Aspect Oriented Business Process Model For Exceptional Flows in Business Processes

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Abstract- The increasing transparency and accountability of all organisations , including public service and government, together with the modern complexity, penetration and importance of ITC (information and communications technology), for even very small organisations nowadays, has tended to heighten demand for process improvement everywhere. This means that Business Process Modelling is arguably more widely relevant than say Time and Motion Study or Total Quality Management (to name two earlier 'efficiency methodologies') were in times gone by. Put simply Business Process modelling aims to improve business performance by optimising the efficiency of connecting activities in the provision of a product or service. Business Process Modelling techniques are concerned with 'mapping' and 'workflow' to enable understanding, analysis and positive change. Diagrams - essentially 'flow diagrams' - are a central feature of the methodology.

Index Terms- Business process modelling (BPM), exception handling, ontology, semantic annotation.

I. INTRODUCTION

SEMANTIC business process management [1], aims to improve the level of automation in the specification, implementation, execution, and monitoring of business processes by extending business process management tools with the most significant results from the area of the Semantic Web. When the focus is on process modelling, i.e., the activity of specification of business processes at an abstract level (descriptive and non executable), annotating process descriptions with labels taken from a set of domain ontology's provides additional support to the business analysis.

A crucial step in process modelling [2] is the creation of valid and robust diagrams that not only comply with the basic requirements of the process semantics but also satisfy the properties that are related to the domain-specific semantics and are able to care about exceptional behaviours as well as verify their correct management. Exceptional behaviours [3] and verifying their correct management, in fact, is one of the key factors that contribute to the process robustness [4].

II. METHODOLOGY

The aspect-oriented programming (AOP) literature [5] has widely investigated this problem for general-purpose language by proposing a solution that is based on the separation of exception-handling concerns by means of their modularization into aspects [6]. An *aspect* is a module that encapsulates a secondary behaviour of a main view.

Taking advantage of the separation of concerns, designers can deal with aspects (which specify, for example, exceptional behaviours) separately and independently from the main view (e.g., the "happy" path). If needed, aspects can be added to the principal perspective in a weaving phase, thus generating the "woven" (integrated) process.

The weaving is performed by exploiting the information about the concern location that is specified in the aspect itself by using both the process and the domain-specific semantic information. The main purpose of this paper is to support designers in the modelling phase by proposing the "aspectization" of requirements, which crosscut a business process modelling notation (BPMN) [7] annotated process, with particular emphasis on exception handling.

III. EXAMPLE USED

Here the aspect-oriented programming (AOP) literature [6] has widely investigated this problem for general-purpose languages by proposing a solution that is based on the separation of exception-handling concerns by means of their modularization into aspects [7]. Taking advantage of the separation of concerns, designers can deal with aspects (which specify, for example, exceptional behaviours) separately and independently from the main view.

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The main purpose of this paper is to support designers in the modelling phase by proposing the "aspectization" of requirements, which crosscut a business process modelling notation (BPMN) annotated process, with particular emphasis on exception handling. 1) The server side, which is represented by the online Shop pool and describes the online buying process from the point of view of the shop, and 2) the client side, which is represented by the Customer pool and describes the process from the point of view of the buyers.

IV. SPECIFICATION OF PROCESS REQUIREMENTS

To ensure that relevant process requirements are satisfied, we make use of constraints. In our previous study, we have introduced two kinds of constraints: merging axioms and structural constraints. Merging axioms, whose formalization is denoted by MA (BPMNO, BDO), are not directly relevant to the purpose of this paper, and their description is, therefore, omitted. Structural constraints are the expressions used to state specific properties that relate to the structure of the process under construction.

In business processes, exception handling represents a typical example of crosscutting concern. The exception handler can be tangled in different scattered points of the process, thus increasing the process complexity, when explicitly managed. Hence, though processes meeting exception-handling requirements have higher robustness (see [4]); Aspects provide a possibility to take out the complexity that is added to the the exception handling. Aspects can then be woven only when needed, e.g., for the constraint verification of the whole process.

V. EXPERIMENTAL EVALUVATION

We performed some experiments in order to provide a first evaluation of the performance of semantic reasoning techniques That is used to support the management of exception handling over annotated BPD. In particular, the goal of the evaluation was to provide an estimate of the impact on the BPM activities of 1) checking the consistency of the BPKB; 2) transforming an annotated BPD into an OWL Abox; 3) checking constraints verification over the BPKB; and 4) weaving the aspects in the BPKB. This extends the preliminary evaluation that we presented In [16], in which only the time for computing the consistency (and classification) of the BPKB was considered.

The first experiment consisted of five phases, which are organized as follows. First, we checked the consistency of the Tbox of the BPKB (*consistency phase*). Second, we ran the population tool to transform an annotated BPD into an OWL Abox (*Population Phase*). Third, we validated the BPKB against the constraint considered, to check whether the given process satisfied the requirement or not (*validation phase I*).

Fourth, once the appropriated aspect handlers have been selected for the process concerns violating the requirements, we ran the aspectization tool to weave the aspect parts into the main process

In the BPKB (*aspectisation phase*). Finally, we validated again theBPKB against the constraint considered to check whether the process, which is integrated with the woven parts, satisfied the exception-handling requirement imposed on the process (*validation phase II*). The reasoning tasks required in each phase have been performed with the support of the Pellet reasoned (v2.0.2), which is integrated with the Pellet IC Validator (v0.4) for the constraint validation tasks.

VI. CONCLUSION

We have presented an ontology-based aspect oriented approach to manage exceptional flows and exception handling in business process models. Our approach includes both the specification of exception-handling mechanisms as separate aspects (that can be woven, if needed, into the main process) and the automated verification of specific constraints, thus describing the desired exception management.

For the aspect definition, we have proposed a visual language to support designers in separating exceptional behaviours from about the domain (e.g., policies for the management of exceptional flows), and the process structure and semantics, are formalized in DL and verified via DL reasoners. In our future research, we will investigate in more detail the generic and reusable classes of constraints for exception handling patterns and their formalization. We will also study how to simplify the tasks of requirement specification and checking by means of user-friendly notations and tools. Finally, we intend to validate our approach further on additional case

Our study represents an extension of the existing literature in which we provide an ontology-based approach that supports automated verification of semantic constraints about BPMN process entities And structure, their relations with domain-specific concepts, as well as the way exceptions are handled.

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