Machine-Assisted Design of Business Process Models Using Descriptor Space Analysis

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Abstract. In recent years, researchers have become increasingly interested in developing methods and tools for automating the design of business process models. This work suggests a method for machine-assisted design of new process models, based on business logic that is extracted from real-life process repositories using a linguistic analysis of the relationships between constructs of process descriptors. The analysis enables the construction of a descriptor space in which it is possible to define new process sequences. The suggested method can assist process analysts in designing new business processes while making use of knowledge that is encoded in the design of existing process repositories. To demonstrate the method we developed a software tool ("New Process Design Assistant" - NPDA) that automates the suggested design method. We tested our tool on the Oracle Applications ERP process repository, showing our approach to be effective in enabling the design of new activities within new business process models.

Keywords: New process model design, Business process repositories, Business process integration and management, Process choreographies.

1 Introduction

In recent years**,** researchers have become increasingly interested in developing methods and tools for automating the design of business process models**.** Process modeling is considered a manual, labor intensive task, whose outcome depends on personal domain expertise with errors or inconsistencies that lead to bad process performance and high process costs [12]. Hence, automating the reuse of constructs, gathered from predefined process models does not only save design time but also supports non-expert designers in creating new business process models. Research in this field encapsulates topics from the areas of software design and data mining [19,15,6,4], and is focused on structured reuse of existing building blocks and pre-defined patterns that provide context and sequences [5].

While most previous work focused on supporting the design of alternative process *steps* within *existing* process models, less work has been carried out on the design of *new* process models. We only identified a few works that address the design of new models [12,14,7]. This work aims at filling this gap by suggesting a generic method for designing new business process models related to any

functional domain. The suggested method guides business analysts that opt to design a new business model, by suggesting process steps (activities) that are relevant to the newly created process model. The business logic for such suggestions is extracted from process repositories through the analysis of existing business process model activities. Each activity is encoded automatically as a *descriptor*, using the "PDC" notation, suggested first in [11] and further elaborated in this work for supporting the field of new process model design. The collection of all descriptors formulates a descriptor space, and distances between every two space coordinates are calculated in terms of business process conduct proximity. We show through an empirical evaluation that by utilizing the descriptor space it is possible to effectively support the design of new process models.

As a motivating example consider an airport process model of check-in related processes. Now, suppose that the airport management desires to offer to its customers a new service: "check-in from home". In addition, it is also desired to outline the "check-out" process model as an extension of the current repository. Although these process models are new, the existing repository encapsulates know-how and business logic that are relevant and useful for their creation (*e.g.*, passenger check-in policies and procedures regarding security, luggage handling, passenger handling, and document validation). In the above scenario, it would have been helpful for the process designer to design the new processes using a supporting system that relies on the reuse of previous know-how instead of doing this manually from scratch. To illustrate our methodology in this work we use a real-world case study for airport process design. Based on a "check-in" process that already exists in the repository, we demonstrate how it is possible to design the two, above mentioned, new business processes.

This work proposes an innovative method for assisting designers in designing brand new business process models while making use of knowledge that is encoded in the design of existing, related process models. Our work presents the following innovations: (a) it provides generic support to the design of new business process models; (b) it equally utilizes objects and actions for business content analysis: we make use of all activity linguistic components (object, actions and their qualifiers) concurrently, without special focus on objects (as object centric methods do) or on actions (as activity-centric methods do); (c) it extends the PDC model [11] to enable the extraction of business logic from business process repositories.

The suggested method was implemented within a software tool, that was demonstrated using the aviation industry case study and the Oracle Applications ERP process repository.

The rest of the paper is organized as follows: we present related work in Section 2, positioning our work with respect to previous research. In Section 3 we present an extended model for representing process activities based on the process descriptor notion, presented first in [11], and extended in this work to support new process model design. In Section 4 we define and discuss the descriptor space and explain how to navigate in it. Then, we describe our method for designing new business process models in Section 5. Section 6 introduces the software tool and our empirical analysis. We conclude in Section 7.