Proposal of Automation of the Collaborative Modeling and Evaluation of Business Processes Using a Semantic Wiki

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Abstract

In the paper a new architecture for the design and evaluation of business process models is proposed. The architecture is based on the use of a semantic wiki system. It supports a distributed and collaborative modeling approach. In such a case, models can be created by a possibly distributed team of analysts. Moreover, they can be gradually improved using an integrated quality metrics system. We give the main architectural assumptions for this approach. Requirements for the system are described along with a prototype implementation. This system offers a practical tool support for the automation of the design and evaluation of models in a distributed environment.

1. Introduction and motivation

Business Process Management (BPM) encompasses all activities such as identification, analysis, design, execution and continuous improvement of Business Processes (BP) [23]. As process complexity is increasing, BP modeling has emerged as a critical task in the BP management. Moreover, the BP management itself is one of the key aspects in the industry including the automation industry.

Currently, visual modeling methods, such as Business Process Model and Notation (BPMN) [22] or Unified Modeling Language (UML) [20], are used in this field. UML is a general-purpose modeling language used mainly for designing object-oriented software [16]. BPMN, in turn, is a leading notation for modeling Business Processes in principle. BPMN captures processes describing activities of the organization, especially at an abstract design level, and provides a notation emphasizing the control flow.

Some tasks or subprocesses can be used to describe either particular kinds of work to complete or some subgoals of the process. Thanks to such a modularization of the BP model, subprocesses can partly help to deal with the problem of model complexity [17].

There are claims that BPM should emphasize a gradual, continuous improvement of business processes rather than a thorough reengineering [9]. BP models are commonly used to gather requirements from the early stages of a project and can be a valuable source of information [10]. There is also a pressure for cooperation between people engaged in the BPM process [4, 19] as well as for measuring the quality of the process for its evaluation. Thus, a distributed and collaborative modeling approach for modeling BP is needed.

The primary motivation for this research is to provide an architecture that supports a collaborative, gradual and evaluative design process. Such a process involves not only modeling activities, but also supports cooperation between developers, software architects and business analysts, as well as provides quality measurement tools for constant evaluation of processes.

The selection of the technology was a deliberate one. Number of tools supporting the modeling of BPs exist. However, these are mostly visual editors offering online model repositories. While these repositories can be used by teams of developers, the actual collaboration during the modeling activity remains mostly unsupported. Wikis are lightweight solutions that found their way into many software companies as well as small enterprises, especially in requirements engineering [1, 5]. Semantic wikis combine accessible distributed content authoring with knowledge modeling and processing [7]. Therefore, extending such a system towards BP modeling allows system architects and system developers to use a flexible tool that they are already familiar with. The extensibility of wiki systems allows for an easy development of the platform.

In the rest of this paper, we present a proposal of the system architecture with main functional requirements in Section 2 and a prototype implementation in Section 3. A design example in our system is presented in Section 4. Section 5 gives an overview of our future works.

2. Proposal of the architecture

The main assumptions behind the architecture of the new intelligent system supporting such a design process are as follows: 1) to support a distributed, collaborative design environment for BP, and 2) to allow for a gradual refinement of the BP models through evaluation methods. It was observed that a *semantic wiki* extended with evaluation procedures can provide such solutions.

Semantic wikis are intelligent systems that base on the well established wiki technology [3]. Regular wiki provide means for distributed and collaborative content management. Among many features of wikis, there are some with the highest relevance to automation in Software Engineering and BP modeling, such as:

- Collaboration – wiki systems support collaborative content creation and editing [14]. In fact this feature depends on the type of system (open or private) and on the set of user permissions.

- Ease of use – wiki requires no special software to create and manage content; a plain web browser is sufficient. Moreover, wiki uses a very simple syntax, with only a few markup elements, for wiki pages. The wiki syntax eases the creation of structured texts.

- Presentation consistency – since users are constrained in their choice of markup, no odd constructs emerge and all page elements are visually coherent. Moreover, wiki uses templates system, in which templates may be parameterized.

Semantic wikis introduce simple knowledge representation techniques that can turn wikis into knowledge management platforms [14]. More powerful wikis offer rule-based reasoning capabilities that allow to capture and describe proper knowledge evaluation procedures [12]. Based on the prior research on semantic wikis [12, 15], a semantic wiki for modeling of BPs is proposed.

The main functional requirements for the practical semantic wiki tool supporting this architecture are:

1. providing the textual notation for BPMN that is easy to be edited manually if needed,

2. translation from the XML serialization of the BPMN model to the textual notation,

3. rendering the visualization of the BPMN model in the wiki system in (soft) real time,

4. decomposition of the BP model to wiki pages corresponding to particular tasks, or

5. decomposition of the BP model to wiki namespaces corresponding to specific subprocesses,

6. providing an environment for model commenting and discussions between designers, and

7. enabling the integration of BP evaluation procedures in the wiki.

Moreover, the most important nonfunctional requirements include such requirements as:

1. providing the repository with the previous model versions with traceability of the source code,

2. supporting management on different scale processes,

3. providing access lists for various types of users,

4. customize a user interface to different platforms,

5. providing possibility of non-conflict cooperation between different kinds of users.

The main use cases for the system are presented in Figure 1. Based on these assumptions a prototype implementation has been provided so far.
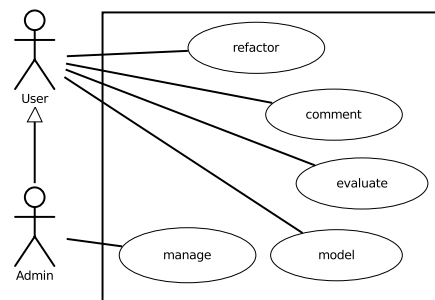

Figure 1. BPWiki usecases

3. Prototype implementation

A preliminary implementation of the proposed architecture is based on the DokuWiki engine[1]. It is a flexible and extensible system, mainly aimed at creating documentation. It can be successfully applied as a simple system for developer teams, workgroups and small companies. DokuWiki has a flexible plugin API which allows for extending its functionality[2]. A user can add some new syntax modes, custom action modes, new export formats etc. Such a plugin can consist of one or more components.

The proposed environment is based on the DokuWiki system enhanced with several plugins (Figure 2), such as:

- a plugin supporting an easily human-readable syntax for BPMN 2.0 subset (namely Business Process Diagrams) that could be used in the wiki both to store the data about BPs and to render the models,

- a plugin for measuring the quality issues of Business Process models,

- a plugin providing evaluation mechanisms for BPMN models,

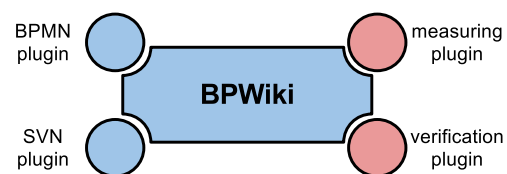- a plugin which allows for integrating DokuWiki content with the SVN repository for files.

Figure 2. BPWiki architecture

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[1]See: `http://dokuwiki.org`
[2]See: `http://www.dokuwiki.org/devel:plugins`

Thus, the *BPWiki* functionality is implemented as a set of DokuWiki plugins. The plugins provide both the *parser* and the *renderer* modes. The first one parses the DokuWiki webpage and interprets its syntax, then the renderer provides a visualization for the parsed data.

Such a solution has several important advantages. Diagrams stored in BPWiki can be easily compared using the SVN version control plugin. The proposed syntax allows for generating Process Diagrams including Sub-Processes stored separately. Since the focus was on the Business Process Diagrams, only some of the BPMN elements are covered[3]. The prototype implementation is available online at `http://urszula.ciaputa.com/sewiki`.

4. Design example

In Figure 3, an exemplary model (based on the example from the "BPMN 2.0 by examples" document [21]) can be observed. It depicts a process of order fulfillment process, which starts after receiving an order message and continues to check whether the ordered article is available or not. An available article is shipped to the customer followed by a financial settlement (a collapsed subprocess). If an article is not available, it has to be procured. The procurement subprocess has two events attached to a boundary. This allows for handling events that can spontaneously occur during the execution of a task or subprocess. In this case, the delivery can be belated or undeliverable, and a customer should be properly informed.

As an example, the textual representation of the shaded fragment of the model presented in Fig. 3 is as follows:

```
{
  events: {
    ...
  },
  activities: {
    ...
    at_shipArticle: "Ship article",
    as_finSettlement: {
      name: "Financial settlement",
      markers: [subprocess]
    },
    as_procurement: {
      name: "Procurement",
      activityType: call,
      markers: [subprocess],
      boundary: [
        ie_lateDelivery,
        ie_undeliverable
      ]
    }
  },
  gateways: {
    g_articleAvail: "Article available"
  },
  flow: {
    f1: ...
    f3: [
      g_articleAvail,
      at_shipArticle,
      "yes"
    ],
```

```
    ...
    f6: [
      g_articleAvail,
      as_procurement,
      "no"
    ],
    f7: [ as_procurement, at_shipArticle ],
  }
}
```

The model is decomposed into subpages and namespaces corresponding to subtasks and subprocesses respectively. Every wiki page provides space for the discussion and comments. What is more important is the possibility of integrating BP evaluation and rule-based scoring modules. Similar approach has been also recently considered (in a different domain however) [6]. This is a work in progress based on the previous work on mapping and analyzing BP with rules [11]. The integrated framework is based on the Loki (logic-based wiki) architecture [15] that allows for implementing strong reasoning procedures in a semantic wiki.

5. Future works

The paper present a work in progress research on the effective intelligent tool support for the automation of business process modeling and evaluation. A semantic wiki allowing for a collaborative design and improvement of BP models was proposed. The novelty of this approach comes from the use of an already omnipresent content authoring tool as a collaborative modeling platform.

Future work will include full application of rule-based engine [13] for implementing BP evaluation methods. Rules would be also used to implement business logic on the BP task level [8]. An outline of integration of the engine was already demonstrated in [2]. Moreover, the conceptual design of business processes would be coupled with a similar process for rules [18]. Such an approach would allow to integrate the design process for both business processes and rules.

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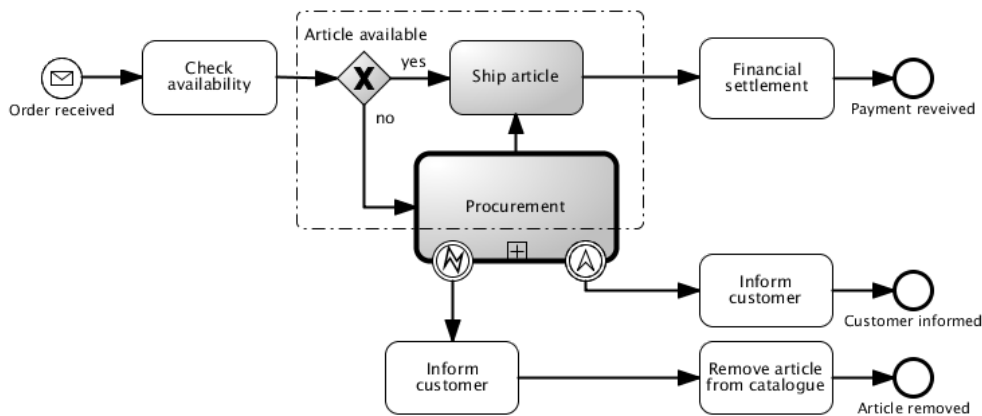
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[3] The list of the implemented BPMN elements is available at: `http://urszula.ciaputa.com/sewiki/_media/notation.pdf`

Figure 3. BPMN model for the *Order Fulfillment Process*

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