

EXPRESSING BUSINESS RULES IN BPMN

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Abstract: The Business Process Modelling Notation is a graph-oriented language for executable business processes. Business rules describe fundamental constraints on a system's transactions. Changes of business rules bring high impact on business processes. It is important for these rules to be represented explicitly, and to be automatically applicable. However, business rules are expressed in a markedly different way than business processes, it can be challenging to integrate them in a model. In this paper, we propose an approach for expressing business rules in BPMN. The key idea is that business rules are operationalized by BPMN subprocesses. This method can improve requirements traceability in process design, as well as minimize the efforts of system changes due to the changes of business rules.

1 INTRODUCTION

The Business Process Modelling Notation (BPMN) (BPMI.org & OMG, 2006) is a graph-oriented language for executable business processes, which has been proposed as the new process modelling industry standard. A key idea of BPMN is that process models are composed of activity nodes and control nodes. Activity nodes denote items of work composing a process, which are performed by humans or by software applications. Control nodes capture the flow of control between activities. In the BPMN, activity nodes and control nodes can be connected by means of a flow relation in almost arbitrary ways.

Business rules are statements which are used to run the activities of an organization. In a business system, business rules describe fundamental constraints and policies for the transactions conducted by the organization. It is important for these rules to be represented explicitly, and to be automatically applicable. However, there is no representation for state in BPMN. Thus, the depiction of business rules that rely on state and transformation laws is unclear (Recker et al., 2006).

In a business process model, business rules can be used to describe system requirements and are considered as the most volatile part of a business system. Their changes bring high impact on the business processes. Business rules are typically written informally in natural language, or

alternatively as structured natural language corresponding to a more formal underlying structure. Because business rules are expressed in a markedly different way than business processes, it can be challenging to integrate them in a model. In BPMN, the symbol representing event can be used to denote rule firings. However, it is not easily to verify whether the business processes satisfy the business rules.

In this paper, we propose an approach for expressing business rules in BPMN. The aim is to improve requirements traceability in process design, as well as to minimize the efforts of system changes due to the changes of business rules.

The remainder of this paper is organized as follows. Section 2 describes the related work. Section 3 discusses business rules and gives some examples. Section 4 describes the method for expressing business rules in BPMN. Section 5 concludes the paper with a summary of the contributions of this research.

2 RELATED WORK

Although business rules are an important topic and have been widely discussed in the information systems development, there has been relatively little research on them in the requirements engineering. Leite and Leonardi built the connections between business rules and the requirements baseline (Leite

and Leonardi, 1998), to analyze changes from the viewpoint of organizational policies. Rosca et al. proposed a modeling framework (Rosca et al., 2002) capturing the structure of the enterprise, in terms of which the business rules can be expressed, and decision-support capabilities for reasoning about and deriving business rules. Wan-Kadir and Loucopoulos consider business rules as an integral part of a software system and its evolution (Wan-Kadir and Loucopoulos, 2004). They developed the Business Rule Model to capture and specify business rules, and the Link Model to relate business rules to the metamodel level of software design elements. Alspaugh discussed an approach (Alspaugh, 2006) for evaluating business rules and scenarios together, by operationalizing the business rules as scenarios, mediating their interactions with other scenarios through co-matching events, and examining their combination through a consideration of the occurrences they match.

There has been much research on the use of business rules in business workflow systems. Rowe et al. (Rowe et al., 2005) describe two classes of business workflow systems: Process centric systems such as BPM and data centric systems. Process centric workflows use business rules to imperatively make decisions during the flow. The rules are all encapsulated in a rules task in the workflow and an embedded rules engine is used (when invoked) to process over the current state of the business objects to see if the conditions of any rules are met and subsequently execute any resulting action. Data centric workflows use business rules as filtering processes within workflows to make decisions about individual items of data.

3 BUSINESS RULES

Business rules describe policies, procedures and constraints regarding how an organization conducts its business. Below are some example business rules.

- BR1: “A bank requires a supervisor’s signature before cashing a check over \$5000.” (Rosca et al., 2002)
- BR2: “Each withdrawal from savings over five transactions/month will be charge a fee of \$1.00 each.” (Alspaugh, 2006)
- BR3: “A customer’s authorization must be confirmed before he or she can request a transaction.” (Alspaugh, 2006)

A business rule can be operationalized by a process that describes how the rule is followed. For example, the process operationalizing BR1 is “cash a check for more than \$5000”. This process can be

divided into three tasks: “present a check”, “sign a check” and “cash a check”, performed by customer, supervisor and teller, respectively.

The goal of BR2 is to discourage excessive transfers out of savings accounts. The process operationalizing BR2 includes the iteration for the activity “withdrawal from savings”. For the subsequent activities, two different situations should be taken into account: If withdrawals from savings have not exceeded five transactions/month, then “charge free”. If withdrawals have exceeded five transactions/month, then the activity “charge a fee of \$1.00 each” will be executed.

BR3 is a general rule. For different business systems, the operationalization of this rule is different. For example, in an ATM system, the subprocess “confirm the customer’s authorization” includes the activities “insert an ATM card” and “enter the PIN for the ATM card”. But for a teller window, the corresponding activities may be “show the account number” and “show the drivers license”.

In some business systems, operationalizing a business rule uses the result of operationalizing another business rule as precondition. Below are two business rules.

- BR4: “Whenever the stock is below the reorder point, only good customers will have their order immediately processed.” (Wan-Kadir and Loucopoulos, 2004)
- BR5: “Good customers of a product are defined as those who have bought at least twice the average sales per customer over the last 12 months.” (Wan-Kadir and Loucopoulos, 2004)

The result of operationalizing BR5 may be “He (She) belongs to good customers.” The operationalization of BR4 uses this result as the precondition for the activity “process the customer’s order”.

Because business rules can be operationalized by processes, it is possible to graphically express business rules in BPMN.

4 EXPRESSING BUSINESS RULES IN BPMN

The BPMN provides a graphical notation for business process modelling. It defines a BPD (Business Process Diagram) incorporating constructs to business process modelling. In this section, the operationalization of business rules described in section 3 will be expressed by using BPMN elements.

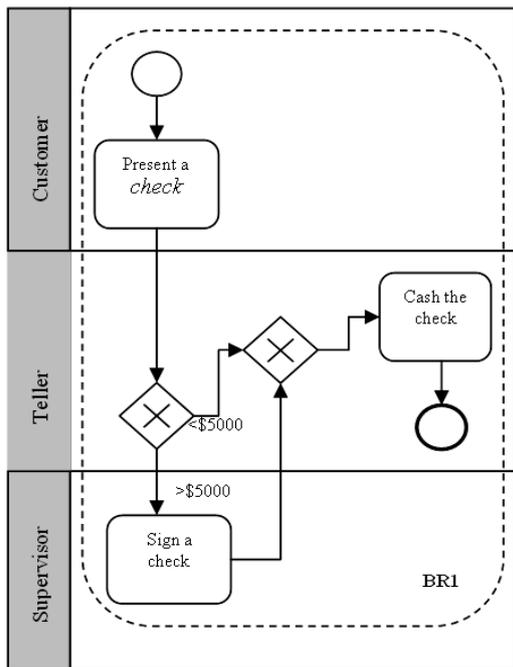


Figure 1: Operationalization of BR1.

4.1 Overview of BPMN Elements

A core subset of BPMN elements comprises event, activity, gateway, sequence flow and message flow (Dijkman et al., 2007).

An event may signal the start of a process (start event), the end of a process (end event), and may also occur during the process (intermediate event). A timer event indicates a specific time-date being reached.

An activity can be a task or a subprocess. A task is an atomic activity and stands for work to be performed within a process. A subprocess is a compound activity in that it is defined as a flow of other activities. There are embedded subprocesses and independent subprocesses. The difference is that an embedded subprocess is part of the process while an independent subprocess can be called by different processes.

A gateway is a routing construct used to control the divergence and convergence of sequence flow. There are: parallel fork gateways (AND-split) for creating concurrent sequence flows, parallel join gateways (AND-join) for synchronizing concurrent sequence flows, data/event-based XOR decision gateways for selecting one out of a set of mutually exclusive alternative sequence flows where the choice is based on either the process data (data-based, i.e. XOR-split) or external event (event-based, i.e. deferred choice), and XOR merge gateways (XOR

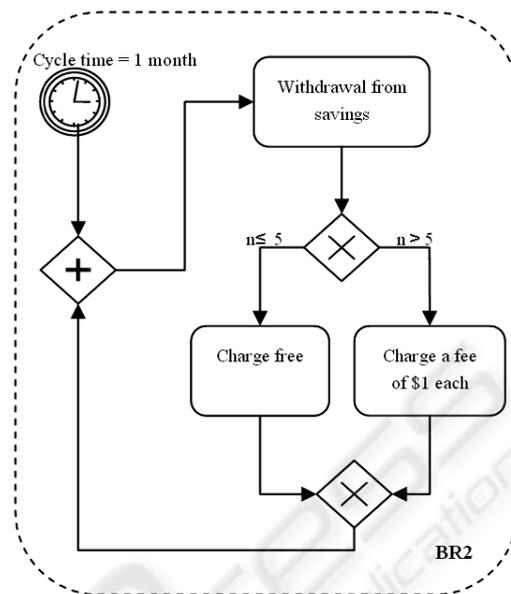


Figure 2: Operationalization of BR2.

-join) for joining a set of mutually exclusive alternative sequence flows into one sequence flow.

4.2 Expressing Business Rules using BPMN Elements

A business rule can be operationalized by a subprocess. A subprocess may be viewed as an independent BPMN process, which encapsulates required BPMN elements.

The examples of business rules described in section 3 are operationalized by BPMN subprocesses and in Figure 1 to Figure 4 illustrated.

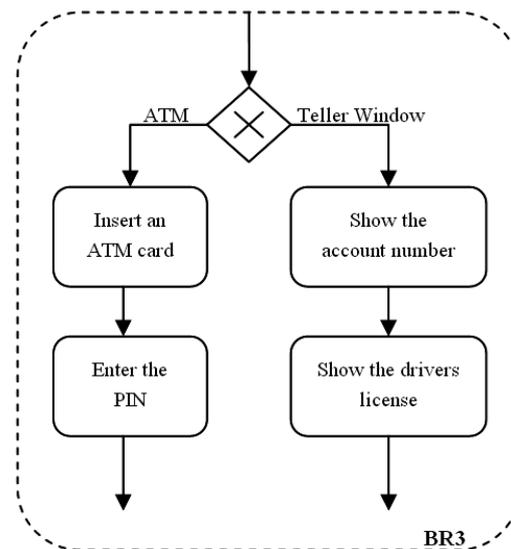


Figure 3: Operationalization of BR3.

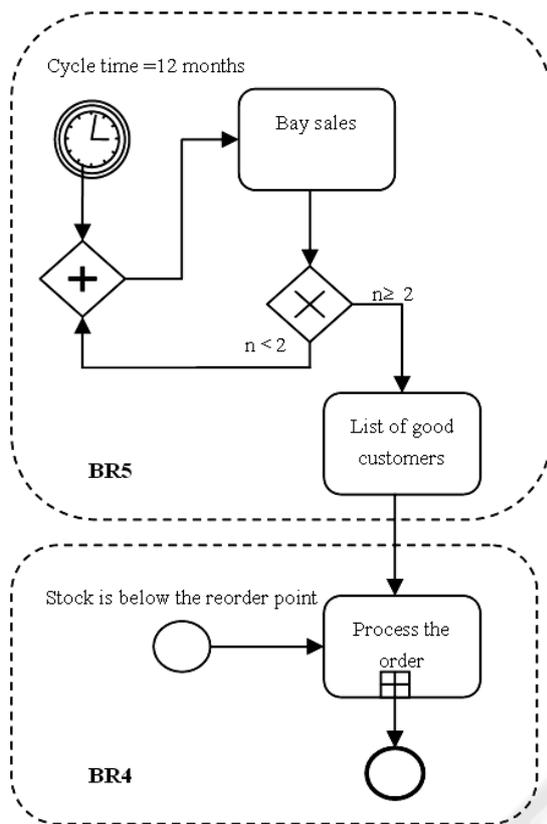


Figure 4: Operationalization of BR4 and BR5

Figure 1 shows the BPMN specification of the subprocess “cash a check for more than \$5000”, which satisfies the business rule BR1. In Figure 1, two grouping operators are used to cluster activities. One pool contains all activities enacted by a given process participant. Within a pool, BPMN lanes are used to distinguish different user types (customer, teller and supervisor) that interact with a specific peer.

Figure 2 depicts withdrawal process following BR2. This subprocess includes iteration.

The Business rule BR3 can be decomposed into two sub-rules for ATMs and for teller windows, respectively. Each subprocess follows a sub-rule and has a list of parameters, and each list is different. Therefore, the subprocess operationalizing BR3 (depicted in Figure 3) can be a parameterized process.

Figure 4 describes the relation between two business rules, BR5 precedes BR4.

A business system may include a set of business rules. Each rule is triggered by an event. A business rule can be a simple rule or a multiple rule. A multiple rule consists of a set of simple rules. A simple rule is triggered by a simple event, while a

multiple rule can be triggered by a compound event. According to the relations between simple rules within a multiple rule, multiple rules can be categorized as sequence rules (R1 precedes R2), parallel rules, merged rules, exclusive rules and embedded rules. A multiple rule can be operationalized by a complex BPMN subprocess.

4.3 Evaluation

Business rules describe system requirements. Expressing business rules by using BPMN subprocesses, we can easily verify whether the developed business process model satisfies system requirements. This method can improve requirements traceability in process design.

Because business rules are encapsulated in subprocesses, changes of business rules can be propagated in a regulated manner to the process model. A change of a business rule propagates only within the corresponding subprocess operationalizing the business rule, without affecting the global structure of the business process. On the other hand, business rules are more likely to be reusable.

This method doesn't change the basic shape of the defined graphical elements and markers of BPMN, and needn't define new constructs. Therefore, business rules can be translated into other languages such as BPEL.

5 CONCLUSIONS

In this paper, we proposed a method for expressing business rules in BPMN. Business rules written in nature language are operationalized by BPMN subprocesses. The description of business rules possesses a visual graphic notation. On the other hand, verifying whether the developed business process model satisfies business rules becomes easier. This method can improve requirements traceability in process design. By using encapsulating technique, the efforts of system changes due to the changes of business rules can be minimized. This method doesn't change the basic shape of the defined graphical elements and markers of BPMN, and needn't define new constructs. Therefore, business rules can be translated into other languages such as BPEL. Furthermore, in a business process model, business rules are more likely to be reusable.

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