Towards a Framework for Customizing the Views of Reusable Public Service Processes*

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Abstract. Processes are the primary constituents of public services and as such demand the completeness to achieve the goal of services. Ensuring the completeness of processes is a challenging task because, in recent days, they entail multiple views stemming from distinctive fields. It requires forming teams that combine deep technical and programming knowledge with business experts. These teams of experts are enormously expensive. Besides, increasingly, the public service organizations realize the need to deliver public services more quickly and personalized to the requirements of local communities or citizens. The service organizations may achieve rapid delivery of services either by hiring a team of experts or by using a solution that underpins the local (human) resources that are non-IT-experts to customize the reusable processes that encapsulate services. The former is not an ideal option for many public service organizations owing to the cost. In case of latter, unfortunately, there is no suitable solution available that can guide non-IT-experts to customize processes. Thus, it is the aim of this research to deliver a framework that allows non-IT-experts to customize the prefabricated and reusable end-to-end processes by parameterizing the services. This customization revolves around the reference guidelines that underpin accommodating multiple-views in a process in a consistent manner.

Keywords: Process, Public service, Reusability, Reference Guidelines, Customization.

1 Introduction

In service oriented systems, processes compose activities in a logical order to perform certain actions that generate predefined outcomes. Thus, processes capture only those activities that can assist producing the desired output. This implies, a process is always vertical to serve a very specific purpose or context (e.g., enterprise); it is not horizontal that facilitates utilizing a process across the contexts. According to the concept of reusability, this is a limitation of processes. The configurable process models [1], [13] and process abstraction technique are the examples of ideal approaches to overcome this limitation. Process abstraction technique facilitates defining the processes from independent viewpoint; these processes are known as generic processes or reusable processes. The reusable processes can be reused in different contexts but it requires customization to fit the model completely into specific context. To facilitate customization, configurable process model plays a significant role by introducing variation point which is in fact, a point of selecting required variants such as, activities that fit to a specific context. The configurable process model visualizes the variation points clearly in the reusable processes so that an user can customize the process by the least effort and knowledge. The variation points can be represented in the processes using the notation called configuration gateway. Therefore, configurable process model is a more suitable approach than process abstraction techniques since they not only support defining the reusable processes but also facilitate customizing the model through configurable gateways.

But, the customization of processes is not limited to selecting the variants because, processes today accommodate multiple views such as quality, legal, and security views that are also known as non-functional aspects. The non-functional aspects are highly important in a service oriented environment. They deal with

* The research leading to these results has received funding from the European Community’s Seventh Framework Programme FP7/2007-2013 under grant agreement 215483 (S-Cube). It was supported, in part, by Science Foundation Ireland grant 03/CE2/I303_1 to Lero – the Irish Software Engineering Research Centre (www.lero.ie).
specifying the quality of services and correlating the policies (stemming from the legislations) with services. In a service based application, a process cannot be regarded as a complete process unless the process definition covers both functional and non-functional aspects. Unfortunately, the existing customization approaches (including configurable process model) have overlooked the non-functional aspects. According to our investigation, no approach available which facilitates customizing any of the views of non-functional aspects. As an example, the configurable process model suggests how to customize the functional aspects such as, selecting activities but it does not suggest the customization of quality view which is a non-functional aspect of a process.

Process customization is not a trivial task because it needs extensive expertise on process and its related technologies. Additionally, customization of non-functional aspects requires expertise from diverse fields since it involves multiple views sourcing from different fields. Strictly speaking, it is not easy for a core expert to cover such a wide variety of knowledge. This leaves the only option to the public service organizations - hiring experts from different fields. Consequently, the service development cost remains high although organization can find reusable processes. This high cost is one of the salient barriers for a large number of public service organizations to exploit the full potentiality of Information Technology (IT).

The above considerations have influenced this research to come and play a role to support a large number of public service organizations to develop services using their local (human) resources that are not expert in IT. In this research, we propose a framework for customizing both functional and non-functional aspects of reusable processes of public services. The functional and non-functional aspects are rendered as views in the proposed framework. The key idea is to segment the functional and non-functional requirements of processes and also visualizing them in comprehensible manner particularly, in views so that the users can understand the requirements of processes. Additionally, the views ease the customization and most importantly ensure the completeness of the processes in terms of functional and non-functional requirements.

The goal of this research is to support the non IT-expert users for customizing the reusable processes by providing a set of comprehensive guidelines. In this frame of mind, we integrate a reference guideline with the proposed framework as a component. The guideline contains a set instructions that enable a non IT-expert to customize reusable processes without having intense knowledge on processes and related technologies. Consequently, the public service organizations can sidestep hiring experts, which reduce the service development cost significantly. The low cost may encourage a large number of public service organizations especially in developing nations to adopt information technology and increase the quality of public services.

We organize this article as follows: section 2 illustrates the motivation of this research. An example of reusable process is presented in this section and used in the subsequent sections to demonstrate the core capability of this research. Section 3 explains different views of the processes. We consider these views as the fundamental concept of this research. We describe our primary contribution - the customization framework in section 4. Section 5 explains a collection of related literatures and finally section 6 concludes the research work and briefly outlines the future extension of this research.

2 Motivating Example

In this section, we illustrate the motivation of this research. Figure 1 shows a reusable permission process which is independent of any specific usage and context.

![Figure 1. Example of reusable permission process](image)

The permission process contains common elements including two participants (or actors) *Citizen* and *Municipality*, activities, and flows that control the sequence of the execution of activities.
In the above process, there are two different pools that separate the activities that need to be performed by two different actors including citizen and municipality. In citizen pool (the upper one), citizen send completed application form attaching the required documents to the municipality for a permission. The municipality decides the approval or rejection based on the legislations and many other factors. The process is vividly specific to public service sector but not specific to any usage or context. The process abstracts the specificity and captures the activities from the global point of view. In particular, Prepare Required Documents, Fill Application, check validity of the documents and approve or reject application are the recurring activities can be found in any permission process.

Now, the reusable process in figure 1 can be reused across the municipalities since the core activities are common. A reusable process abstracts from a specific usage, i.e. it can be applied for many scenarios but needs to be customized before it is in practice [8]. For instance, if the municipality of Tilburg wants to reuse the permission process for ‘permission for building construction’, the process needs to be customized. The customization may include adding and renaming activities and specifying parameters for instance, policy parameters (e.g., Prerequisite) and quality parameters (e.g., Processing Time).

The customization discussed in the above does not seem to be highly complex because the presented example is simple but still it requires experts who possess adequate expertise on processes. The complexity may increase exponentially in case of complex process customization. Our contribution aims at providing a customization framework that guides the customization of the reusable processes without having intensive knowledge.

3 Description of Process Views

In this section we explain different views of the public service processes. The idea behind presenting the process views is to provide a clear image about the elements and different aspects of processes. This clarification enhances the awareness of a non IT-expert in particular, awareness about performing certain actions in a process such as, addition or deletion of activities and specifying performance or policy parameters. One very important advantage of these views is – it helps ensuring the completeness. Through views a process can be partitioned and visualized that turn the process incompleteness easily detectable. Our proposed customization framework contains parameters that are used to customize these process views. Figure 2 shows the views of public service processes.

![Figure 2. The views of reusable public service processes](image)

The views in the above figure provide a complete understanding of public services process requirements to the users. We discuss these views in the followings:

A. Legal View

The Legal View is one of the most significant views of the public service processes due to the fact that legal requirements are very important to the public service administrations. The legal view comprises of public service policy related requirements that associate with a process. The policy requirements are of critical importance to guide a process to reach its goal. In particular, policies of public service organizations lead the execution of a process. The legal view also incorporates security related requirements of a process. They are technical requirements to ensure the system is adequately secure for protecting the information of service clients such as citizens. In addition, public service processes from different units of public administrations very often share the information. Thus, processes are interconnected and exchange information typically using messages (e.g., SOAP messages) over the Internet. Therefore, it is crucial to ratify the security of payload (information) while it is being transferred from sender to receiver. Notably, the policies as well as the securities are indeed the non-functional requirements of a service.

The policies are composed of rules that apply in a process. A typical example of a rule is "an application for residence permission can be approved only by the responsible officer". This is known as segregation of duty rule. The proposed customization framework includes parameters that can be used to specify these rules in processes. Similarly, the framework includes a set of parameters to specify the security requirements of
processes. As an example, the framework provides authentication parameter that is used to authenticate the identity of a service requester.

**B. Quality View**

Service quality is another important aspect in service oriented environment especially from the service client perspective; quality is the primary requirement. Like legal requirements, quality is a non-functional requirement. The satisfaction of service client depends plainly on the level of quality of services provided by the service providers. Thus, service providers today largely concentrate on quality requirements of the services. In this frame of mind, we offer a separate view called Quality View for presenting the quality requirements of services. These requirements can be parameterized using the customization framework since it contains a large set of quality parameters. Essentially, the key quality aspect of a process is performance which primarily involves time based parameters such as Response time, Processing Time and so on.

**C. Activity View**

The Activity View is the functional aspect of public service processes. In this view, we adopt the concept of configurable process model, which allows users to choose an activity from several alternatives. The activity view visualizes the activities of a process. The customization framework allows an user to choose activities to personalize the process according to the requirements of user. Additionally, the proposed customization framework facilitates adding and refining activities. For instance, permission process is a reusable process for permission related services; now, if the Tilburg Municipality wants to personalize the permission service for building construction, they may require adding activities.

**D. Participant View**

The Participant View is neither functional nor non-functional aspect of processes. It describes the actors involved in a process. Reusable processes involve the actors but without specific identity of these actors. As an example, if a driving license permission process involves two actors named requester and provider, the identity of the provider is not yet specific to a service client. This implies the actors must be labeled to the specific ones. In this regard, we offer the participant view that visualizes the actors. The customization framework facilitate renaming the actors. For instance, the actor Municipality in motivating example (see figure 1) can be renamed to Tilburg Municipality.

The above segmentation of views assists the users to ensure that a process definition (after customization) covers the required activity, policies, security and qualities in particular the performances. This means, views underpin ensuring the completeness before actualizing (implementing) the processes.

**4 Customization Framework**

In this section, we explain the main contribution of this research - the customization framework.

![Figure 3. The reusable process customization framework](image)

Like the classical system architecture, the customization framework consists of frontend and backend environments. Figure 3 shows the framework.
The front-end environment contains solution interface for process customization. The solution interface provides design environment to the users. A public service provider uses the interface to query the reusable processes in the repository. The user may query the local repository which is his local drive and also remote repository. The framework contains a web based interface to connect the users with remote repositories that provide reusable public service processes as service. The users find required services and load on the local machine. After loading a process, the users perform the customization to personalize the process. The interface is adequately user friendly that eases the customization.

The backend environment consists of Process Repository and Reference Guideline. The repository is the physical storage that contains the reusable processes as well as customized processes. The most important component of this framework is the reference guideline that guides the customization. The reference guideline supports users by providing operators and parameters that are essential for process customization. We discuss the reference guideline elaborately in the following section.

4.1 Reference Guideline

The key ideas behind the public service process customization are personalization and localization. These ideas have been using extensively in web-based application development. We adopt both ideas in our customization framework. For our purpose, we define personalization as a principle of tailoring reusable public service processes to fit into a functional unit of public service administration to serve the specific usage. For example, personalization of reusable permission process (see Figure 1) for the passport unit of a municipality turn the process into passport permission process that serve as a passport processing service for the citizens. Localization on the other hand is a principle of tailoring services focusing on the requirements of specific locations. Service policies are enormously diverse. They vary across continents, countries, provinces, and even municipalities. Localization underpins tailoring processes with respect to the requirements of local organizations. As an example, localization of passport permission process requires customization such as policy, quality, and so on to suit the process for a particular municipality (e.g., Tilburg Municipality). To facilitate the personalization and localization, we offer a process customization reference model which provides a customization layout that users follow while tailoring reusable processes. Figure 4 shows the process customization reference model.

![Figure 4. The reference model for reusable process customization](image)

The process customization reference model comprises of three different layers: meta-reference model layer, reference model layer, and solution model layer. The customization starts at meta-reference model layer. The users import a reusable process from local or remote repositories at this layer and personalize the process by customizing the views according to the requirements of specific usage. The personalization of the process at meta-reference model layer changes the state of process by generating the reference model (which is a reusable process as well). Note that, the reference model is not a solution yet. The reference model layer facilitates localizing a reference model by performing another customization which produces the solution model. The solution model is the concrete solution that users can deploy on the process engine (e.g., BPEL engine).

To exemplify the process customization reference model, we consider the permission process (see in section 2). The permission process is a reusable process. An user imports this process at meta-reference layer and personalizes through tailoring the views of permission process. This personalization generates permission process for residence permit which is not yet a concrete solution but a reference model for public service organizations. The localization through another customization of permission process for residence permit at reference model layer produces the concrete solution which is residence permit for Tilburg Municipality. At
reference model layer, the customization of process is focused on the requirements that help localizing the process.

In order to facilitate the users to personalize and localize the processes we provide the reference guideline and integrate with the customization framework as a component. Now, what is the reference guideline? Generically, a guideline can be referred as a set of explicit instructions to perform a task. Our intention is to build such a guideline and integrate with the customization framework. Since this is the starting phase of our research, the reference guideline offers the basic advantages in particular, it offers a set of parameters and operators that are used in process customization. These parameters are derived from different fields taking the process views specially, activity view, legal view and quality view into account. This means the parameters are clustered according to the process views. Table 1 in the figure shows the list of parameters and operators.

Table 1. The customization parameters and operators

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Operators</th>
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<tbody>
<tr>
<td>Performance</td>
<td></td>
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<tr>
<td>Processing time</td>
<td>Authentication</td>
</tr>
<tr>
<td>Response time</td>
<td>Authorization</td>
</tr>
<tr>
<td>Waiting Time</td>
<td>Non-repudiation</td>
</tr>
<tr>
<td>Delay</td>
<td>Intelligibility</td>
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<tr>
<td>Throughput</td>
<td>Tamperproof</td>
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<tr>
<td>Latency</td>
<td>Integrity</td>
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<tr>
<td>Precision</td>
<td>Confidentiality</td>
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<td>Segregation of Duty</td>
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Noticeably, the reference guideline is the outcome of extensive literature studies and intensive analysis on public service requirements. It is influenced by the works from various researchers including [2], [15], and [16]. The main focus of these works was on constraint related research specifically performance constraints, security constraints, policy constraints, and operational constraints. [11] proposed an interesting work that influences the idea of depositing the parameters into a repository. The process of eliciting the parameters included in reference guidelines influenced by the analysis model proposed by [5] [10].

Now, how to perform the customization using the reference guideline? The answer is parameterization. Parameterization plays a pivotal role in customization: the parameterization allows setting parameters of target solution [8]. The users parameterize the process views using the parameters and operators listed in the table (Table 1). We briefly discuss them in the followings:

i. **Find**: A public service provider uses this operator to find the reusable public service processes in the repository.
ii. **Load**: This operator is used to load a process on the design interface of the customization framework to tailor the process for specific context.
iii. **Add**: A service provider may find missing activities in the reusable process, which need to be added in the target solution. An activity can be added in the process using this operator.
iv. **Prune**: A public service administrator may find unnecessary activities in the reusable process, which need to be eliminated from the target process. An activity can be removed from the process using prune operator.
v. **Refine**: This operator is used to refine the activities. Refinement of activity refers the decomposition of an activity into sub-activities. For instance, `prepare permission application` is an activity may be refined to `prepare document` and `fill application`.
vi. **Rename**: Reaming means re-labeling different parts of target process. For instance, an activity ‘Prepare Required Document’ of source process may be renamed as ‘Prepare Documents’ in the target process. In addition, the Tilburg municipality may want to rename the actor “Gemeente Tilburg” instead of “Municipality”.
vii. **Select**: This is a very important operator which is used to select activities as well as parameters from the lists. For instance, a user selects activity `process permission request` activity of permission process and then also selects the performance parameter `processing time`. 

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viii. **Value Tagging**: It is not an operator listed in the table, but we add tagging facility in our customization framework. The key idea of value tagging is to facilitate specifying the value of parameters. The framework provides the Boolean values entail True and False as well as the numerical value. Using value tagging, a user can specify the target value for performance parameters for instance, processing time = 5 days.

From the above discussion, it is clear that the customization framework is underpinning robust concept composed of multiple process views that deal with both functional and non-functional requirements of processes within the domain of public services. The framework includes a reference guideline containing a rich set of parameters that support customization of processes. The reference guideline is an added value to the public service organizations since it enhances the understandability on customization of processes. This lessens the dependency of public service organizations on expensive external experts (e.g., consultants) and in consequence reduces the service development cost.

Considering the completeness, the customization framework can be deemed as a potential solution that underpins ensuring the completeness. The users can easily identify the missing elements policy, security, and performance requirements of processes using the process views.

5 Related Works

There are three substantial key concepts in this article revolving around reusability, reference guideline, and public services. In literature review, we search for related works taking these concepts into account. The concept of reusable process is heavily documented throughout various bodies of literature, where authors argue its meaning within various contexts. [17] presented a research work that highlights fragmenting a complex business process into shards that are intended to be flexible and reusable for future business process modeling. This research work is enormously interesting especially the life-cycle model for business process modeling using reusable fragments. However, the scope of the work does not solve our problem entirely since we focus not only on facilitating reusability but also a robust guideline for process customization, which adds value on the top of reusable fragments.

[6] initially proposed reusable business processes as an approach for large-scale enterprises. Their work has been cited in an extensive number of research works, yet was criticized by [14] with counterarguments on SAP reference model. [8] proposed a framework with guidelines to transform a model with reference models in particular, the SAP reference model. Strictly speaking, these research results serve different direction and are only conceptually connected to our research. In this paper, we narrow down our scope to process reusability within public service sector, which has not been considered yet. The closest work related to reusable public service processes has been proposed by [12], in which the authors presented a modeling view of generic processes. However, their main contribution was to support the Public Administrations to achieve the resolution of organizational interoperability and systematically address the homogeneous Service Composition.

Considering the design guidelines, a number of frameworks exist today including [3] and [9]. They provide guidelines for designing interoperable systems and application. However, these frameworks deliver detailed information and guidelines about central government systems only; they fail to introduce specific information and overall business rules regarding local administration portals and services [4]. [7] proposed a model for service design, which is closely related to this research. The model incorporates elements of requirement balance, design reuse, and service quality. But it does not cover the holistic view of reusable service design the way our proposed customization framework covers. Considering the non-functional aspect, it covers only the quality view of services but does not entail the legal view which is highly significant for public service sector. Additionally, the reference guideline of customization framework provides a rich set of parameters and operators that are missing in the model.

6 Conclusion

The customization framework described in this article aims at delivering comprehensive guidelines for customizing reusable processes. In this frame of mind, a reference guideline is integrated in the framework. This guideline is a collection of operators and a rich set of parameters from multiple domains to guide a non IT-expert for customizing a reusable process which is independent of any specific context. The objective of this research is to underpin cost-efficient service development in public service domain. By using this framework public service providers will be able to reap this benefit since they do not require hiring many external experts. Additionally, with the help of comprehensive process views that are underlying the customization framework, public service organizations will be able to verify the completeness of their services.

Truly speaking, it is not easy to achieve cost-effectiveness and completeness that we have envisaged in this article. It requires a robust and more comprehensive reference guideline which is richer with adequate number of parameters and operators that support rigorous customization. The framework that has been introduced in this paper is core research in nature that requires extensions and refinement. In future work, we
plan for improvements and extensions of the reference guideline. We will enrich the reference guideline by feeding more parameters to support customization more effectively and efficiently.

A prototypical implementation is the subject of an ongoing work. We rely on the Eclipse Modelling Framework (EMF) to formally specify our solution framework model. By using EMF, we have automatically generated the Java code for graphically reading, customizing, and manipulating public service processes.

References


