Modelling business policies and behaviour based on extended Open-edi Business Transaction Ontology (OeBTO)

Introduction

Model Driven Development (MDD) provides a basis for the alignment between business and IT by promoting the role of models and automatic creation of code by predefined model transformations. Current Web service solutions have succeed in aligning with business processes enabling thus loosely-integrated and reusable task automations – here, the business information is captured on a procedural, that is, tactical level. Business models, however, offer some important advantages compared to process models. Using a business ontology, such as REA [1], e^3 value [2], or BMO [3], the business modeller can, in a single view, elicit the actors involved in a business scenario and explain their relationships, by formulating them in terms of *economic values (i.e. resources)* exchanged between those actors. In this way, these models facilitate describing of, in a structured way, the provider and consumer interactions as a basis for the identification of services that are aligned with their needs.

To facilitate a comprehensive business orientation in the model-driven Web service engineering, we have identified two important needs:

- To define adequate models and modelling frameworks: Services exist in collaborative business environments, and as such they should be conceptualized accordingly. Recently, the International Organization for Standardization (ISO) has proposed an integration of REA and the Open-edi frameworks as Open-edi Business Transaction Ontology (OeBTO), to scope the concepts and relationships involved in collaborative business transactions [4]. OeBTO captures the economic commitments realized by economic and business events issued by the partners, along the collaboration lifecycle in the Open-edi sense.
- To enable binding MDD models precisely and unambiguously, to facilitate a correct propagation of model information from higher to lower abstraction levels. Despite of well defined syntax, in most models, semantic descriptions of concepts are neither formal nor machine readable.

Following the outlined concerns, we have already published a number of research articles addressing the issues of defining models and modeling framework and binding models at different levels of abstractions. We have stated in the beginning of this section that we consider REA and Open-edi (i.e. OeBTO) as a comprehensive and well-established conceptual basis for defining a business collaboration context. TO facilitate a formal, model-driven method for defining and transforming service models from the business to the software level, we propose the following:

– An extension to the original OeBTO to capture a service-centric business model. In its current form OeBTO does not capture the notions related to the service behavior or policies.

As such, in this report, we elaborate, further, the issue by defining extensions to the collaboration-oriented OeBTO to explicitly capture service-related notions, such as the service policies and behavior.

Overview of major concepts in the service-oriented extended OeBTO

Modelling of service-oriented solutions starts with the identification of business transactions. Once the business transactions in a given business case are identified considering the core resource exchanges, they

are explored to define the Agents involved in it, as well as the Economic Resources being exchanged. The economic events through which the resources are exchanged between the partners are also elicited. A business transaction comprises a set of Economic Events, i.e. an Economic Exchange. They are further specified in the form of Economic Commitments summarized in an Economic Contract which governs a Business Transaction. These contract-related elements are not further elaborated OeBTO; from our point of view, we see them important to facilitate a formal relation to service-related elements. We have formalized the definitions and relations of the described elements in OWL as shown in Figure 1:

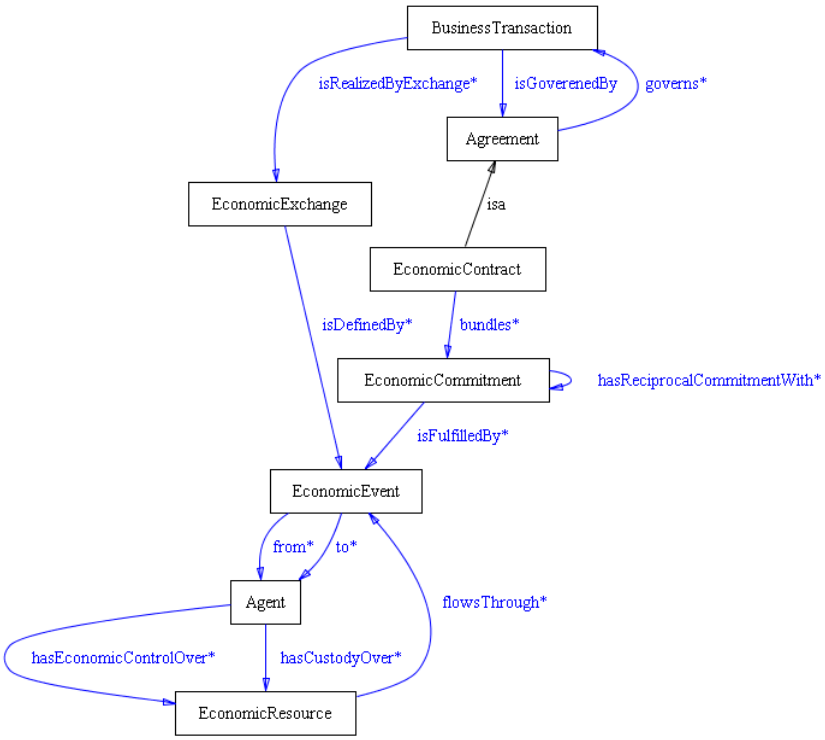

Figure 1 a part of the extended OeBTO, in OWL.

In OeBTO, the Business Event is used to represent elementary business operations elicited for every business transaction phase at the third layer of the framework. In order to capture the services that compose events, we introduce the business service element to OeBTO. A Business Service is an aggregation of Business Events within a Business Transaction Phase, and is seen as a standalone business function that can be reused as part of other economic exchanges, i.e. business transactions. A Business Service, as well as contained Business Event may require (input) and /or provide (output) certain Resource, such as an artefact or a physical object. Every business service is offered by a Provider. The major elements of the extended OebTO, that concern concepts such as business service, business event and their relationship to behaviour and policy elements are depicted in Figure 2.

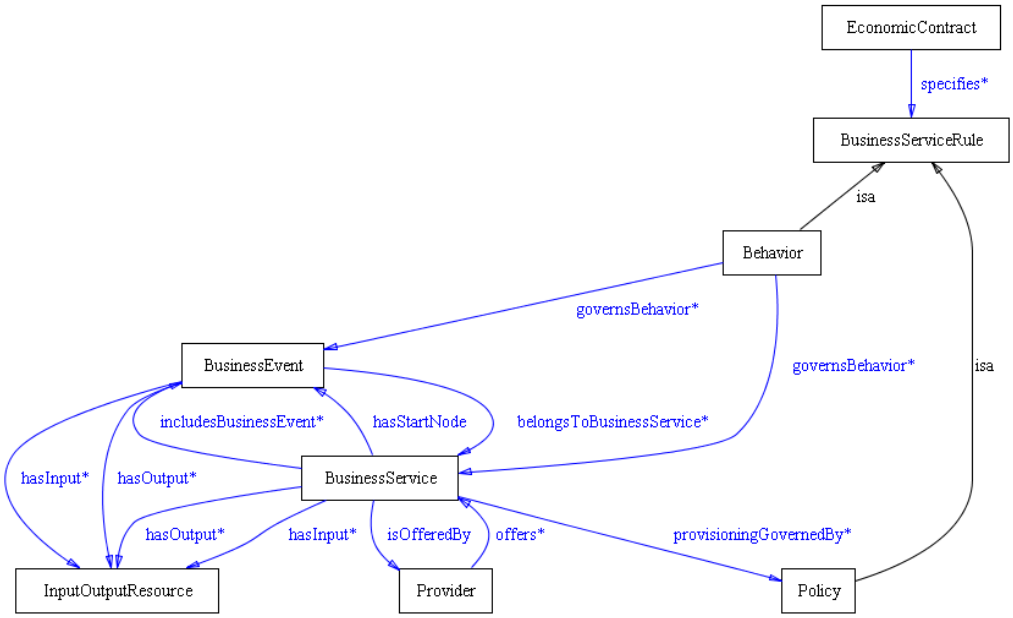

Figure 2 The extended OeBTO.

Modelling policies and behaviour in service-oriented context

Identification of candidate business services and constraints that govern internal and external aspects of their interaction have been a subject of number of research activities in Service-oriented system development.

Having surveyed the major service modelling aspects of SOA [5] and software services [6], we argue that the aspects such as behaviour and policy can be well-applied to business services. This is in order to determine constraints that may govern: a) interrelationships between business services and their constituent components such as business events, b) accessibility of services by consumers. As such, in this report, we focus on following aspects of constraints applied to business services and how they can be modelled based on Open-edi Business Transaction Ontology.

– *Behaviour,* for defining compositions of service operations.

– *Policy*, to denote policy assertions and constraints on the use of a service by consumers.

Behaviour aspect: in the service modelling context, we consider contracts (see Figure 1)to include, in addition to legal aspects, requirements for provisioning of business services. In our extension to the original OeBTO (Figure 3), we define Behavior, as a specialization of Business Service Rule directed from an Agreement, to include directives related to the process flow of business services and containing business events. Under Behaviour, the business service modeller can further specify: a) a Condition, such as “Parents consent shall be obtained prior to providing medical treatment to children under 16 years of age”, b) Order, when a business service or a business event has a precedence order originating from Data or Trust preferences, like “Patient medical history on allergies should be considered before prescribing medicines”; and finally c) Concurrency, where two or more services or events are decided to be executed simultaneously to speed up the process execution. In the ontology, we have modelled the described constraints on the behaviour using implication axioms, such as for Order - “*if* business_service_x *then* business_service_y”, for Condition - “*if* Cond *then* business_service_x *and if not*Cond *then* business_service_y” and for Concurrency- “business_service_x *and* business_service_y”.

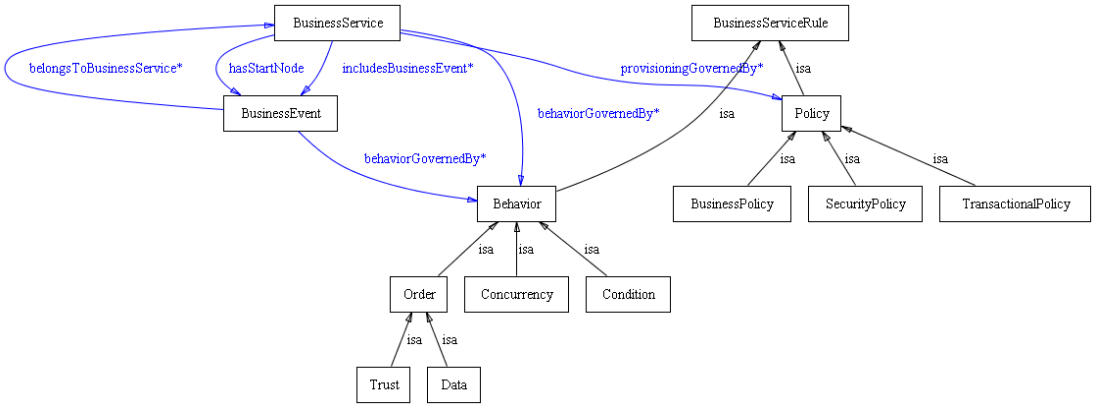

Figure 3 Policy and Behaviour in Layer 2 of the extended OeBTO, OWL.

Policy aspect: Another specialization of Business Service Rule concerns Policy, i.e. the constraints on the interaction between a business service and its consumer. Service policies can be of different kind; for the purpose of this study we follow the classification provided in [7], suggesting: a) business policy, concerning the interaction on the level of actor, i.e. *who can interact with a business service*, b) transactional policy, which concerns the constraints *on the functionality provided by the business service* from the consumer, and c) security policy, regarding *trust and privacy aspects of interactions between the consumer ant the service*. Following this, we have in OWL refined the Policy class to the tree described classifications. A policy may concern a single service (*individual policy*), or several of them (*group policy*). Any Policy may be complex, and such, decomposed to a number of atomic statements, i.e. Assertions (OWL class). An Assertion must contain Expression (OWL class), which consists of a key term to identify objective of an assertion. Each key term defines a capability (a data type property of Expression class) of a business service or a requirement (a data type property of Expression class) that need to be fulfilled by the consumer of the service. As an example we consider an assertion "Patient should have no allergic reaction history to the medicine being prescribed". Considering objective of the assertion as medical treatment, we define key term medical_treatment. We then define "allergic_reactions = none" as the requirement defined by this expression. The described policy structure modeled in OWL is depicted in Figure 2.

Conclusion

In this report, we have proposed several extensions to Open-edi Business Transaction Ontology (OeBTO). The proposed extensions focus on capturing service-related notions, such as the service policies and behavior.

The service-aware OeBTO modelled in OWL with the extended concepts defined in this section (depicted in Figures 1 and 2) will be used as the input for creating the Web service model in the OWL-S ontology. Since OWL is entirely grounded in the formal logic, the two aspects of business service, (i.e. behaviour and policy) are modelled in the way to enable the processing of their meaning by a machine algorithm and thereby transform them to a software service ontology.

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