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Implementation of subontology of Planning and control for business analysis domain

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Abstract

Ontologies are at the heart of the semantic web. They define the concepts and relationships that make global interoperability possible. However, as these ontologies grow in size they become more and more difficult to create, use, understand, maintain, transform and classify.

As ontologies become common in more applications and as those applications become larger and longer-lived, it is becoming increasingly common for ontologies to be developed in different area of public sector of economics. Ontologies present special challenges to the problem of conceptual modeling.

This paper describes the process of the implementation of a subontology of forecasting and evaluations for business analysis domain in order to develop an easy and correct way to find the needed statistical information in a knowledge base.

Key words

ontology, forecasting, assessment, Protégé, implementation

Introduction

Understanding and solving global business analysis problems requires a new kind of science: science that is collaborative, interdisciplinary, and responsive to the needs of decision-makers. Cross-disciplinary networks of scientists worldwide are marshalling their understanding in efforts to provide scientific results that target complex problems.

In recent years ontologies have become the subject of interest in communities beyond just those of knowledge representation and library science. Many times these ontologies were built by people highly trained in knowledge representation and reasoning. Many times the authors became highly literate in the domain as well. Conceptual modeling for these kinds of situations has been studied. The knowledge acquisition is a fairly centralized process in proposed strategies for conceptual modeling in literature.

Large ontologies have become more common in broad consumer applications ranging from search, to e-commerce and auctions, to configuration, to more general information sites. Developing of ontologies requires creative thinking. Development of solutions to such problems can be conceived as two-phased:

- an idea generation phase (specification, conceptualization) – it requires a combination of domain expertise and divergent thinking;

- implementation phase;

Our work is motivated by research in other domains as well as by our intention to exploit repositories of information in a specific domain - business analysis.

In our area of interest, domain and its applications appear to be an area of challenge in constructing subontologies for some subdomain.

Business analysis ontologies can be developed manually, semi-automatically or automatically, by

knowledge servers reasoning on formal knowledge representation languages. The resulting ontologies generally consist of concepts modeled by hierarchical relationships. Concepts are identified by names and described by properties and associative relationships with other concepts. The hierarchical or associative and direct or indirect relationships constitute the explicit knowledge represented in the ontologies.

The goal of this paper is to propose innovative design of the business analysis ontology.

Several methodologies and frameworks have been developed – CommonKADS, MIKE, MOKA, and Protégé [14], [4], [2], [9]. They all lay emphasis on modeling. Models capture the essential features of a real system by breaking them down into smaller components to be better understood. They are used in system development to facilitate communication between different people.

To understand the working mechanisms within a knowledge-based system we use models [3]. Models and modeling contribute to the understanding of the source of knowledge [1]. Thus knowledge modeling is the important key component for the construction of knowledge bases. One of the modeling paradigms for knowledge engineering methodologies is ontology. The ontology provides a way of representing domain knowledge. It consists of concepts, relations and constraints on the relations.

The domain knowledge consists of the domain schema and the knowledge base.

Ontologies could help people and computers to access the information they need by making the link between the information form and content explicit. Moreover, ontology is now recognized as powerful tool that enables sharing knowledge [15].

An ontology defines a common vocabulary for researchers who need to share information in a domain. A domain ontology corresponds to an organized set of domain generic terms that can be used to describe a particular domain by providing machine-interpretable definitions of basic concepts in the domain and the relationships between them [11].

The most important task in the methodology is the definition of a Domain Conceptual Model. Then, it is important to assign all the necessary time to carry out a good conceptual analysis. The conceptual model resumes the knowledge adquired during the specification phase and it is the basis of conceptualization. This conceptualization has to be agreed on by domain experts.

Methods

Our domain of interest for this study is business analysis. We build and engine a subontology representing subdomain of business analysis – Onto-BAn.

Onto-BAn is an ontology that has been under development at the South West University of Blagoevgrad since 2009. Its objective is to conceptualize the business analysis objects. The underlying data model for Onto-BAn is a frame-based structure implemented with Protégé 3.4.1. Onto-BAn is modeled by IS-A and PART-OF relationships and allows multiple inheritance.

Building ontologies with Protégé

Protégé is a popular open source ontology editor and knowledge base framework [13].

Protégé supports the export to standard ontology languages as OWL and RDF schema, but it is easily extensible through its plug-in interface. This makes it a flexible base for a rapid prototyping and application development. Protégé has several built-in advantageous features. These include GUI – a standardized graphical user interface, and flexible platform for knowledge-based domain modeling.

We are going to describe the Protégé features in detail, and demonstrate how we used them for subontology of Planning and control development.

Protégé is an ontology development environment with a large community of active users. The representation mechanism for ontologies and knowledge bases (Protégé's model) is based on a flexible metamodel which is comparable to object-orientated and frame-based systems. It basically can represent ontologies consisting of classes, properties (slots), property characteristics (facets and constraints), and instances. Recently Protégé has been extended with support for OWL, and has become one of the leading OWL tools. Protégé provides functionality for editing classes, properties, and instances.

The Protégé GUI consists of overlapping tabs that offer a "browser" and "form" for creation, viewing, editing, and saving different type of information. These tabs include "classes", "slots" and "instances" (figure 1). The forms consist of configurable components, called widgets. Typically, each widget displays one property of the selected object

The classes tab displays the tree of the ontology's classes on the left, while the selected class is shown in a form in the center.

Protégé classes represent originally the abstract domain concepts. Each of these abstract classes is described by a set of defined attributes. These are in Protégé called slots. The concrete class occurrences are represented in Protégé as instances. We use these three forms to enter the different type of information required in the planning and control entries: methods for forecasting and evaluations.

During ontology design, the most interesting reasoning capability from this type of tools is classification. Classification is used to infer specialization relationships between classes from their formal definitions. Basically, a classifier takes a class hierarchy including the logical expressions, and then returns a new class hierarchy, which is logically equivalent to the input hierarchy. Protégé can display the classification results graphically. After the user has clicked the classify button, the system display both the asserted and the inferred hierarchies, and highlights the differences between them. The visualization can utilize the interaction between knowledge engineers and domain specialists and thus should increase the effectiveness of the knowledge acquisition process

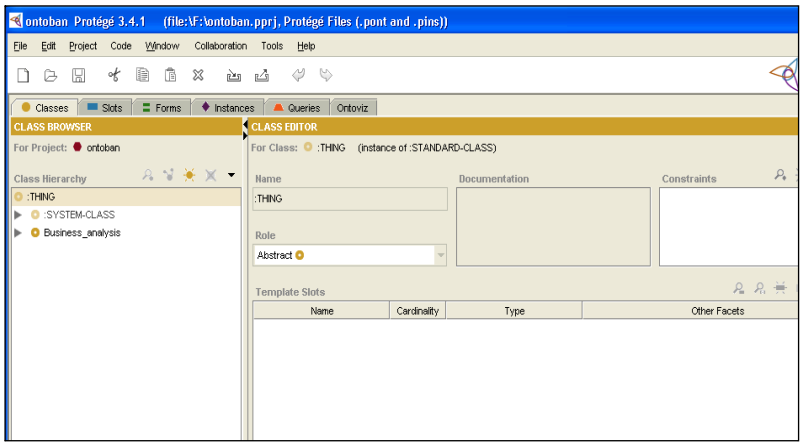

Figure 1: Protégé tabs.

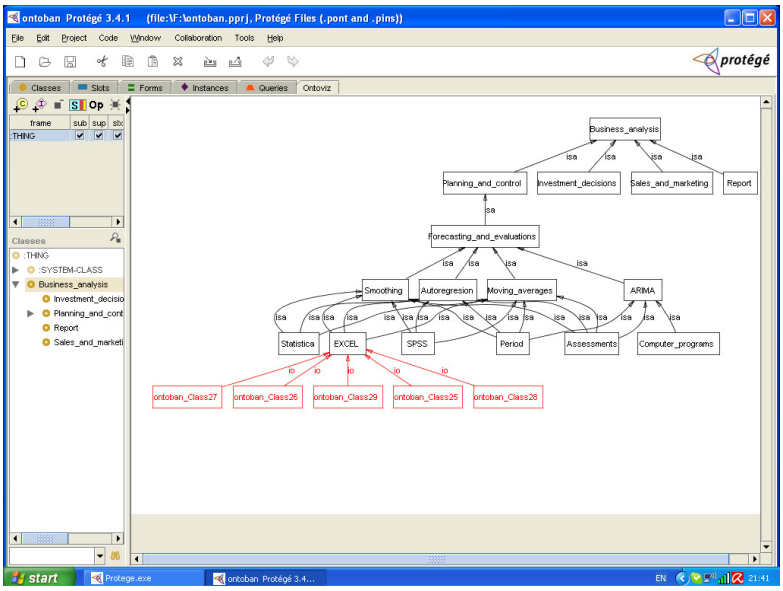

Figure 2: Visualization of the class hierarchy.

Results

A model of ontology of the business analysis domain (subdomain Forecasting and assessments)

In this paper we propose a domain ontology for business analysis. In order to elaborate an ontology for that domain we have used terms proposed in [7] and [10] for the business analysis of a company.

Onto-BAn ontology

The main terms are organized in:

- Report - Nature and analysis of financial report;

- Planning and control - Financial planning and control;

- Investment decisions;

- Sales and marketin

We are going to follow the two phases (specification and conceptualization, implementation) for the construction of the knowledge model of investment decisions subdomain of business analysis domain.

Specification: This section describes the process of developing an Onto-BAn ontology (subontology) for business analysis domain (forecasting and evaluations). This subontology only considers the needs for creating the forecasting related to expenses and data. It includes general concepts for the forecasting, evaluations, assessments and methods for forecasting and specific concepts for the formulation. According to the level of conceptualization and granularity, the ontology proposed here is domain ontology. Domain ontology describes the vocabulary related to a specific domain. In this case study, the ontology describes the business analysis domain (planning and control subdomain). The ontology objective is to facilitate communication among the members of the central administration staff or corporation leadership that must deal with the budget, bringing adequate terminology to non-expert users.

Conceptualization: In this step, a list of the most important terms was elaborated. The core of basic terms is identified first and then they are specified. Then with these concepts, the key term list was defined.

Each term is defined in properties and relations, generating a complex network of classes, subclasses, instance and slots. The ontology Onto-BAn is designed as a reflection of the views of specialists in the areas of business analysis, statistics, and knowledge engineering. The model of subontology of Forecasting and evaluations can be used as a starting point for the elaboration of a general model of the Business analysis and models of subdomains of business analysis.

In the following we describe the class “Forecasting and evaluations” of the class “Planning and control”.

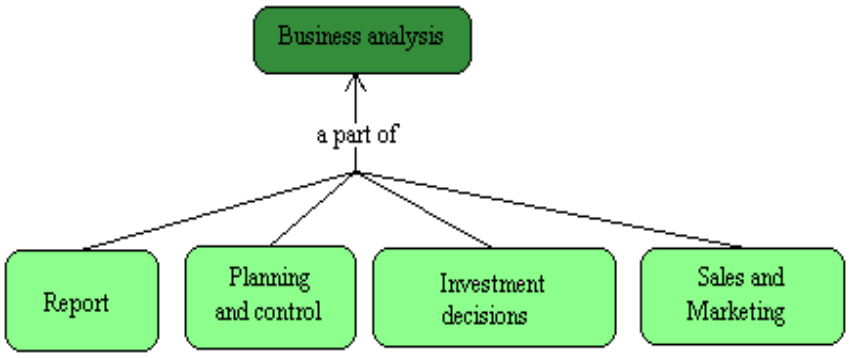

Figure 3: General diagram of the ontology Onto-BAn (superclass and classes).

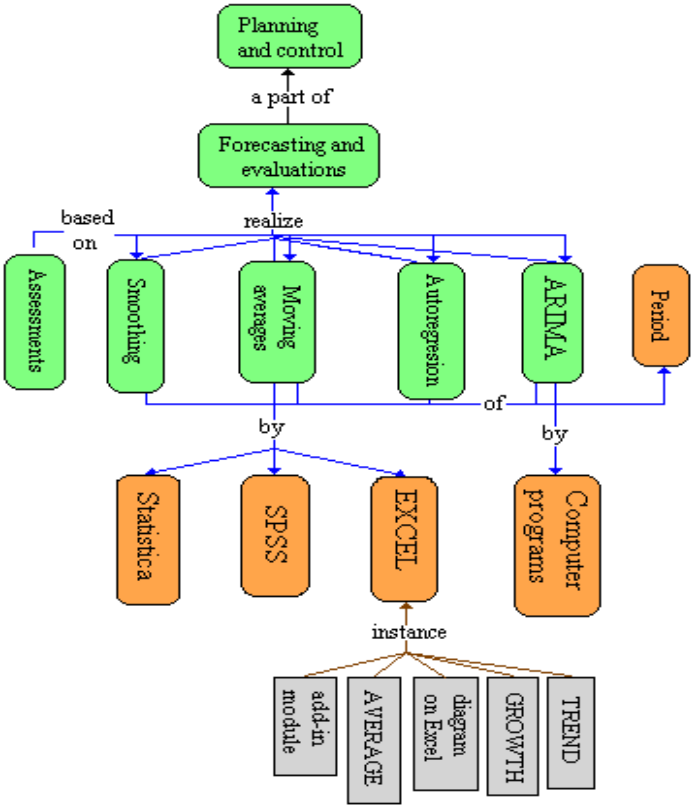

Figure 4: Class "Forecasting and evaluations" [6] Conceptual model.

Description of class "Forecasting and evaluations"

The class "Forecasting and evaluations" (see figure 4) is designed to describe the basic methods of forecasting and assessments. For the purpose of that investigation the concepts are grouped into four classes:

- Moving averages;

- Smoothing;

- Autoregression;

- ARIMA.

Since forecasting and assessments are very important for a company they are connected to other classes of the ontology Onto-BAn. The class "Forecasting and evaluations" and subclass "Assessments" correspond to the major issues directly, which makes them interesting for analysts – what is planned, what, how and where it is transacted, which are the results and the effects, what is the feedback to the corporate leadership.

The relations in class "Forecasting and evaluations" are of the type "a part of", "realize", "of", "base on", "by", and "instance".

For clarity, only some instances of subclass "Excel" are shown (the most popular) [6]. When we realize the ontology Onto-BAn in Protégé, we show some (the most important) instances of subclasses "SPSS" and "Statistica".

Implementation: In order to implement the ontology, we chose Protégé 3.4.1 because of the fact that it is extensible and provides a plug-and-play environment that makes it a flexible base for rapid prototyping and application development. Protégé ontologies can be exported into different formats including RDF Schema and Web Ontology Language.

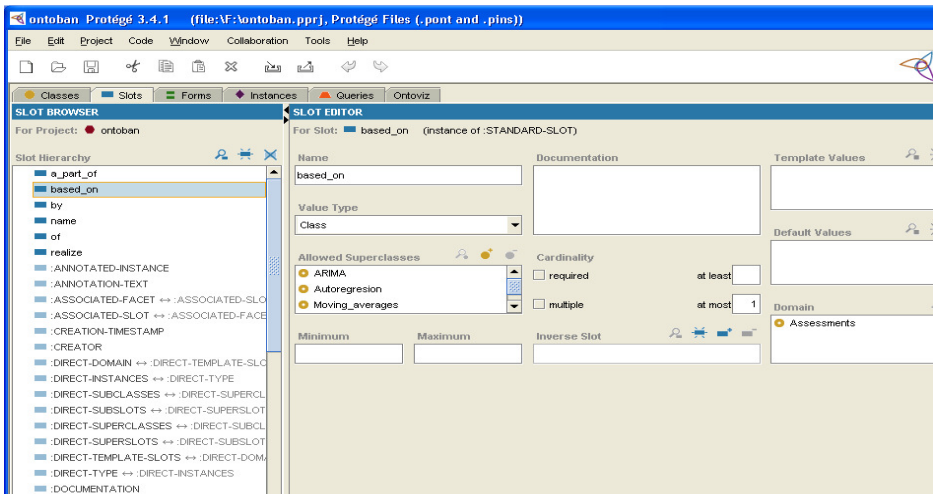

Figure 5: Realization in Protégé 1.

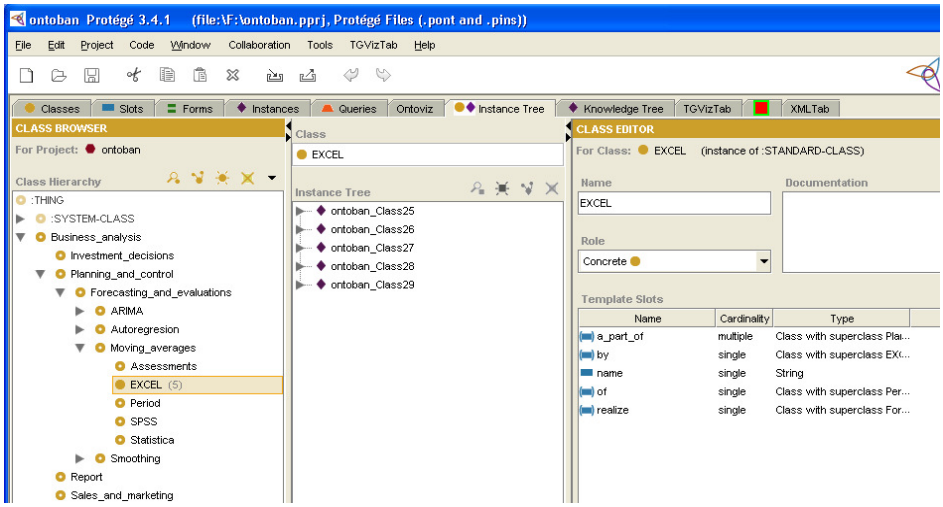

Figure 6: Realization in Protégé 2.

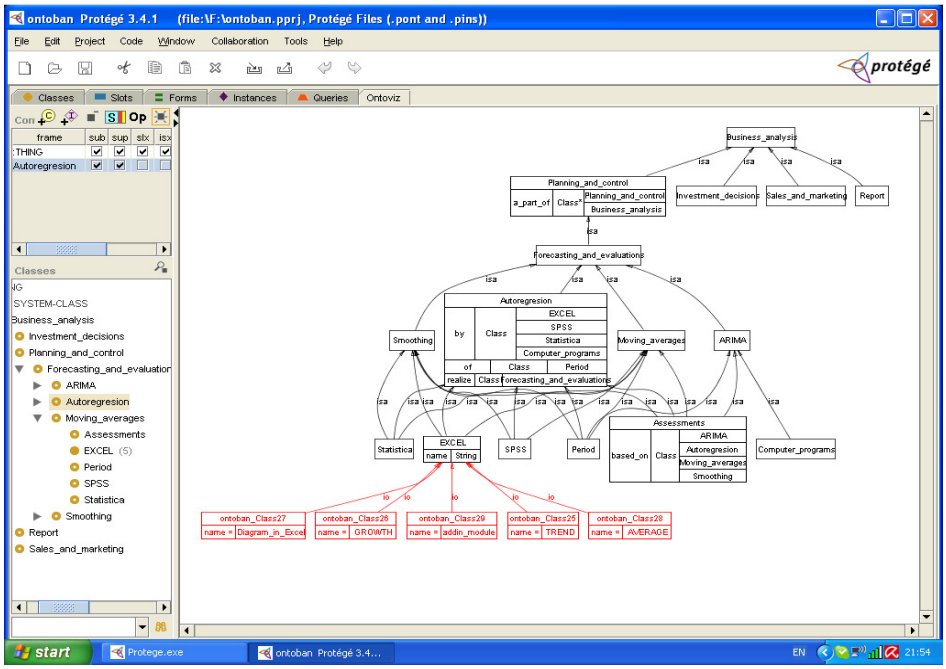

Figure 7: Visualization in Protégé.

Conclusions

In this paper, we focus on the implementation phase after linking short-term user needs supported by informal semantics with longer-term formal ontology development.

The considerations discussed in Section 2 can serve as arguments for the conclusion that Protégé is a perfect instrument for the development of software tools for intelligent search. Building domain ontologies is not a simple task when domain experts have no background knowledge on engineering techniques and/or they have not much time to invest in domain conceptualization.

Ontology building process is characterized by its very high cost and elaborate overlapping activities of development. Researchers have proposed many approaches namely bottom-up, top-down, and middle-out. In [16] Van der Vet sees that a bottom-up approach is very attractive for many scientific and engineering fields. The approach focuses on building complex concepts from their primitive (basic) concepts and a list of construction rules. We are going to use this approach to design, engineer, and create our ontology.

In knowledge engineering, a number of alignment tools are provided such as Protege [5], Chimeara [8], PROMPT [12], but we prefer to use Protege to build our ontology. In this paper we present an implementation of subontology for the forecasting subdomain. We provide the basic conceptualisation and we make implementation of our subontology "Planning and control" with Protégé.

Future research

In the future we intend to realize the subontologies for other classes of the ontology Onto-BAn for business analysis domain by using the bottom-up approach and integrated environment Protégé 3.4.1

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References

[1] Abdullah M. S., Evants A., Benest I., Paige R., Kimble C. (2004): Modelling Knowledge based systems using the eXecutable modelling framework (XMF), In: Proceeding, 2004 IEEE, Conference on Cybernetics and Intelligent Systems, (Vol.1) Singapore.

[2] Angele J., Densel D., Landes D., Studer R. (1998): Developing knowledge based systems with MIKE. Journal of Automated Software Engineering.

[3] Booch G., Rumbaugh J. E., Jacobson I. (1999): The Unified Modelling Language User Guide, Addison-Wesley, Reading, MA.

[4] Gennari J. H., Musen M. A., Fergerson R. W. et al. (2003): The Evolution of Protégé: An Environment for Knowledge-Based Systems Development, International Journal of Human Computer Studies.

[5] Grosso W., Eriksson H., Fergerson R., Gannari J., Tu S., Musen M. (1999): Knowledge modeling at the milenium (the design and evolution of Protege 2000), In: Proceeding of the Twelfth BannfWorkshop on Knowledge Aquisition, Modeling, and Management, (pp. 16-21).Voyager inn, Bannf, Alberta, Canada.

[6] Karashtranova E., Atanasova I. (2010): A model for implementation of the dependence between random events in knowledge bases, Economics and management, (Vol.1), Blagoevgrad.

[7] Karlberg K. (2003): Business analysis with Microsoft Excel, IN: SoftPress Ltd.

[8] McGuinness D., Fikes R., Rice J., Wilde S. (2000): An environment for merging and testing large ontologies, In: Proceedin of KR-00 (Vol. 1).

[9] MOKA (1998): homepage, Available online at http://www.kbe.conventry.ac.uk (URL) (Accessed March 2010).

[10] Newbold P. (1984): Statistics for business and economics (1st edition), IN: Prentice-Hall, New Jersey.

[11] Noy N., McGuinness D. (2001): Ontology Development 101: A Guide to Creating Your First Ontology - Stanford Knowledge Systems Laboratory Technical Report, KSL-01-05.

[12] Noy N., Musen M. (2000:) Prompt: Algorithm and tool for automated ontology merging and alignment., In: Proceedings of the 17th national Conference on Artificial Intellligence (AAAI - 2000), Texas.

[13] Protégé (2008): Protégé Available online **at** http://protege.stanford.edu (Accessed January 2010).

[14] Schreiber A., Akkermans J., Anjewierden A. et al. (2000): Knowledge Engineering and Management: The CommonKADS Methodology, MIT Press.

[15] Sure Y., Corcho O. (2003): International Workshop on Evaluation of Ontology based Tools (2nd edsition), (EON 2003).

[16] Vet P., Mars N. (1998): Bottom-up construction of ontologies, In: Proceedings, IEEE Transaction on knowledge and Data Engineering, (Vol. 10, no 4, pp 513-526).