A SEMANTIC WEB MODEL FOR EDUCATIONAL MANAGEMENT AT SECONDARY LEVEL

Luminița PĂTRAŞCU[1]

Lucrarea propune un model de date RDF, destinat prelucrării automate a datelor din zona învățământului preuniversitar, în contextul Web semantic. Baza de cunştințe constituită din model şi setul de date prelucrate reprezintă contribuția originală a autorului.

Articolul prezintă etapele de dezvoltare a modelului propus, pornind de la un set de date în formă tabelară până la reprezentarea grafică a datelor analizate.

Modalitatea propusă de abordare a datelor din învățământul preuniversitar în perspectiva Web semantic, este de natură să aducă, în opinia autorului, beneficii atât unităților de învățământ preuniversitar, liceelor, care organizează examene de evaluare de tip bacalaureat, cât şi instituțiilor de management scolar la nivel teritorial şi central care colectează şi prelucrează anual seturi mari de date.în vederea evaluării şi diagnosticării modului de evoluție al sistemului de învățământ

This paper proposes a model of RDF data for automatic processing of data in the school education, in the context of Semantic Web. Knowledgebase consists of model and processed data sets and it is the author's original contribution.

The paper presents the development stages of the proposed model, based on a set of data in tabular form by plotting the data analyzed.

The method proposed in the pre-university education data approach to semantic Web perspective, is likely to bring the author's opinion, benefits for pre-schools, high schools, which holds baccalaureate exam type assessment and school management institutions at local level and central collecting and processing large sets of date per year to assess and diagnose the evolution of education system

Keywords: Knowledgebase, baccalaureate, RDF model, semantic web, knowledge management, structured knowledge, web 3.0

1. Introduction

This paper proposes a model of RDF data for automatic processing of data in the school education, in the context of Semantic Web. Knowledgebase comply with National Education Law [1] consists of model and processed data sets and it is the author's original contribution.

[1] Ph.D. student, Faculty of Automatic Control and Computers,University POLITEHNICA of Bucharest, Romania, e-mail: patrasculum@yahoo.com

1.1. Date and semantics. Semantic Web

Nowadays, people have to deal with great demand on knowledge and information [2], so, the secondary schools (high schools) who have advanced computer networks connected to the Internet and trained personnel for maintenance and operation, are able to benefit from opportunities for processing and information retrieval from the new generation Web, Web 3.0.

Data from a data source model some of the real world, its field of interest. Semantics issue date is determined by the correspondence between a data source and intention regarding its use. The data source is a future model. The model can be a database, a conceptual scheme, etc. Under these conditions, meaning the data was derived from the database to use and has been entrusted to the user of the application[3].

The emergence of the Web has changed this. Databases are available on the Web today, in some forms in which both users and applications access for both consultation and for use.

In such an environment, which is changing its semantics must be available, along with the data. For humans, this is achieved by choosing the format. For application programs necessary for these semantics is provided in a conventional form that can be processed by computer. The name Semantic Web originates from here, from these objectives and needs.

1.2. Web 2.0. and Web 3.0.

Web 2.0. is a concept that reunites sites and resources sharing common characteristics, without implying a clearly defined set of tools. Web 2.0. has supported the need to participate through social networking and it is currently being adopted in educational tools [4].

Semantic Web is a collaborative initiative led by the World Wide Web Consortium, initiative to promote common formats for data published on the web. Encouraging the inclusion of semantic content in Web pages, Web Semantic Web aims to convert the current, unstructured documents in a "web of data", built on the foundation of RDF (Resource Description Framework).

As recommended by W3C (World Wide Web Consortium) "Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise and community boundaries"[5].

Tim Berners-Lee described the Semantic Web as a component of Web 3.0 [6]. While Web 1.0. was focused on companies, Web 2.0. on communities blogs, Web 3.0 is focused on the individual lifestream, the semantic web and consolidating dynamic contents, user engagement and user behaviour[7].

1.3. Knowledge Management [8]

It focuses on the acquisition, access and maintenance of knowledge within an organization. It turns out to be a key activity of large organizations as they see internal knowledge as intellectual statement that can extract higher productivity, new value creation and competitiveness. Knowledge management is especially important for international organizations departments distributed over large areas but is of great importance and educational organizations that have common schools throughout the country. More information is available in a structured form modest, e.g. text, audio, video.

From the perspective of knowledge management, current technologies suffer from limitations in the following areas:

- Search information. Companies as well as schools that depend, usually based keywords are search engines, whose limitations we have already outlined;
- Extracting information. Search and save documents containing relevant information takes time and human effort. Intelligent agents today are not able to solve this task in a satisfactory manner.
- Maintenance information. Nowadays there are problems such as inconsistencies in terminology and failure to delete outdated information;
- Areas of information covered. The new knowledge that is implicit in corporate databases is extracted using methods and algorithms to discover patterns and connections between data. However this task is still difficult for poorly structured collections of documents distributed.
- View information. Often it is desirable that access to certain information to be restricted to certain groups of employees; that hide certain information is known in the database but are difficult to achieve in the Intranet (or web).

The purpose of the Web - the Semantic is to enable knowledge management systems more advanced in that:

- Knowledge will be organized in conceptual spaces according to their meaning;
- Automated tools will provide maintenance support by checking inconsistencies and extracting new information.
- Search based on keywords will be replaced with the response to a query, the information requested will be recovered, extracted and presented in a friendly human form;

- provide support for the answer to the query on multiple documents;

- Define who is allowed to see certain parts of information (even parts of documents) will be possible

1.4. Modernization of education reflected in the school education system [9]

A new organization of cycles - unit makes the proposed structure of school education levels to the EQF:

- A generalized free education for 13 years until the end of high school from preparatory class;
- Compulsory education is kept to 10 years (school class (1) + primary (4) + secondary education (5)) and organized in the same type of educational establishment. Compulsory schooling ends at 16. It abolishes the vocational school and three high schools promotes: theoretical, technological, vocational.
- At the end of primary and compulsory education, students will be assessed at national level evaluation function is to diagnose the effectiveness and quality of education
- Secondary schools will gain autonomy in determining the number of seats and admission procedures, based on rigorous national standards. The state will monitor compliance with quality standards.
- Baccalaureate exam will check the degree of development of key competencies and specific (by profiles of schools)

2. RDF identifiers in namespaces

RDF data model specific idea of combining the concept of triple and triple sets[3]. With the introduction of namespaces, RDF uses the Web infrastructure to be agreement on how to reference a particular entity. Standard RDF namespace infrastructure itself has to define a small number of standard identifiers defined in the standard namespace, a namespace called RDF [8] .

rdf: type is a property that provides a basic system types in RDF. As a case study analyzing the relationship between several concepts related to organization of university education, such as school education level, branch, field, specialization using type information, as shown in Table 1. Subject rdf: type in the triple can be any identifier, and the object is understood as a type. There are no restrictions on the use of rdf: type in types, and so on as it is shown in the Table 2.

Table 1

Getting on the organization of pre-university education in Romania using rdf: type to describe scenarios

Subject	Predicate	Object
preuniv: high school	*rdf:* type	*edu:* school
preuniv: branch	*rdf:* type	*preuniv*: theoretical
preuniv: profile	*rdf:* type	*preuniv:* humanist
edu: school	*rdf:* type	*edu:* gymnasium school
edu: gymnasium school	*rdf:* type	*edu:* lower secondary level
edu: level	*rdf:* type	edu: secondary level

Table 2

Definition of name

Subject	Predicate	Object
edu: school	*rdf:* type	preuniv: high school
preuniv: school	*rdf:* type	edu: gymnasium school

When we read a triple, we do so in order subject - predicate-object, so that the first triple in Table 1, would read „Secondary school is school type" Unfortunately, this is less so-perfect syntax. Things would be simpler if we could express and other kinds of statements such as „Profiles include educational paths" or „profiles are contained in the various specialties".

This goal has to do with choosing a name for the resource rdf: type, if it were called rdf: isInstanceOf. When read aloud, we just take the liberty to add words to the link. Thus, this triple reads: „A secondary school is a type of school" adding connecting words necessary to make the sentence to

rdf: Property is an identifier that is used as RDF type to indicate when another identifier should be used as a predicate rather than the subject or object. We declare all identifiers that I used as predicates so far, as shown in Figure 1.

2.1. RDF and tabular data

RDF represent a way of distributing data over the Web, in particular, data in tabular form. Given that we have all the details of RDF mechanisms (including namespaces and triple) already presented, we review the tabular data and their presentation consistent in RDF.

Case study

Number of students enrolled in the National Baccalaureate exam, grouped into secondaryschools , profiles and branches.

Given a table in a relational database, which describes information about schools, students and majors that students follows (see Table 3), we analyze the possibility of an RDF graph that reflects the content in such a way for information

(Table 3) to be maintained but may be subject to data subject to joint operations such as RDF and RDF query.

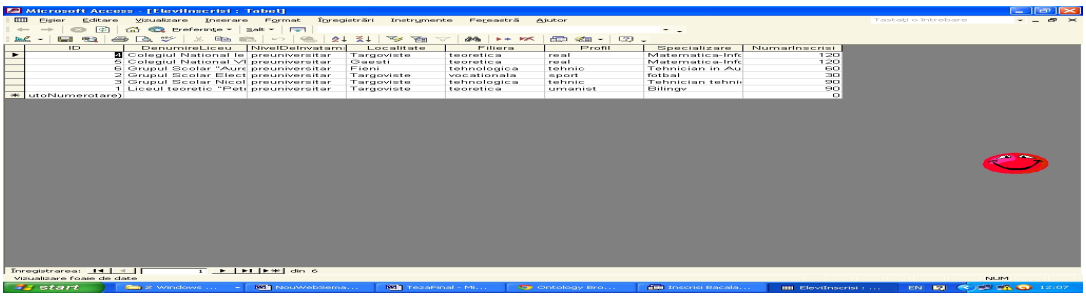

Fig. 1 Relational database management students enrolled in the national baccalaureate exam,the school, and profiles, Branches -Joined Baccalaureate

Table 3

Students enrolled in Secondary School Baccalaureate exam- Tabular data samples for triple [5][10]

ID	Name Secondary School	Level of education	Locality	Branch	Profile	Specialization	No. of Joined
4	Colegiul National Ienachita Vacarescu	secondary	Targoviste	theoretical	real	Mathematics and Computer Science	120
5	Colegiul National Vladimir Streinu	secondary	Gaesti	theoretical	real	Mathematics and Computer Science	120
6	Grupul Scolar "Aurel Rainu"	secondary	Fieni	technological	technical	Technician in Automation	60
2	Grupul Scolar Electrotehnic "Spiru Haret"	secondary	Targoviste	vocational	sports	Football	30
3	Grupul Scolar Nicolae Cioranescu	secondary	Targoviste	technological	technical	Technician computing	90
1	Liceul Teoretic "Petru Cercel"	secondary	Targoviste	theoretical	humanities	Bilingual	90

3. SOLUTION

Each row of the table describes a single entity, all of the same type. This is given even the table name: Secondary Schools-by number of students enrolled on the branches and profiles. We certainly have information about each of these

items, based even on the table columns, such as school name, level of education, branch, profile, number of students enrolled in the baccalaureate exam and want to represent this data in RDF.

As each row represents a distinct entity, each row will have a distinct URIs. The need for unique identifiers is present only in the database that is web - Semantic, so there is a unique identifier (local) available-called, the primary key of the table, in this case column called ID. Web - the Semantic we need a globally unique identifier. The simplest way to form such an identifier is to have one URI for the database itself (perhaps a URL if the database is on the Web),using this URI as a namespace for all identifiers in the database. Because this database is for an institution of education (Country School Inspectorate), we call *edu* namespace.

Then, we create an identifier for each line by concatenating the table name: „Secondary Schools" with unique key and to express the unique key identifier in this namespace edu, resulting identifiers: *edu: SecondarySchool1*, edu: *SecondarySchool* 2 and so on.

Each row in the table says a few things about the item: school name, level of education, field, specialization, etc. RDF to represent them, each will be a property that will describe „Secondary Schools". But just as with the unique identifier for rows, we need to have globally unique identifiers for these properties. We use the same namespaces that I used to court, but because two tables can have the same name column (but not the same properties) should combine the name of the table with the column name. This will result in properties such: *Edu: SecondarySchool_NameSecondarySchool, edu: SecondarySchool_LevelOfEducation* and so on.

With these conventions in place, we can now express all the information in the table that triple. There will be a triple per cell-so, for n rows and c columns, there will be nxc triple. Data presented in Table 3 have 8 columns and 6 rows, as a result will be 48de triple, as shown in Table 4.

Triples in the table are slightly different from the triple that we have seen so far. Although the subject and predicate of those triples are RDF resources (made with qnames namespaces) Objects are not point-data resources but they are strings, integers and so on. RDF is the data representation system therefore lends RDF data from XML literal that all possible values for triple objects, in which case all data type is string or integers.

Usual interpretation of this table is that each row of the table corresponds to an instance and that the type of these instances corresponds to names in the table. In the Table 3, each row corresponds to a high school .We can represent this in RDF by adding a triple turn to specific instances described in each line type, as shown in Table 5.

Triple full transcript resulting from the conversion data in Table 3 is shown in Figure 2. Types (e.g. where the predicate is rdf: type and class object is

edu:SecondarySchool) are shown as links in the graphic object is a triple that time point are shown (for the sake of compactness in the figure) in their subject inside the box stratified common.

Table 4

Triple representing some data in Table 3

Subject	***Predicate***	***Object***
edu: SecondarySchool1	*edu: SecondarySchool* _ID	1
edu: SecondarySchool1	*edu:SecondarySchool?*_Name *SecondarySchool*	Liceul teoretic "Petru Cercel"
edu: SecondarySchool1	*edu: SecondarySchool* _LevelOfEducation	secondary
edu: SecondarySchool1	*edu: SecondarySchool* _Branch	theoretical
edu: SecondarySchool1	*edu: SecondarySchool* _Profile	humanist
edu: SecondarySchool1	*edu: SecondarySchool* l_Specialization	bilingual
edu: SecondarySchool1	*edu: SecondarySchool* _NumarEleviInscrisi	90
edu SecondarySchool12	*edu: SecondarySchool* _ID	2
edu: SecondarySchool12	*edu SecondarySchool* _ Name *SecondarySchool*	Grupul Scolar Electrotehnic "Spiru Haret"
edu: SecondarySchool12	*edu: SecondarySchool* _ LevelOfEducation	secondary
edu: SecondarySchool12	*edu: SecondarySchool* _Branch	vocational
edu: SecondarySchool12	*edu: SecondarySchool* _Profile	sports
edu: *SecondarySchool12*	*edu: SecondarySchool* _ Specialization	football

Table 5

Triple representing the type of information in Table 3

Subject	***Predicate***	***Object***
*edu: SecondarySchool*1	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 2	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 3	*rdf:* type	*edu: SecondarySchool*
edu SecondarySchool 4	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 5	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 6	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 7	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 8	*rdf:* type	*edu: SecondarySchool*
edu: SecondarySchool 9	*rdf:* type	*edu: SecondarySchool*

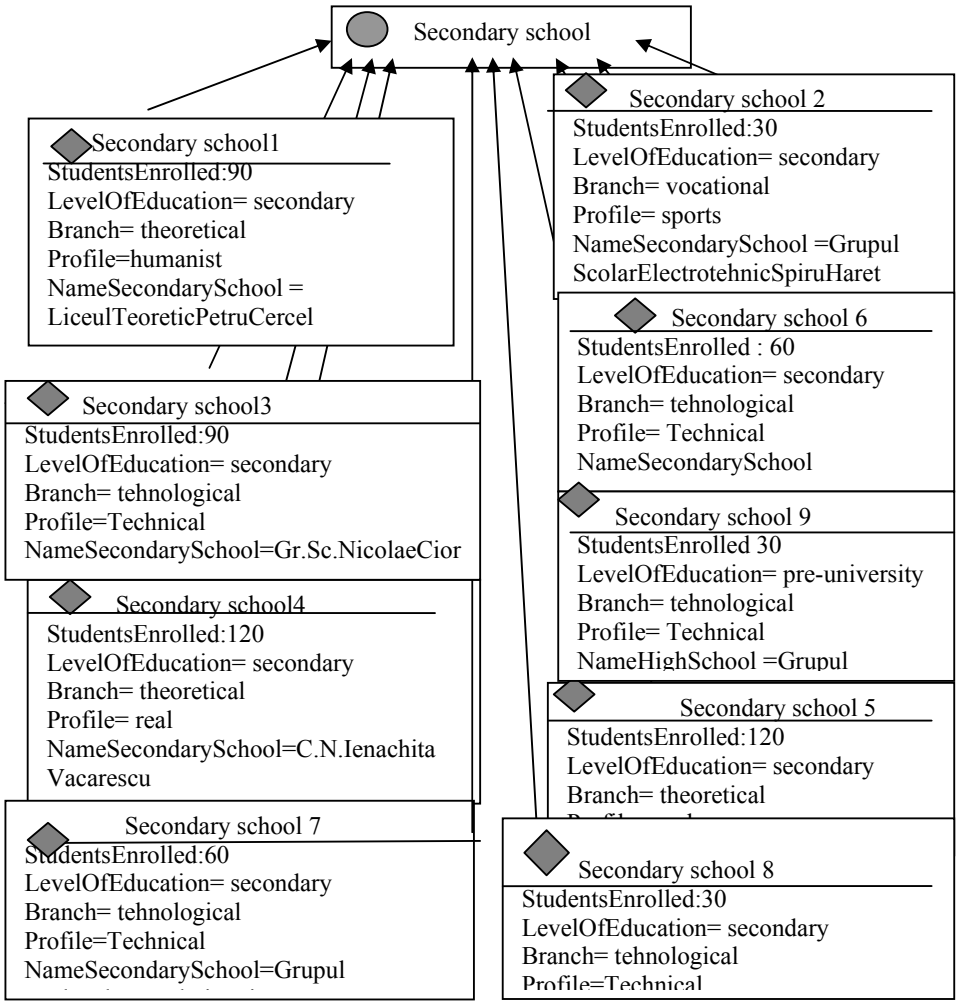

Fig. 2 Graphic version of tabular data in Table 3

4. Conclusions

Conceptual background presented in the pre-university education institutions was organized as RDF model. These concepts , according to the National Education Law No.1 / January 5, 2011, are represented as triples and triple sets, the proposed identifier and a namespace for university education, namely: edu.

The case study presented data on students enrolled in the national baccalaureate exam was represented in tabular form and as a triple in RDF. Proposed RDF model supports local educational institutions that collect these

types of data for processing and providing feed-back middle and high schools, increasing efficiency and speed the process of collection.

R E F E R E N C E S

[1] Legea nr.1/5ian 2011, a Educației Naționale, Bucureşti, 2011
[2] *D. Cârstoiu, V. Sgârciu, A.S. Cernian,* „Experimental validation of clustering by compression technique", Scientific Bulletin of University Politechnica of Bucharest, series C, **Vol. 73**, ISS 3, 2011
[3] *D. Allemang, J. Hendler*, „Semantic Web for Working Ontologist, Effective Modeling in RDFS and OWL", Morgan Kaufmann Publication, 2008
[4] *T. Ionescu, A. Olteanu, A.D. Ioniță*, –„Leveraging open –source e-learnig systems with Web 2.0. and knowledge structures", Scientific Bulletin of University Politehnica of Bucharest, series C, **Vol. 73**, Iss. 2, 2011
[5] „W3C Semantic Web Activity" (http://www.w3.org/2001/sw/). World Wide Web Consotium (W3C). November 7, 2011. Retrieved November 26, 2011.
[6] *V. Shannon*, (June26) „A'more revolutionary' Web" (http://iht.com/articles/2006/05/23 /business/web/php). International Herald Tribune. Retrieved May 24, 2006.
[7] http://www.labnol.org/internet/web-3-concepts-explined/8908
[8] *G. Antoniou*, *Frank van Harmelen,* „A Semantic Web Primer" Second edition, The Mit Press, Cambridge, Massachusetts, London, England, 2008
[9] *** „România Educației, România Cercetării", raportul Comisiei Prezidențiale pentru analiza şi elaborarea politicilor în domeniul educației, Bucureşti, 6 iulie 2007 („Education Romania and Research", Report of the Presidential Commission for review and policy development in education, Bucharest, July 6, 2007)
[10] *C. Eschenbach, M. Gruninger,* „Formal Ontology in Information Systems" Proceeding of Fifth Conference, FOIS, IOS Press, 2008