ONTOLOGY-DRIVEN BUSINESS RULE SPECIFICATION

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Extended Abstract

INTRODUCTION

"*Business rules are statements that define or constrain some aspect of the business"*(Business Rules Group 2000). The discovery and specification of business rules is a complex task for which many different approaches have been proposed (Von Halle 2002; Rosca et al. 2002; Kardasis and Loucopoulos 2004; Xue and Feng 2006). In this paper we describe and demonstrate a novel approach which is ontology-driven: Ontology-Driven Business Rule Specification (ODBRS). An enterprise ontology provides a conceptual specification of the essence of the operation of an enterprise model (Dietz 2006) and examples include e3-value (Gordijn and Akkermans 2001), Enterprise Ontology (Dietz 2006), and the REA Enterprise Ontology (McCarthy 1982, Geerts and McCarthy 2000, Hruby 2006). In this paper we will focus on the use of the REA-EO for ODBRS. We first describe ODBRS as a novel approach to business rule discovery and specification, and second, we demonstrate this approach with an example.

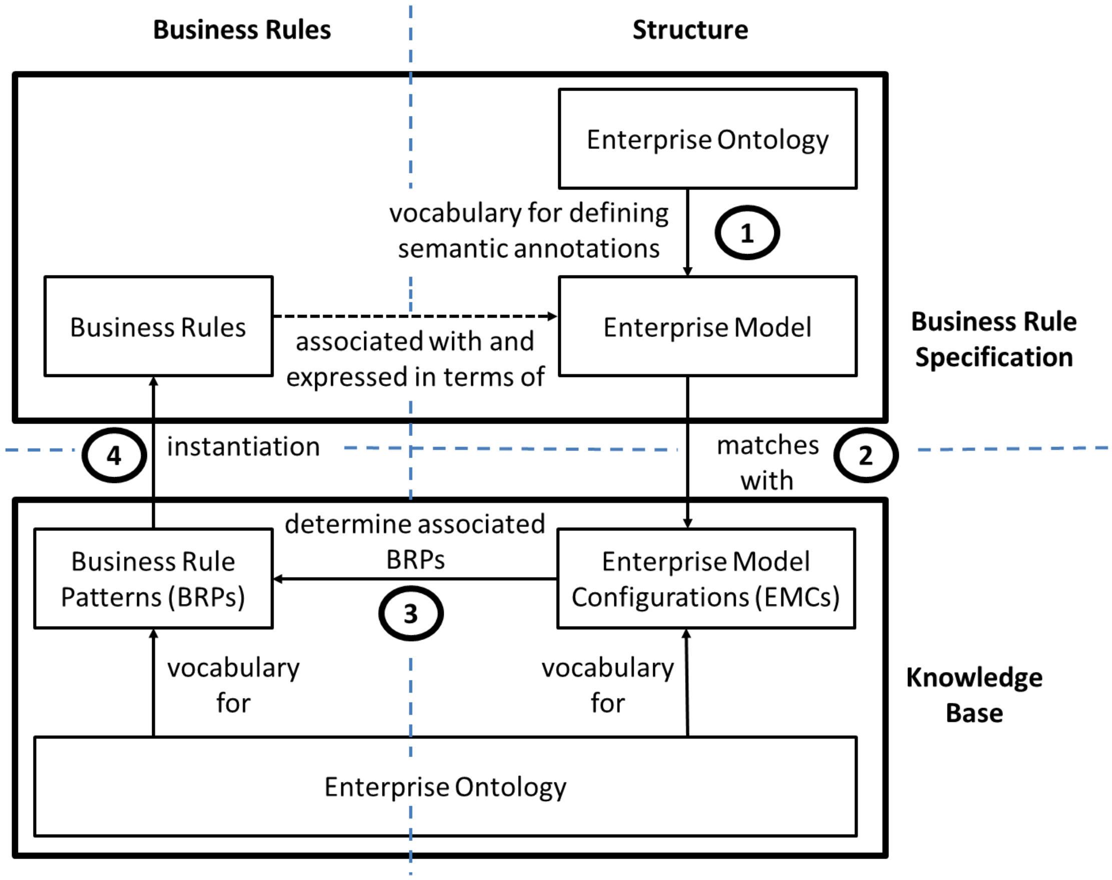
THE ODBRS APPROACH

As shown in Figure 1, the ODBRS approach is comprised of four steps:

(1) **Classification:** an enterprise model is classified in terms of the enterprise ontology – the REA-EO in our case – and this is done by adding semantic annotations.

(2) **Matching**: using the semantic annotations, the constructs in the enterprise model are matched against the Enterprise Model Configurations (EMCs).

FIGURE 1
The ODBRS Approach



(3) **Association**: the Business Rule Patterns (BRPs) associated with the matching EMCs determined in step 2 are identified.

(4) **Instantiation**: business rule specifications (BRSs) are generated starting from the BRPs. This is done by replacing the ontological terms in the BRPs – which act as variables – by enterprise model elements.

The input of ODBRS is an enterprise model which defines the actual economic phenomena relevant to a business organization. Business rules are not explicitly defined as part of the enterprise model but derived from ontological specifications in a knowledge base (lower part of Figure 1). Enterprise Model Configurations (EMCs) represent stereotypical economic phenomena defined in terms of the REA-EO. The matching process determines which Enterprise Model Fragments (EMFs) are instantiations of the EMCs defined as part of the knowledge base. The matching process is based on semantic annotations; i.e. the classification of the enterprise model in terms of the REA-EO. A key part of ODBRS is discovering Business Rule Patterns (BRPs) implied by EMCs. A BRP is defined in terms of the REA-EO and applies to all instances of the EMCs it is associated with, across business processes and business organizations. The output of ODBRS is the business rules generated by replacing the ontological terms in the BRP templates by the actual phenomena specified in the enterprise model.

DEMONSTRATION

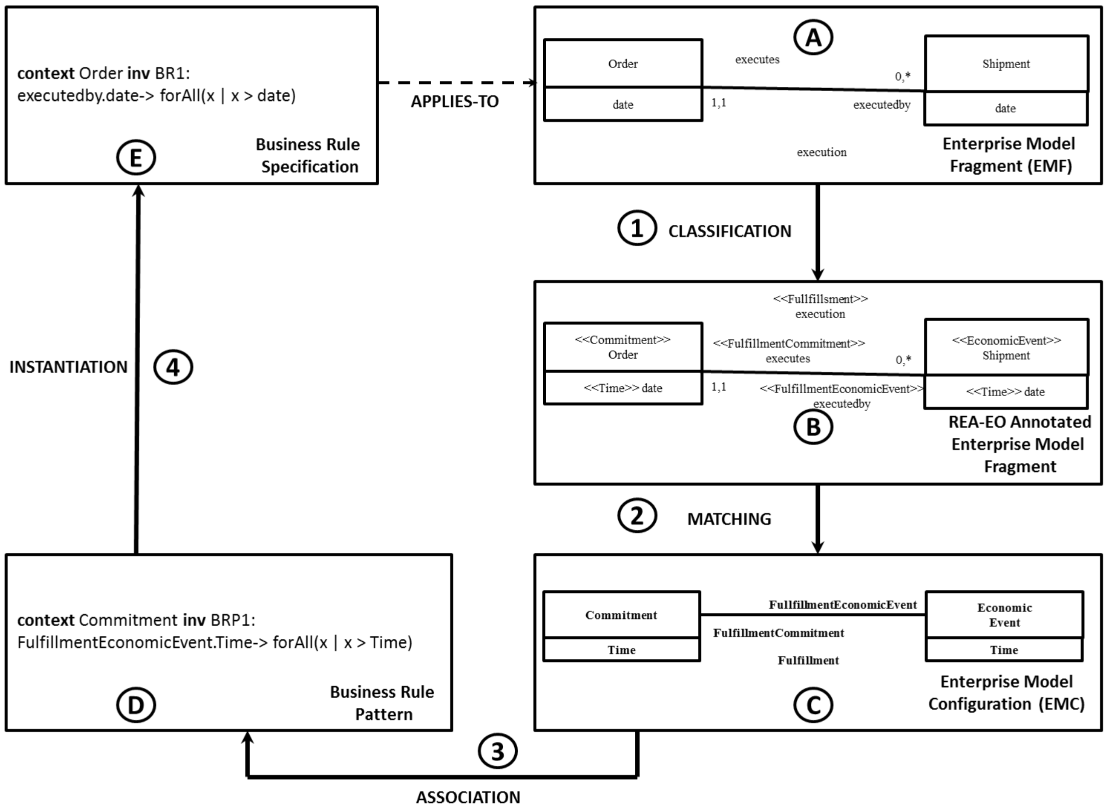
Figure 2 demonstrates ODBRS with an example. Panel A represents an Enterprise Model Fragment (EMF): orders are fulfilled by shipments and a date is recorded for both orders and shipments. The result of the classification process is shown in Panel B: semantic annotations are used to classify the different elements of the EMF in terms of the REA-EO. For our example in Panel B, the following semantic annotations apply:

Order → Commitment (Object Primitive)
Shipment → EconomicEvent (Object Primitive)
execution → Fulfillment (Association Primitive)
executes → FulfillmentCommitment (Association End Primitive)
executedBy → FulfillmentEconomicEvent (Association End Primitive)
date (Order) → Time (Role Declaration)
date (Shipment) → Time (Role Declaration)

As the example above illustrates, we use an REA-EO grammar that contains object primitives, association primitives, association end primitives, and role declarations. The last two are typically not considered a part of the REA-EO vocabulary (McCarthy 1982; Geerts and McCarthy 2000; Hruby 2006). In the context of business rule specifications, association ends are instrumental for path navigation. Role declarations are important for the generalization of business rule specifications that rely on attribute values.

During matching, the semantic annotations are used to identify instances of the EMCs. In Figure 2, UML is used to graphically define the EMC (Panel C). It is obvious that visual matching is feasible for small examples only and that real-world

FIGURE 2
Demonstration of ODBRS



applications will need the use of automated tools. The EMF in Panel A is an instance of the EMC in Panel C.

The Association step identifies the BRPs that apply to an EMC. Panel D shows that the following BRP is associated with the EMC defined in panel C:

Commitments Occur Before Their Fulfillment Events

context *Commitment* **inv** BRP1:

FulfillmentEconomicEvent.Time->forAll(x | x > *Time*)

For the definition of the BRPs, we use a syntax that is a combination of OCL and the REA-EO vocabulary. For illustration purposes, we have italicized the terms which are part of the REA-EO vocabulary: Commitment, FulfillmentEconomicEvent.Time, and Time. These ontological terms are variables that will be replaced during the instantiation step.

During instantiation, the actual business rules associated with the enterprise model are specified. Here the REA-EO concepts that function as variables in the BRPs are substituted by actual elements from the enterprise model. The following substitutions were made to generate the business rule specification in Panel E of Figure 2: Commitment → Order; FulfillmentEconomicEvent.Time →executedby.date; self.Time → Order.date. As indicated by the "applies_to" relationship, the specified business rule is fully integrated with the enterprise model that we used as input for our example (Panel A).

CONCLUSIONS

ODBRS is an alternative approach for discovery and specification of business rules. It strongly relies on knowledge-intensive specifications that link ontological definitions of business practices (EMCs) with business rule patterns (BRPs). The focus of the paper is on describing the ODBRS approach. Many aspects of ODBRS need to be explored further, including: (1) an extended specification of the knowledge base, and (2) the development of automated tools to support ODBRS.

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