Chapter XI
Towards an Operational REA Business Ontology

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ABSTRACT

It is widely recognized that ontologies can be used to support the semantic integration and interoperability of heterogeneous information systems. Resource Event Agent (REA) is a well-known business ontology that was proposed for ontology-driven enterprise system development. However, the current specification is neither sufficiently explicit nor formal, and thus difficult to operationalize for use in ontology-driven business information systems. In this chapter REA is redesigned and formalized following a methodology based on the reengineering extension of the METHONTOLOGY framework for ontology development. The redesign is focused on developing a UML representation of REA that improves upon existing representations and that can easily be transformed into a formal representation. The formal representation of REA is developed in OWL. The chapter discusses the choices made in redesigning REA and in transforming REA’s UML representation into an OWL representation. It is also illustrated how this new formal representation of the REA-ontology can be used to support ontology-driven supply chain collaboration.

CURRENT SITUATION

The last 10 years there has been an increased interest in generic models that describe parts of a business or the activities of a business. These so called “business ontologies” have been proposed to support requirements elicitation, modeling and engineering of e-commerce application, enterprise systems and e-collaboration systems (Assmann, Zchaler, & Wagner, 2006; Baida, Gordijn, Saele, Morch, & Akkermans, 2004; Dietz, 2005; Grunninger, 2003). For instance, in ontology-driven business modeling, they are used to constrain the contents and structure of
business models, thereby helping to identify and organize relevant objects, relationships and other knowledge (Guarino, 1997). The use of ontologies at run-time (i.e. ontology-driven systems instead of ontology-driven development - Guarino, 1997) also offers great potential for business ontologies. Specifically in and between enterprises ontology-driven information systems can be used to create interoperability at different enterprise levels: shop-floor, intra-enterprise and inter-enterprise level.

The two oldest business ontologies are TOVE (Fox, 1992) and the Enterprise ontology (Ushold, King, Moralee, & Zorgios, 1998) and were developed by some early ontology researchers. The major contribution of their work was not the ontologies themselves but the ontology engineering methodology which was used to develop the ontologies. More recent business ontologies like the Resource Event Agent business ontology (REA-ontology) (Geerts & McCarthy, 2002), \( E^3 \)-value ontology (Gordijn, 2002) and e-BMO (Osterwalder, 2004) have their origin in some kind of business theory and were developed by information system researchers and not ontology researchers. The main problems with the more recent developed business ontologies is that they were developed in ad hoc manner without taking into account some basic ontology engineering principles which results in a series of problems: the applicability of these ontologies is limited because the intended use is not always clear, the conceptualization of the ontology is not clear and is divided over different sources, and these ontologies do in most cases not have a formal representation. On the contrary these ontologies have a strong theoretical background and are in most cases better understood by business practitioners which have the same background as the developers. As a result they offer real opportunities for businesses which are currently not realized and which can be realized if new Semantic Web technologies are used.

**Problem Statement**

The REA-ontology is an example business ontology that has been proposed for ontology-driven enterprise systems development. The origin of REA is an accounting data model (McCarthy, 1982) that has been extended first into an enterprise information architecture and later into a full-scale enterprise ontology. This development followed an ad-hoc process rather than being guided by an Ontology Engineering methodology. The REA developers focused more on the theoretical background of the ontology (events accounting and Micro-Economic theories) than on the representation, formalization and computational correctness of the ontology (although they did perform in Geerts & McCarthy, 2002 an ontological analysis using Sowa’s classification (Sowa, 1999)). As a consequence, there is no formal representation of REA. Furthermore, the available literature sources on REA (e.g. Dunn, Cherrington, & Hollander, 2005; Geerts & McCarthy, 2005, 2006; Hruby, Kiehn, & Scheller, 2006) present different views on the REA conceptualization of an enterprise and use a variety of different formats (including text, tables and diagrams) to specify the ontology. The lack of a generally accepted conceptualization and a uniform, complete and formal representation of the ontology causes imprecision in its definition and ambiguity in its interpretation. For instance, in (Gailly & Poels, 2006) we showed that the ontological concepts and the relations between the concepts are not strictly defined and that the ontological axioms, only informally defined in text, are confusing (mixing up types and instances of concepts). There have been attempts to formalize REA (e.g. Bialecki, 2001; Chou, 2006), but the results obtained were highly dependent on the researchers’ subjective interpretation of REA.

**REA-Ontology**

As an ‘event ontology’ (Allen & March, 2006), REA focuses on the events occurring within the