Onto-VP2M:
A New Approach to Model and Manage Collaborative Process Versions using Contexts and Ontologies

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ABSTRACT

Collaborative process (CP) flexibility is an active research area in the field of business process management (BPM). It deals with both foreseen and unforeseen changes in the environment where CPs operate. In the literature, the version-based approach is largely used to cope with CP flexibility. However, BPM practitioners from various organizations can encounter some difficulties in a multi-version setting, of which when they must select the most appropriate CP version to be executed. Therefore, the aim of this article is to offer a solution to help them in this delicate task by proposing an ontology-based approach to model and query the context of versions of CP. More precisely, the authors recommend a new ontology, entitled BPM-Context-Onto, and a framework, entitled Onto-VP2M-Framework, providing support for (1) context version modeling in the BPM area, and (2) context-based querying exploiting reasoning mechanisms of the proposed ontology. The evaluation of the recommended framework shows that combining ontology with context reasoning is a promising idea in the BPM area. This novel framework has been examined within a real case study, namely the Subsea Pipeline CP.

KEYWORDS

INTRODUCTION

A Collaborative Process (CP) is defined as a set of independent intra-organizational processes, where several partners are involved in one global process, while each has its own intra-organizational process (Aalst, 2000). Therefore, the CP describes the way the processes of involved partners interact together using web-based technologies (Ritgen, 2010). Management of Collaborative Processes (CP) is now considered as a mature area for CP which do not evolve over time. However, flexibility of CP, which corresponds to the ability of CP to evolve over time, has not been deeply investigated and it is still an open issue in Business Process Management (BPM) (Dumas, La Rosa, Mendling, & Reijers, 2018). This issue is very important as the strong competition among organizations lead them to frequently change and adapt their CP to face new client’s requirements or to benefit from new collaboration opportunities.

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In the literature, the version-based approach is appropriate to deal with the flexibility of intra-organizational processes and of CP. In fact, many research contributions have recommended the version-based approach (e.g., (Ben Said, Chaâbane, Bouaziz, & Andonoff, 2016; Chaâbane, Bouzguenda, & Bouaziz, 2011; Dadam & Reichert, 2009; Elloze, Chaâbane, Bouaziz, & Andonoff, 2016; Ekanayake, La Rosa, ter Hofstede, & Fauvet, 2011; Kradolfer & Geppert, 1999; Zhao & Liu, 2013)) for several reasons. On the one hand, it is the basic reality in companies: new technologies, governmental rules, organizational contexts or the adoption of new standards lead them to define several versions of their processes. On the other hand, it helps address three main needs of process flexiblity (Reichert & Weber, 2012): (1) flexiblity by evolution, since the different significant changes on processes are modeled within process versions, (2) flexiblity by variability, since it is possible to model alternative versions, depending on the context of their execution, and (3) flexiblity by adapation, since it is possible to model versions for occasional situations or anticipated exceptions.

There is no doubt that the works cited above are very interesting and are a step forward with respect to versioning for process flexiblity. However, they do not address the question of reusing these versions of process. This question is of utmost importance in a multi-version environment, where numerous versions co-exist. More precisely, in such an environment, BPM practitioners (i.e., BPM end-users and designers) have to face the problem of selecting, among different versions of CP, the most appropriate one. This selection is required both at run-time, if BPM practitioners have to select the version of CP to be executed, and at design-time, if they have to select an old CP version to be used to make up a new CP version.

As each version is required in a specific context, it becomes crucial to consider the context to choose the appropriate CP versions. In the BPM area, the notion of context is defined as “…the minimum of elements containing all relevant information that impact the design and the execution of a process…” (Rosemann, Recker, & Flender, 2008). Actually, several taxonomies have been proposed in order to classify these elements of context (e.g., (Brocke, Zelt, & Schmiedel, 2016; Rosemann et al., 2008; Saidani, Rolland, & Nurcan 2015; Wang, Zhang, Gu & Pung, 2004)). We outline the largest one provided by (Rosemann et al., 2008) which distinguishes four types of context (1) immediate context, which covers elements on process components, namely context of activities, events, and resources, (2) internal context, which includes elements on the internal environment of an organization that impacts the process (3) external context, which encompass elements relating to external stakeholders of organizations, and finally (4) environmental context, which contains elements related to external factors.

We emphasize the requirement of context-awareness in process versioning (1) to structure versions of CP and (2) eventually create context-based queries to search and find adequate versions of CP. For this purpose, we recommend an ontology-based approach for context modeling and querying. Indeed, it is worth taking advantage of the ontology to ensure a semantic interoperability between the partners involved in collaboration.

As a consequence, paper’s contributions are threefold. The first introduces onto-VP2M, an ontology-based approach with a BPM context ontology as a solution for CP version modeling, context modeling and version querying. The second describes how to create context-based queries so as to find the adequate version(s) of the process using the ontology-based approach. The third consists of a framework called onto-VP2M-Framework, which provides support for (1) context version modeling in the BPM area, and (2) context querying based on reasoning mechanisms of the proposed ontology. This framework has been experimented within a real case study, namely the Subsea Pipeline CP example. This paper ends up by evaluating the effectiveness of using semantic technology (i.e., ontologies) in process versioning as compared to non-semantic technology.

Accordingly, the remainder of the paper is organized as follows. The next section reviews the related works about modeling and querying process context, and compares our approach to the proposed approaches by these works. In the “VP2M for Modeling Versions of Processes” section, we present the background of the paper, namely the VP2M meta-model for process versioning. The