Generic and Domain Specific Ontology Collaboration Analysis

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Abstract: DEMO (Design Engineering Methodology for Organization) has its foundation in Enterprise Ontology and provides a generic platform for business process modeling. REA (Resource-Event-Agent) ontology that originates from accountancy systems provides a domain specific platform for value modeling business processes. Both modeling frameworks have their irreplaceable position in business process modeling. The paper contemplates different aspects of both ontologies and analyzes possible way for collaboration between these modeling frameworks.

Keywords: DEMO, value modeling business ontology, REA ontology, fact

1. Introduction

DEMO methodology is based on Enterprise Ontology and provides generic platform for business process modeling based on social character of business processes. DEMO provides guidance as to how to cope with huge diversity and complexity of modeling enterprises. The final results of DEMO are four aspect models completely independent of realization and implementation which capture the modeling reality as a whole. Enterprise Ontology is a generic ontology which means that it deals with generic aspects of modeling domain. DEMO registers all elementary actions and events with good empirical evidence. Including social character of business process modeling DEMO has far the best abilities to capture and model all social activities in which human beings enter into and comply with commitments. All other objects (entities) such as e.g. resources and their attributes DEMO registers but does not work with them directly. In other word, DEMO knows about them perfectly well but does not further elaborate them.

REA modeling framework is a domain specific approach which originated from the accountancy domain and matured to a conceptual framework and ontology for Enterprise Information Systems. This ontology is called the REA Enterprise Ontology because three of the fundamental concepts are Resources, Events, and Agents. The REA model records information based on the coherence between the data of one or more economic events. The main benefit of the REA approach is keeping track of primary and raw data about economic resources. All accounting artifacts such as debit, credit, journals, ledgers, receivables, and account balances are derived from the data describing the exchange and conversion REA processes. All reports based on the
accounting artifacts are always consistent, because they are derived from the same data (Hruby, 2006).

2. DEMO - Main Features with Respect to REA

According to DEMO (Design & Engineering Methodology for Organizations) methodology see Dietz (2006), an organization is composed of people (social individuals) that perform two kinds of acts, production acts and coordination acts. The result of successfully performing a production act is a production fact. An example of a production fact may be that the payment has been paid, or offered service has been accepted. All realization issues are fully abstracted out. Only the facts as such are relevant, not how they are achieved. The result of successfully performing a coordination act is a coordination fact. Examples of coordination acts are requesting and promising a production fact.

A fact is a particular arrangement of one or more objects. Depending on the number of objects that are involved in a fact, we speak of unary, binary, ternary, etc., facts. An example of unary fact is that Vendor is a Person. Another example of binary fact is that a Customer receives a Pizza.

In general, a state is determined by the set of facts that exist at that moment. A state change or state transition consists of one or more facts starting or ending to exist. The occurrence of a transition at some moment is called an event. Events are caused by facts in the system that the world is associated with. Events concern existentially independent facts. Coordination and production acts and facts are arranged into a transaction pattern.

Fig. 1 The standard transaction pattern. Source: Kervel (2012)
DEMO distinguishes the basic, standard and complete transaction patterns according to the numbers of transaction steps. The diagram in Fig. 1 shows interrelated acts and facts (states) of the standard pattern. The partition of the initiator contains the coordination acts and the decisions are represented by diamonds in the diagram. The production act and the production fact are depicted in grey color in the partition of the executor. The reason for locating the production fact in the executor partition is that the production is usually placed separately from the initiator partition. The coordination facts are situated in the middle of the figure as states in bold format. The complete transaction pattern is extended by four cancellation patterns regarding to the standard transaction pattern. The advantage of this methodology is completely defined state machine inside the transaction pattern. The all essential states are defined in underlying infrastructure.

3. REA Model – Main Features

REA ontology can be characterized as value modeling business ontology which means that the value of resources is its prime interest. Each process or transaction is viewed through paradigm of observation of a resource value. REA model describes paired transactions during which the rights to the resources are changed (in case of exchange process) or the resources are used or consume to create a new resource entity (in case of conversion process). From the value perspective, the dominant entity partaking in the process is a resource entity.

Fig. 2 REA model with commitments and claim entities. Source: Hruby (2006)

Commitment entity addresses the issue of modeling promises of future economic events and the issue of reservation of resources. The reason for this solution is that
economic events specify according REA ontology only actual increment or decrement in resource values, not the future increment or decrement in resource values.

Commitment entities and their relationships with other entities are shown in Fig. 2. Each commitment is related to an economic resource by a reservation relationship which specifies what resources will be needed or expected by future economic events. The corresponding event entities are related to each other by the exchange duality relationship and the corresponding commitment entities are related to each other by the exchange reciprocity (in case of an exchange process).

4. Collaboration Analysis

Both modeling frameworks utilize notion of transaction or transaction pattern, which in general contains common things such as two sorts of human beings partaking in the transaction and an event representing occurrence of production activities. DEMO transaction represents precisely defined state machine and transactions are organized in a tree structure utilizing production facts aggregation (composition) to form a business process. To express transaction dependence, the dependent transaction is enclosed within an ‘independent’ transaction in the context of a business process. REA framework assumes that a business process is composed at least of two transactions which are bound through the reciprocity and duality relationships see Fig. 2. In REA, one sort of transactions stands for decrement in value of economic resources and the other sort of transactions represents increment in value of economic resources.

When thinking about ontology collaboration, the first thing that one may occur is concept mapping from one ontology to another. However, direct concept mapping from DEMO to REA will fail because concepts in DEMO are missing in REA and vice versa. Direct mapping from REA to DEMO would require expressing each REA concept in DEMO primitives. This approach would bring about a lot of incompatibilities.

The only possible way to design some way of collaboration is to start from the common area of both frameworks. REA, as other business process modeling frameworks, addresses the production world. Only the production world is expressed in the REA model. The DEMO’s Object Fact diagram is exclusively aimed at the world of production and its elements are depicted in the form of object classes and their property types and attribute types which are arranged according to facts. These facts represent production facts.

In DEMO, production activities are enclosed in coordination activities. Due to social character of business process, the coordination activities are given precedence to production activities. Consequently, the production fact becomes existent only if it is accepted by the corresponding coordination fact. It means that a production fact can be accessible from the successful coordination fact. In this way, DEMO could send corresponding production facts to the REA model.

REA modeling framework works only with “production” activities. An economic event reflects changes in the value of economic resources with regards to different economic agents. It stands for a production act and production fact in DEMO. An economic agent that marks a human being or an organization has its counterpart in
DEMO actor, more specifically in its actor role. An economic resource is a concept of a domain specific ontology that is closely connected with production activities. DEMO as a generic methodology is able to capture the resource value changes in its coordination facts but it does not further record or processed them. The ability to capture a production activity by means of coordination activities is possible because the DEMO production fact comes into existence when it passes successfully through the accepted coordination fact. In DEMO, coordination facts have the following structure (Dietz, 2008):

<performer> <intention> <addressee> <product>

Meaning of the individual parts of the coordination fact is following:
<performer> and <addressee> represents actor roles and subjects involved in the coordination fact,
<intention> marks the phase of the coordination act within the scope of transaction pattern,
$product> represents the result of the transaction. It includes production fact and property types (attribute types) of the product.

In the promise transaction step intended response time is included and in the accept transaction step the creation time is included.

5. REA Model Essential Relationships

REA model essential relationships are those that relate “decrement” in resource value transactions to “increment” in resource value transactions. They are the reciprocity relationship between corresponding commitments and the duality relationship between corresponding events. The reciprocity relationship (in case of exchange processes) means that corresponding economic agents (actor roles) agreed on the resource types and their amount that will be exchange for other amount of resource types, on the time and place promised in the commitment. This agreement also supposes that the promised amount of resource types will be available at the promised time. In DEMO it means that for every resource type exchange (in case of exchange process) there will be a corresponding transaction. The reciprocity relationship represents that all DEMO’s transactions have to be in the promised transaction step and that there will be possibility to check this step explicitly.

The duality relationship connects corresponding “production facts” lying on different sides of the exchange process. In happy case in DEMO it means that every transaction accomplished the accepted transaction step. The accepted transaction step means that the corresponding production fact came into existence. In case that not all transactions have been successfully completed, REA introduces the claim entity which registers incurred differences in resource’s amounts. This solution is in compliance with reality where some time delay among transactions occurs.

In terms of production facts, a DEMO transaction includes both current and future economic events. It means that the claim entity can be managed by DEMO transaction themselves. No special entity is possible.
6. Conclusion

The paper deals with the idea of different ontology collaboration and with utilizing conceptual facts for this reason.

References