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Using SBVR Profile for Integrating Business Vocabulary with BPMN Process Models

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***Abstract*— Creation of business vocabulary is the first step in business modelling and development of its supporting information systems. Current CASE tools still lack this capability. The goal of the paper is to allow integrating business vocabulary and business rules with business process models in CASE tools by providing UML profile for this purpose. The idea is demonstrated by a prototype implementing the proposed UML SBVR profile, and a business process example for illustrating the advantages of using SBVR vocabulary in the modelling.**

***Keywords*— business vocabulary, business process, business rule, SBVR, BPMN, UML profile**

I. Introduction

Information system projects start from business modelling and describing the business vocabulary, which allows reaching the shared understanding between software developers and business stakeholders. However, till now the business vocabulary remains beyond CASE tools that support business and information system modelling and design. The "Semantics of Business Vocabulary and Business Rules" (SBVR) [1], [2] has given a formal background for implementing such vocabularies, and there are several SBVR editors created for various purposes (e.g., [3], [4], [5]. However, a gap between initial business models and the vision of target information system still exist. SBVR business vocabularies yet have not become an integral part of widely used software development processes and CASE tools.

The most urgent tasks in the design of today information systems is modelling of business processes and business rules. Current modelling methods and tools usually are oriented to one of these aspects, and such are OMG standards – Business Process Model and Notation (BPMN) [6] and SBVR. After long discussions, the general opinion was reached that in order to model the comprehensive business behavior, a process representation should be obtained by combining business processes and business rules as these two modeling aspects should be considered as complementary approaches [7], [8].

Several attempts were made for integrating BPMN business process models and SBVR business rules. SBVR and BPMN specifications should be compatible as they are grounded on the same CMOF metamodel and were developed by the same OMG consortium. However, there are several ways how these specifications could be related.

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We suggest creating a UML profile for mapping corresponding elements of two metamodels instead of extending the SBVR metamodel as it was proposed in [9]. The similar proposal was made in [10], but it addressed only a limited number of BPMN elements. Our work is based on the SBVR metamodel, which was imported into the CASE tool MagicDraw and transformed into corresponding UML stereotypes, thus allowing to reach the completeness and compliance with the SBVR as well as with the BPMN, which profile was already implemented in MagicDraw in the same way. Besides this, our work is focused not only on the completeness of the specifications, but also to the methodology of modelling and the rational use of the tool.

The rest of the paper is structured as follows. The second section discusses related works. The 3rd section presents SBVR profile for desribing business vocabularies and its implementation in UML CASE tools. The 4th sections describes the usage of business vocabularies in compliance with BPMN process models. The 5th section presents conclusions and future works.

II. Related works

The problems of modelling business processes and business rules are addressed for many years by scientists, practitioners and communities as, e.g., Business Rule Group (http://www.brcommunity.com). Business processes define dynamic aspects of business domains; business rule modelling approaches focus on static aspects. The principle of separation of concerns suggests keeping these two kinds of models separately. However, both concerns should be integrated for managing business processes in practise.

Analysis of business process and business rules modelling languages, provided in [11], has shown that the best representation power of business processes with minimum overlapping is characterized by combinations BPMN with SRML and BPMN with SBVR. But SRML specification is not further developed, while SBVR is attracting more and more attention. The SBVR seems the best candidate for modelling business rules; moreover, the heart of SBVR is the business vocabulary, which may be adapted for specifying process concepts and relating them with business data models.

There were attempts to implement a tool for transforming the BPMN process model to SBVR structured English (SBVR SE) [10], and to integrate processes and rules [12]. Both cases are capable to process just a limited number of BPMN constructs. Modelling methods of Ross [13] and Visual SBVR [4]) have given the insights that there is a need to express business rules in a graphical notation. The main disadvantage of these methods is that graphical notations are very large and require a lot of

graphical elements in order to have suitable representations of business rules. Moreover, their graphical representations are not associated with any business modelling approaches and are not appropriate for integrating business processes and business rules.

Business process modelling languages represent procedural process models, which contain explicit information about process flow. Business rule languages mostly are devoted for declarative specifications. Goedertier and Vanthienen [14] have proposed the approach for declarative business process modelling on the base of SBVR, and have presented sixteen types of business rules for this purpose.

Agrawal [9] proposed the extension of SBVR metamodel with BPMN concepts – Semantics of Business Process Vocabulary and Process Rules (SBPVR) for declarative business process modelling. SBPVR categorizes business process concepts into process concept types, process fact types, and process rules. It presents five types of process rules (integrity rules, reaction rules, derivation rules, deontic rules and execution rules) that may be further extended as needed. SBPVR metamodel allows integrating business vocabulary, business rules and business process models. However, it requires modifying the SBVR standard that means narrowing the area of further practical application of the SBPVR.

Another disadvantage of SBPVR and other declarative approaches is that business process models are better understandable for business participants and computers when they are modelled in the explicit graphical way. Such proposals were made by Business Rule Group as well as [15], [16], [5], [17], etc. There is a distinction between process rules, defining the process flow, and constraint rules defining constraints on business data or activities, Constraining business rules are specified in specific places of graphical process models. However, aforementioned proposals were made for relating SBVR with UML state machines or activity models. Though BPMN models have their equivalents in UML activity models, BPMN is more acceptable for business participants and it is worth for considering as the suitable business process modelling language.

BPMN and SBVR models are based on two different metamodels. Skersys et al. [18],[19] have proposed to develop supplementary mapping data structure for linking the two metamodels instead of merging them or selecting one metamodel as a main one and extending it with elements from other metamodel. This was because any modifications of SBVR and BPMN metamodels could affect the future use of the proposed integration. One of their scenarios for using integrated BPMN and SBVR models is related with semi-automatic extraction (mining) of business terms and facts from the BPMN models. Such scenario is very probable in practise, but currently we argue on more reliable approach to use pre-created SBVR vocabulary of business concepts for defining BPMN processes and activities in order to reach precision of integrated BPMN and SBVR models.

Concluding on analysis of related works, we can made a presumption that current needs for integrating modelling of business processes with business rules may be at least partially resolved by integrating graphical BPMN models with SBVR based specifications of business rules. The integration should not modify SBVR and BPMN metamodels. For avoiding uncertainties of naming elements of BPMN models, SBVR vocabulary should be used during the overall business process and rules modelling life cycle.

III. SBVR profile

The SBVR profile is based on SBVR specification [2], where most of categories of SBVR meaning (noun concepts and verb concepts) are directly represented by elements of UML class diagrams (Figure 1).

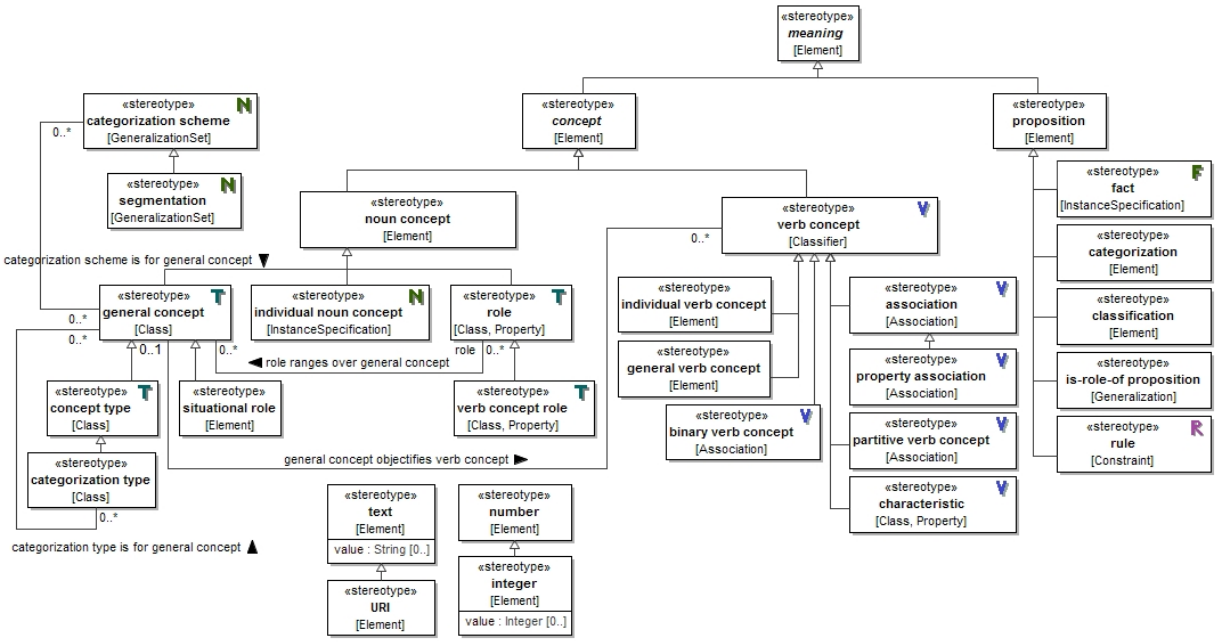

Figure 1. Part of UML profile for SBVR business vocabulary

According [2], only few stereotypes <<role>> and <<is role of>> are needed for visualizing a sense of UML symbols representing classes or properties, and generalizations. We have introduced some additional stereotypes for specifying associations, property associations, categorizations, characteristics and partitive verb concepts for the convenience of users (Figure 2 (1)). The SBVR business vocabulary contains synonyms and synonymous forms, which are used in the real life for representing business knowledge. For representing software artefacts, usually only preferred representations of SBVR vocabulary are used, with one exception – inverse relations, which are necessary for specifying business rules. We have added the stereotype <<synonymous form>> for representing synonymous forms of SBVR verb concept wordings having sense of inverse relations.

The most of stereotypes for categories of SBVR meaning are accompanied with categories of SBVR representations, which are visualised by icons, i.e., T symbolizes term, V – verb concept wording, N – name, F – fact (Figure 2, (1)). Roles and characteristics are represented as attributes, and verb concept roles are represented as roles of associations. Roles, characteristics and associations also may be represented as classes. In such a case, they are decorated with <<role>> or <<verb concept>> stereotypes. SBVR profile contains primitive concepts “text”, “number”, “integer”, specified in [2], and additional ones “boolean” and “datetime”.

SBVR profile was created by three steps: 1) classes of SBVR metamodel in CMOF format were converted into UML stereotypes; 2) UML metaclasses, the most suitable for each stereotype, were specified; 3) SBVR properties duplicating UML properties were removed, and types of the rest properties were adjusted to provide the most suitable editing. The implementation of the profile in UML CASE tool MagicDraw is based on its DSL engine, which was created in compliance with UML profiling [20], [21], [22].

IV. Creating BPMN process models using SBVR profile

As an example, we have taken a fragment of EU Rent BPMN process model specified on the base of EU Rent example [1], though the latter does not aim to represent any obvious business process model nor in procedural nor in declarative way. Various process models may be created on the base of EU Rent. We have used EU Rent business concepts and business rules for defining our EU Rent BPMN process “rent car”. Here we present just a fragment of the overall “rent car” process, which contains a variety of BPMN elements necessary to prove a concept.

Creation of the business concept vocabulary, presented in Figure 2, is the prerequisite for initiating the business process model. Such vocabulary can exist in an enterprise, can be created in advance, or developed in conjunction with the graphical business process models.

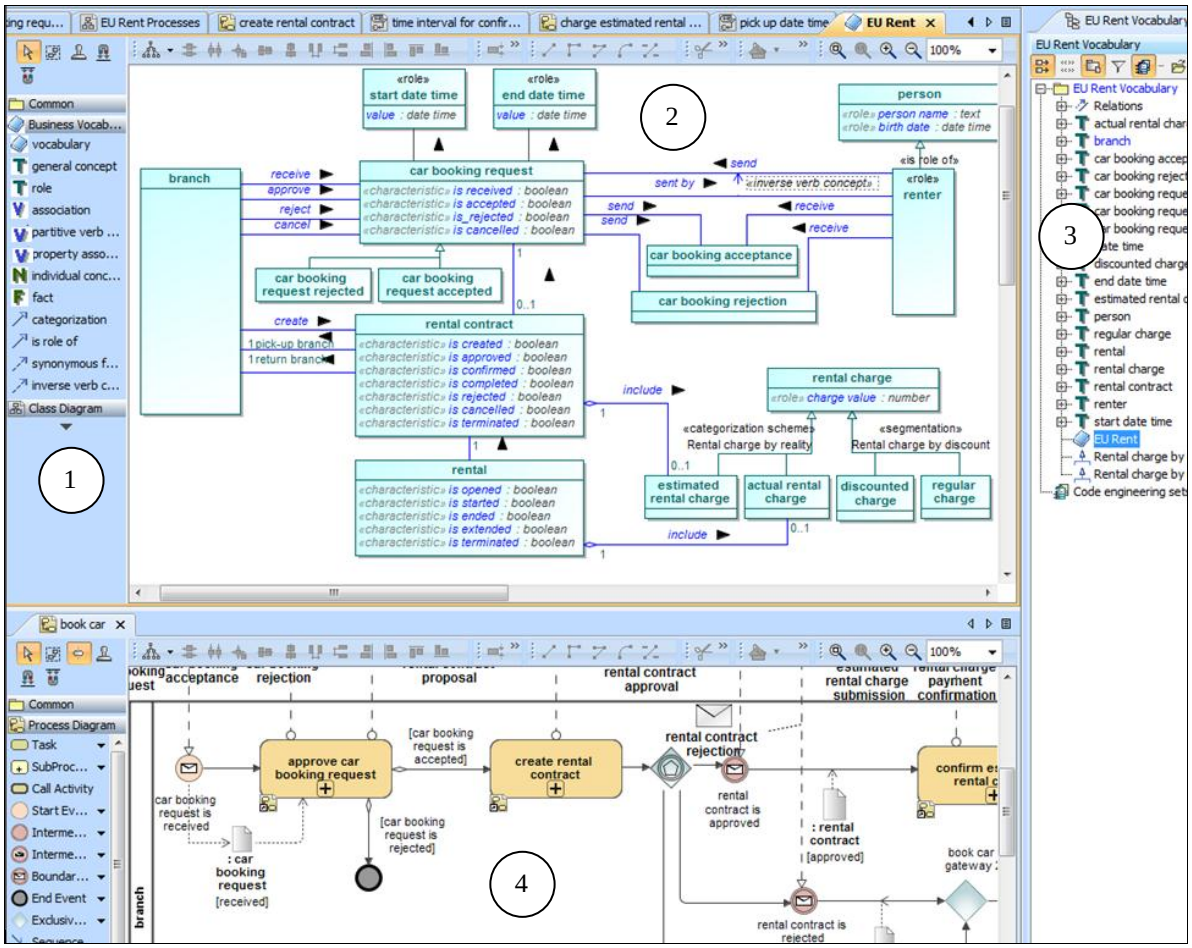

Figure 2. Modelling BPMN process using SBVR business vocabulary

The SBVR provides two kinds of vocabularies: vocabulary for business concepts and vocabulary for business rules. Business concepts are categorized as noun concepts (general concepts (e.g., branch, rental,) roles (e.g., start_data_time), verb concept roles (e.g., driver), individual concepts (e.g., Tom_Jones), concept types (e.g. role)) and verb concepts (e.g., branch *cancel* rental). Each concept is presented in SBVR representation style as a term, *verb*, or Name.

For creating business process elements, integrated with business vocabulary, the certain rules are applied for defining names of BPMN process elements. For example, the name of the activity "create rental contract" is a part of the verb concept branch *create* rental_contract. For creating such activity in compliance with the business vocabulary, the general concepts branch (corresponding to BPMN pool), rental_contract (corresponding to a BPMN data object) and the verb concept branch *create* rental_contract should be created in the business vocabulary (Figure 2, (2)).

SBVR business rules are based on verb concepts, represented by verb concept wordings; the verb concepts are based on noun concepts represented by terms and names. For representing business rules, keywords are used: each business rule starts from a keyword "It is obligatory that", "It is necessary that", etc.; other keywords that, and, or, etc., are needed for relating verb concepts in formulations of business rules.

As was mentioned in Section 2, there is the distinction between process rules and constraint rules, and this distinction must be understood in order to correctly describe them. E.g., business rules related with BPMN activity "approve car booking request" may be described like in Figure 3, where the first rule is the process rule, defining the process flow (what activities should be done after approving car booking request), and the 2nd and 3rd rules are constraints on activities "create rental contract" and "cancel car booking request".

```
It is obligatory that
  branch create rental_contract or
    branch cancel car_booking_request if
      branch approve car_booking_request
It is obligatory that
  branch create rental_contract if
    car_booking_request is_accepted
It is obligatory that
  branch cancel car_booking_request if
    car_booking_request is_rejected
```

Figure 3. Example of business rules for BPMN process fragment

Such business rules can be automatically included in SBVR vocabulary for business rules (Figure 4 (1)) by extracting them from BPMN models if two conditions are hold: 1) BPMN process models are created in compliance with the business vocabulary using strict naming rules; 2) parts of constraining rules are manually specified at various BPMN process model points: sequence flow conditions; business rule tasks; conditional events etc.

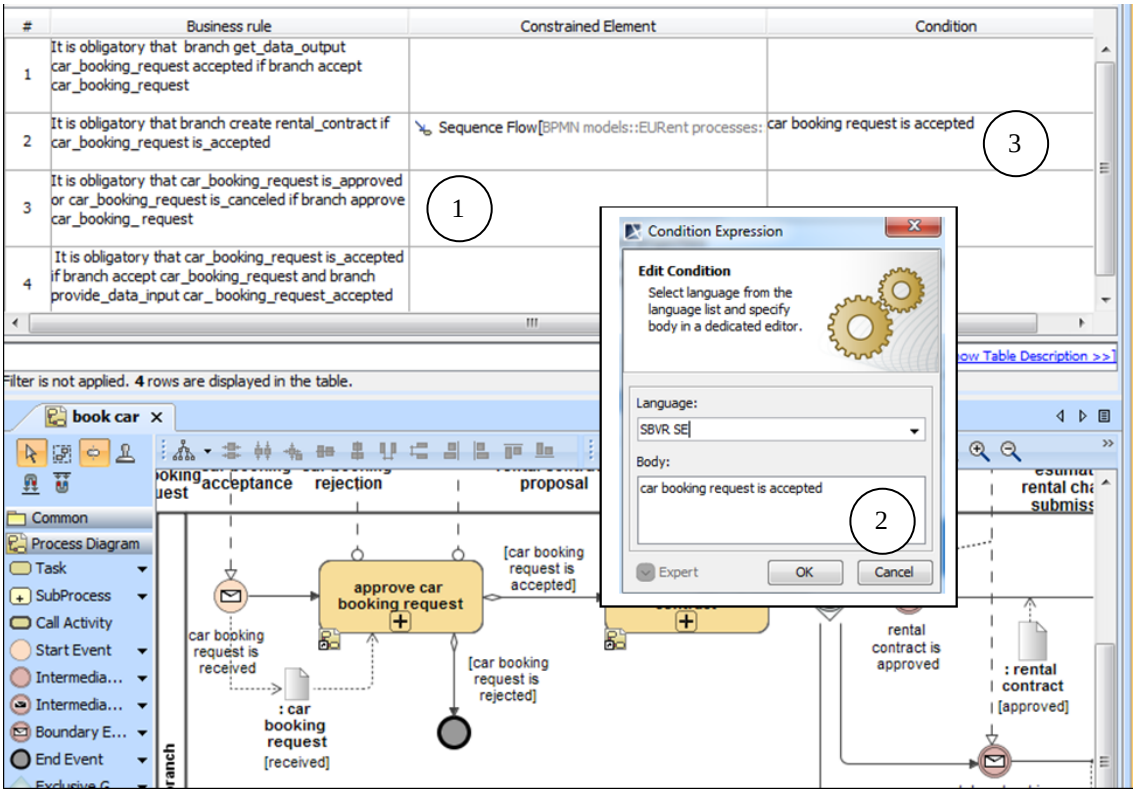

Figure 4. Vocabulary of business rules for BPMN process In CASE tool (fragment, where 1st and 4th rules are from the detailed subprocess model)

BPMN process rules are defined by visual BPMN process models and can be automatically included into BPMN business rules vocabulary. The needs of BPMN modellers are to specify business process constraints; such rules cannot be defined by visual models. They are expressible in SBVR Structured English (SBVR SE) [2]. For specifying business rules in SBVR SE, UML constraint expressions can be adapted. E.g., BPMN modellers would need to specify conditions as shown in Figure 4 (2), and the complete business rule will appear in the vocabulary of business rules, which currently is implemented in MagicDraw as the table (Figure 4 (3)). The current implementation of SBVR SE in MagicDraw is limited to textual expressions, understandable for stand-alone SBVR SE Editors, such as presented in [5]. For having business rule editing capabilities equal to OCL, UML CASE tools should be supported with an interface with the SBVR editor capable to parse and verify SBVR business rules.

V. Conclusions and Future Works

The paper presents the SBVR profile and its prototype implemented in UML CASE tool MagicDraw, along with the methodology for integrated modelling of BPMN business processes and business rules. Our work is based on the SBVR CMOF metamodel, which was converted to the SBVR profile thus allowing reaching the completeness and compliance with the BPMN, which profile was already implemented in MagicDraw in the same way. The methodology for integrated modelling of BPMN business processes and business rules in compliance with SBVR business vocabulary is based on separation of process rules and constraint rules, and strict requirements for naming BPMN elements. There is a lot of future work directed towards implementing SBVR profile–based SBVR–BPMN transformations, integration with the suitable SBVR SE editor, and elaboration of the technology for working with SBVR business vocabularies and BPMN business process models.

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