not as developed at the moment as that of relational databases. The relational database schema has various benefits over ontology management system such as robustness, performance, maturity, availability and reliability.

Large volume of web data is stored in relational format. So when ontology is documented in relational database it can interoperate with immense measure of existing data in relational format. Relational database gives scalability to the queries and reasoning on knowledge provided by ontology. Efficient reasoning and querying on ontology will make semantic web more useful.

Mapping of ontology in relational database supports operations such as searching and retrieval. A lot of research work has been done on direct transformation of relational database to RDF/OWL concepts and description. Existing transformation approaches from OWL ontology to relational database, face certain problems i.e. data loss, structure loss, focus on the initial level mappings i.e. tables to classes and columns to properties.

Other scenarios for relating OWL and Relational Databases are possible, although, the direct transformation from OWL to relational schema is not defined anywhere. It is not only a feasible way, but certainly the fastest and most theoretically valid one to move ontological information to relational database and to make it accessible by different applications and systems. As OWL is built on XML, it seems worth to try transformations from XML to RDB. But OWL has more advanced features, than XML documents, namely, constraints and inference support, and these features must be preserved when mapping OWL to RDB. [1]

Relational databases are often used as a basis for persistent storage of ontologies to facilitate rapid operations such as search and retrieval, and to utilize the benefits of relational databases management systems such as transaction management, security and integrity control. On the other hand, there appear more and more OWL files that contain ontologies. Therefore, our object is to build an application for the automatic transformation of an OWL ontology to relational database using XSLT as transformation language, protégé 5 to build the ontology transformation source, SQL server is used as a language to represent the target database and C sharp to made the interface of our application.

The rest of the paper is divided in four chapters. Chapter one deals with Ontologies and logic description. Chapter two displays Relational databases and SQL. As for the third chapter, it explains the extensible stylesheet language. The fourth chapter is devoted to the implementation. A general conclusion sums up our work and highlights future perspectives.

GENERAL CONCLUSION

In this research paper, our objective was to find out the possibility to transform the OWL ontologies of the semantic web to relational databases using XSL. This kind of mapping could be considered as a way to store ontologies in other formats as relational databases, so that we can benefit from RDBMS features, such as transaction management, security and integrity control.

In order to propose the transformation rules to our problem, we presented the major concepts that we need to understand and to know which are ontologies, relational databases specially the SQL and XSL languages. These three branches represented the transformation elements. Then, we applied the implementation of the transformation rules by an ontology example of "Medical"; we represented this example with protégé tool to create the OWL code that contains the classes, properties and individuals. Next, we created an XSL stylesheet that contains the XSLT code to transform the OWL ontology source to a relational database. Finally, we proved our transformation by executing some queries on the target generated database.

As a future perspective, we are going to cover all ontologies constructs for the automatic transformation of OWL ontologies to relational databases with the exception of those constructs that have no correspondences with the relational model.

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الملخص

من أجل تسهيل عملية التحويل الأوتوماتيكي لأنطولوجيات ال OWL الى قواعد بيانات علائقية، قمنا بفرض مجموعة من قواعد التحويل لهذه الأنطولوجيات وذلك باستعمال ال XSL. من أجل تصميم مشروعنا، اخترنا 5 Protégé لإنشاء أنطولوجيات ال OWL، SQL Server management studio، 2008 كمحيط لقواعد البيانات العلائقية المراد الوصول إليها، Oxygen XML Editor 16.1 كلغة لإنشاء ورقة النمط التي تحوي قواعد التحويل، و Visual studio 2012 كمحيط برمجة وذلك باستعمال لغة ال C sharp. الكلمات المفتاحية: أنطولوجيات، قواعد بيانات علائقية، OWL، تحويل، SQL.

Abstract

To facilitate the automatic transformation of the OWL ontologies to relational databases, we propose a group of rules to transform these ontologies by using XSL.

Our project was based on Protégé 5 tool to create the owl source ontology, SQL Server management studio 2008 as environment for the target relational databases, Oxygen XML Editor 16.1 as a language to create the transformation stylesheet that includes the rules and Visual studio 2012 as the programming environment with C sharp programming language.

Key words : ontologies, relational databases, transformation, OWL, SQL.

Résumé

Afin de faciliter la transformation automatique des ontologies owl vers des bases de données relationnelles, nous proposons un ensemble des règles pour transformer ces ontologies en utilisant le XSL.

L'élaboration de notre projet fût basée sur l'outil Protégé 5 pour la création des ontologies OWL, SQL Server management studio 2008 comme environnement pour les bases de données cible, Oxygen XML Editor 16.1 comme un langage pour la création de la feuille de style qui contient les règles de transformation et Visual studio 2012 comme environnement de programmation avec le langage de programmation C sharp.

Les mots clés : ontologies, base de données relationnelles, transformation, OWL, SQL.