

# XBRL AND THE MULTIDIMENSIONAL DATA MODEL

Ignacio Santos and Elena Castro

*Carlos III University of Madrid, Computer Science Department*

*Avda. de la Universidad N° 30, 28911 Leganés, Madrid, Spain*

**Keywords:** XBRL (eXtensible Business Reporting Language), XML (eXtensible Markup Language) Taxonomy, XDT (XBRL Dimensional Taxonomy), Conceptual data model, MDM (Multidimensional data Model).

**Abstract:** Over the past ten years, there has been a significant increasing of the development of XML and Data Warehouse (DW) applications, and, in turn, more and more applications need to interact, and with different technologies. In parallel, the economic data in the last ten years have also evolved, increasingly companies and financial institutions need more information, in addition, this information must be reliable and on time. Nowadays, it is taking a significant rise for XBRL standard, based on XML. This language is mainly used in accounting reports and this consists of a set of taxonomies, which define different accounting regulations of a specific report. XBRL is becoming a global de facto standard. XBRL reports are created from various sources and are validated at source, so that, this is syntactically correct. XBRL represents business information, and it is multidimensional, and therefore the logical destination is a DW. This paper aims to analyze the data model of XBRL and its semantics, and how to map this data model to the Multidimensional Data Model (Conceptual Model) and in turn to the Logical Model, either ROLAP (Relational OLAP), MOLAP (Multidimensional OLAP), or HOLAP (Hybrid OLAP), so they can be analyzed by business users.

## 1 INTRODUCTION

The accounting world is static and dynamic. It is static, because the accounting reports use strict regulations, such as the International Financial Reporting Standard (IFRS), or the Accounting General Plan in Spain. For example, the financial statements of credit institutions are specific reports, and they are defined with one or more taxonomies, but they have structures and meaning fixed. In addition, the accounting world is dynamic because accounting directives vary with time, turning up versioning problems, or location. For example, accounting regulations on capital movements are based on Basel II (Basel II, 2004), but because recent financial crisis, these regulations will be amended in Basel III (Basel III, 2010). All of these reports entail that a large number of companies, economic and financial entities, must be called upon to use a large number of resources in Information Technology (IT). This paper presents the basis of study to analyze and transform the data model of this set of taxonomies in an automated way on a multidimensional data model.

In the section two we develop the research work about XML and the Multidimensional Model. The

section three, describes the XBRL data model. In the section four, we analyze our proposal, about the transformation of the models. The section five, an example is shown. And, in the last section, some conclusions and ongoing work are presented.

## 2 FROM XML TO THE MULTIDIMENSIONAL MODEL

In this section, we check some works about XML, and Data Warehouse and its connections.

In Kurtev et al., XML documents are transformed into other formats, using XML Schemas (Kurtev, 2003). Ogbuje does a comparison and mapping of XML and Resource Description Framework technologies (RDF), and with the Model Driven Architecture (MDA) architecture (Ogbuje, 2002). XML documents are usually stored in database. XML was not designed for data storage, but it is a data description language (Lucas-Torres, 2009). It is possible to transform of an automatic way the multidimensional model to a logical model, using MDA (Mazón, 2007), (Pardillo, 2008), (Mazón, 2005), (Castro, 2004), (Golfarelli, 2001).

These developments are based on the Relational Model (Logical Model), and not in the E/R model (Conceptual Model). On the other hand, the conversion between heterogeneous models and applications with different sources, especially Web applications and databases has been analyzed (Golfarelli, 2001). It can be compared XML DTD (Document Type Definition) model and the E/R, by analyzing the mapping of DTD to E/R model, to Object/Relational Model (O/R) and to Relational. It's possible to analyze also the entire life cycle, from the XML document to databases (Golfarelli, 2001), (Castro, 2004). It is proposed an XML notation of referential integrity (Pakorný, 2002).

### 3 XBRL REPORTING LANGUAGE

Since the bankruptcy of Enron Corporation, was the need to streamline the information received by the supervisors of the stock markets to get this information quickly, without mistakes, for security, and also easy to analyze. XBRL is an XML-based standard for financial reporting. Charles Hoffman, an accountant and auditor, in April 1998 proposed to automate the exchange of financial information, developing a prototype of the financial statements and audit programs, defining the bases of XBRL (XBRL, 2001). These reports are used, for example, to send balance sheets between Town Councils, Autonomous Regions, and Treasury Ministry, or to send results of corporate accounts to the Association of Spanish Property and Commercial Registrars in Spain, or to send financial statements to the Supervision, and so on. XBRL is being used in most of the world and is expanding rapidly, using it in more than a half of European countries. Examples of financial institutions are Bank of Spain, National Commission of Securities Market of Spain (CNMV), Bank of Portugal, "Deutsche Börse", Committee of European Banking Supervisor (CEBS), in the U.S., Board of Governors of the Federal Reserve System (FED), US Securities and Exchange Commission (SEC), and other countries as Japan, India, etc. And, in last autumn China incorporated this standard. A financial report is based on business rules such as IFRS, Basel II (Convention on the law and banking regulation), and others. These standards may be international, and/or national and/or local and/or company, or financial institution. This set of rules can be inherited or overwritten. XBRL allows modelling the information, the expression and the semantic meaning commonly required in the econo-

mic and financial reports. It uses XML syntax and related technologies like XML Schema, XLink, XPath and Namespaces to provide semantic meaning. (Hernández-Ros, 2009).

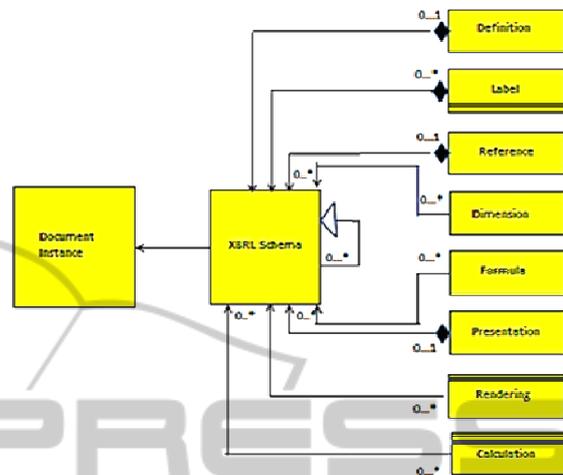


Figure 1: UML design of XBRL Schemas and linkbases (DTS).

XBRL semantic information is separated from the application software, and it uses the XML standard, extending its definitions to support semantic. A report consists of an XBRL instance, which is the report itself, and this report has a set of XML Schemas or XBRL Schemas, called Discoverable Taxonomy Set (DTS), which specify the economic concepts. As it is displayed in Figure 1, each XBRL Schema may have up to eight roles (linkbases). These roles are the definition, presentation, label, reference, and so on. However, each XBRL Schema may have 0 or 1 role of a given type, and this in turn depends directly on the existence of taxonomy, so the diamond means combination (no aggregation), except in dimensions, formulas, and render, which can be used for multiple taxonomies, and a taxonomy can have 0 or more dimensions, renders o formulas. Also, a XBRL Schema can have one or more labels, but conceptually is one, is the same label of the concept, but in different languages. Also the labels depend on the existence of taxonomy. Each XBRL Schema and its Linkbases (roles) are taxonomies or concept definition, which are inherited (Martín, 2006). It begins with a definition of concepts, in general accounting concepts for example IFRS. From this taxonomy or concept definitions, each country or supranational institution adapts this taxonomy to accounting laws, adding concepts or changing them. XBRL Dimensional Taxonomies (XDT) has treatment of dimensions, domains and hypercubes

(Hernández-Ros, 2010), (Schmehl, 2009), (XBRL International, 2001). In this specification a “Primary Item” in the XBRL data model is a fact schema in the Multidimensional Data Model (MDM) that represents a report.

### 4 XBRL MODELING, PROPOSAL

UML provides a framework to capture more semantic with XBRL reports (Callaghan, 2002), (Callaghan, 2006). The XBRL reports are multidimensional (Snijders. 2005), and there is a need to be interoperable with other applications (Ardenne. 2005). The XBRL reports are formed of DTS, which use dimensions with a high meaning and semantic constraints (Piechocki, 2007), (Felden, 2007). This approach is defined by XDT (Hernández-Ros, 2010).

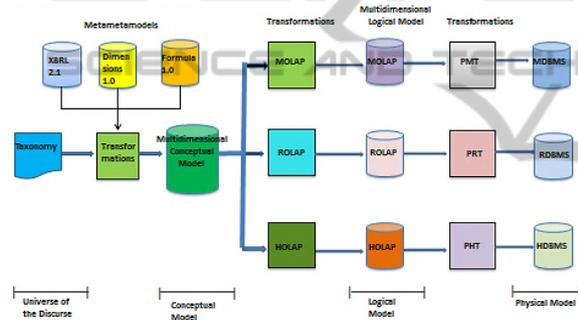


Figure 2: Global transformation of the XBRL metamodel.

We propose to develop a process of transformation of XBRL metadata, to metadata for a multidimensional database (Figure 2), but we want to analyze the semantic and syntactic anomalies that the designer finds when the taxonomy is created (Schmehl, 2009). From a report, we get the DTS and we will obtain an abstract data model XBRL. Since this model, we do a transformation to MDM (Conceptual Model). Our process with the instance, its taxonomies (DTS), with the help of metadata definitions of XBRL 2.1, Dimensions 1.0 and Formula 1.0, we will obtain the Conceptual MDM. And, from the Conceptual Model, we have to transform to the Logical Model metadata. With respect to the logical model we have three techniques, MOLAP, ROLAP, and HOLAP. And finally pass from each of the logical models to physical model. In this physical model would be implemented the coding to create the builders in the corresponding managing.

### 5 EXAMPLE GUIDE

In this section, we analyze an example and demonstrate how the mapping between the XBRL data model and the MDM is possible. The example is the 6610 report (Public Sector Consolidated Balance report), that Spanish banks sent to the Supervision, Bank of Spain in 2008 (BdE-FINREP, 2008), (BdE, 2008). This report is an adaptation to the common framework agreement of the CEBS, recently the European Parliament has reformed and renamed this institution as European Banking Authority (EBA).

In the Figure 3 is showed with the help of Fujitsu’s Xwand tool, our contribution about the dimensional view of 6610 report. We can see the change in the name in the multidimensional data model of this report 6610. On the one hand we see the “Primary item”, which is equivalent to the fact schema, the distribution dimension, the dimension attributes, fact attributes or measures, and the facts.

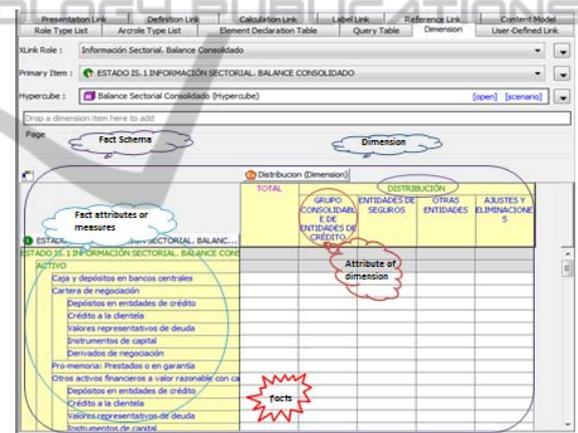


Figure 3: View of Dimensional table with Xwand of Fujitsu.

### 6 CONCLUSIONS

XBRL is a language XML-based that is especially devoted to accounting reports, with a number of advantages over other, consists of a set of taxonomies that will be inherited to form the specific report, to suit a particular Economic and financial report. This makes the set of taxonomies is high, for collecting the semantic. As we are demonstrated the XBRL reports are dimensional and for that they can be transformed and automated in the MDM, we want to build a model of abstract data and analyze it, semantically. Ongoing work with the creation the necessary infrastructure of the automation process

and its development. Finally analyze your performance in each of the stages, and in full.

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