Defining PPIs for Process Variants based on Change Patterns*

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Abstract. Business Process (BP) families are made up of BP variants that share commonalities but also show differences to accommodate the specific necessities of different application contexts (i.e., country regulations, industrial domain, etc.). Even though there are modelling techniques to represent these families (e.g., C-EPC, Provop), there is no work aimed at the performance measurement of the different BP variants that conform the family. Process Performance Indicators (PPI) are commonly used to study and analyse the performance of business processes. However, the application of such indicators in BP families increases the modelling and management complexity of the whole family. To deal with this complexity, this work introduces a modelling solution for managing PPI variability based on the concepts of change patterns for process families (CP4PF). The proposed solution includes a set of patterns aimed at 1) reducing the number of operations required to specify PPIs and 2) ensuring PPI family correctness.

1 Introduction

The increasing adoption of Process-Aware Information Systems (PAISs) during the last decade has resulted in large process model repositories which usually comprise collections of related process model variants (process variants (PVs) for short). While PVs pursue the same or similar business objectives (e.g., good delivery), they show differences depending on their application context (e.g., country regulations). This collection of PVs defines a Business Process (BP) family.

Managing PVs is a complex task that requires the use of specific approaches, such as C-EPC [1] or PROVOP [2]. Nevertheless, there is no work aimed at the performance measurement of the different PVs.

Process Performance Indicators (PPI) are commonly used to study and analyse the performance of business processes. However, the application of such indicators in BP families increases the modelling and management complexity of

* This work was partially supported by the European Commission (FEDER), the Spanish and the Andalusian R&D&I programmes (grants TIN2015-70560-R (BELI), P12–TIC-1867 (COPAS), P10-TIC-5906 (THEOS) and TIN2013-42981-P (SMART-ADAPT)), and the Spanish network TIN2014-53986-REDT (RCIS).

the whole family and may require the definition of new mechanisms that help during their definition and subsequent management.

To address this complexity, this paper proposes investigating the application of change patterns for process families (CP4PF) [3] to the definition of PPIs in PVs. The main reason to conduct the research based on Change Patterns (CPs) is that these may reduce the number of operations required to specify PPIs and ensure the correctness of PPIs along the whole BP family.

2 Change Patterns for PPIs in Process Variants

CP4PF allow the modeling and evolution of the process families, which are intended to reduce the effort needed for such purposes [3]. On that basis we seek to define a set of general CPs for managing PPI variants. The following steps are deemed necessary to the implementation of these CPs:

Define modelling restrictions: First, it is necessary to define a set of restrictions allowing the correct definition and configuration of PPIs. Restrictions may be constructed considering specification of languages for PPI definitions.

Design change patterns: Bearing in mind *CP4PF* structures described in [3] and PPI variability criteria introduced in previous work of some of the authors [4], we have identified a preliminary set of operations to be implemented for configuring PPI variants. Those operations are shown below:
Let $\mathcal{BBP}$ be a base business process (process model where context-specific structural adaptations are applied in order to derive a particular PV) where a set of PPIs are defined as a PPI variant.

- **INSERT**$_P$: A PPI is inserted when it is not defined in the $\mathcal{BBP}$, but it is required in the PV being derived.
- **INSERT**$_M$: A measure is inserted when the structure of a PPI needs to be changed in the PV being derived.
- **DELETE**$_P$: A PPI is deleted when it is defined in the $\mathcal{BBP}$, but it is not required in the PV being derived.
- **DELETE**$_M$: A measure is deleted when the structure of a PPI needs to be changed in the PV being derived.
- **MODIFY**$_P$: A PPI attribute is modified (e.g., scope) when in the BBP it is specified in a different way from the required in the PV being derived.
- **MODIFY**$_M$: A measure attribute is modified when the requirements of the measure in the $\mathcal{BBP}$ are different from those required in the PV being derived (Changes depends on the type of measure).
- **MOVE**$_P$: A PPI is moved when it is defined in the $\mathcal{BBP}$ over a set of BP elements, but those BP elements are different in the PV being derived.

Then, each operation is represented by means of CPs for PPIs variants and each CP should be constructed or adapted for fulfilling the set of restrictions defined in the first step. The configuration of PPI variants should be made by means of *Adjustment Points*, where we define the starting and ending points of each operation. Depending on the restrictions previously defined, it is possible to specify more than one CP for each operation (e.g., $INSERT_M$, is related to as many CPs as type of measures exist in restrictions).

Instantiate change patterns: In this step, it is necessary to choose a language for modelling BP families and a language for PPI definitions that will be used as a basis for applying CPs.

Validate change patterns: In order to validate the CPs proposed, a case study must be selected that should reflect variability in PPI definitions. For performing this step, we will follow different validation techniques, such as (i) experiments performed by real users for evaluating usability and complexity of CPs, and (ii) count and compare operations required in the modelling and configuration of PPIs using CPs and without them, in order to validate whether the amount of operations is reduced when CPs are used.

Implement CPs: Finally, a software tool that supports the modelling and management of PPIs in PVs would be of utmost usefulness for final users.

3 Example of Change Pattern

Let us suppose a Process Family (PF) associated with performing customer-facing order management and order fulfillment activities. The PF is comprised of two PVs: the intention of PV-1 is to have the product or service available when a customer order arrives, whilst PV-2 configures, manufactures, and/or assembles the product from standard raw materials, parts or ingredients, in response to a specific firm customer order.

Although the control-flow of both PVs are different, they also shows similarities, e.g. both PVs includes the same PPI to measure a specific activity in each variant. Just as there are BPMLs focused on the reuse of some common parts of PVs, we propose to reuse PPI definitions (or some parts of them).

Figure 1 shows a PPI defined for the PV-1, which measures the execution time of the activity *Load Vehicle and Generate Shipping Documents - LV&GSD*. The same PPI is defined for PV-2, this time to measure the activity *Load Product and Generate Shipping Docs - LP&GSD*. For reusing this PPI definition we need to first disconnect the PPI from PV-1 and then to reconnect it to PV-2. This change in PVs results in the application of 4 actions: 2 *delete actions* for deleting connections and 2 *add actions* to reconnect the measure with the PV.

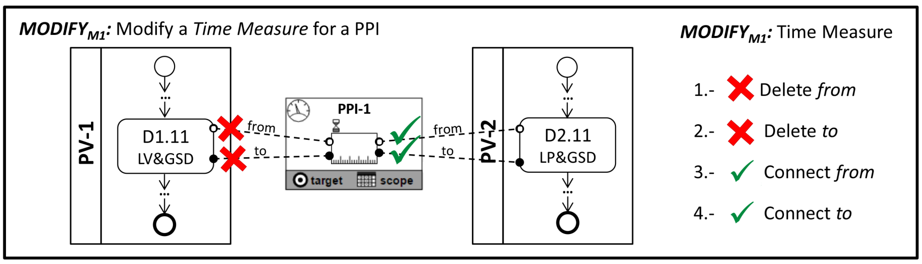

Fig. 1. Example of actions required for an operation $MODIFY_M$ (Time Measure).

In order to reduce the number of required operations and also to ensure the changes are performed correctly, we propose to use CPs for PPI definitions. For our example we should define a CP for the operation $MODIFY_M$. This operation can be related to as many CP as type of measures exist in the restrictions. This example is associated with a time measure.

The application of each CP is considered as a single action that requires a set of parameters to specify the internal actions to be carried out.

The example of PPI in Figure 1 has only one measure that needs to be reconnected, but when the PPI has more than one measure, CPs are more meaningful because the amount of actions for each operation is reduced significantly.

4 Ongoing and Future Work

The technique used for the management of PPI variants is being currently developed and applied in a case study based on processes and metrics of SCOR [5]. We use *PROVOP* for the modelling of BPs and their PVs involved. Moreover, *PPINOT* [6] and variability restrictions defined in [4] are used to model PPIs and to configure their variants.

In order to validate our technique, we also plan to apply it to the process of organ donation and transplantation, based on information provided by surgeons from various Spanish hospitals. The validation techniques will be similar to those used in [3], performing experiments with real users and counting and comparing operations required in each definition and configuration of PPIs, for concluding whether or not the number of operations is reduced.

Finally, we plan to implement a software tool that assists users to manage variability in the control-flow and performance perspective of BPs by using CPs.

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