

SBVRwiki a Web-based Tool for Authoring of Business Rules^{*}

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Abstract. In the paper, a new tool called SBVRwiki is proposed. It is an online collaborative solution that allows for distributed and incremental SBVR rule authoring for business analytics and users. It uses the Dokuwiki back-end for storage and unlimited version control, as well as user authentication. It supports creation of vocabularies, terms and rules in a transparent, user friendly fashion. Furthermore, it provides visualization and evaluation mechanisms for created rules. It is integrated with the Loki knowledge engineering platform that allows for on-the-fly conversion of the SBVR rule base and vocabularies to Prolog.

1 Introduction

SBVR (Semantics of Business Vocabulary and Business Rules) [8] is a mature standard for capturing expressive business rules. It is also suitable to model their semantics, including vocabularies in a formalized way. Furthermore, it can be perceived as a useful tool in the communication of business analytics with business people. Finally, the set of vocabularies and rules described with the use of SBVR can be an important part of requirements specification from the classic software engineering methodologies.

However, an effective use of the SBVR notation is non trivial, as it requires certain knowledge engineering skills. Moreover, practical software tools are needed to support business analytics in the rule acquisition process. Such tools should allow for syntax checking, and automatic hinting, as well as preliminary evaluation of the resulting set of rules on the semantic level. Currently, there are only few specialized tools that offer proper SBVR authoring. In fact, this is one of the limiting factors in the wider adoption of the notation.

In order to improve this situation, in this paper, a new tool called *SBVR-wiki* is discussed. It is an online collaborative solution that allows for distributed and incremental rule authoring for all participating parties. SBVRwiki uses the Dokuwiki¹ back-end for storage and unlimited version control, as well as user authentication. It supports creation of vocabularies, terms and rules in a transparent, user friendly fashion. Furthermore, it provides visualization and evaluation

^{*} The paper is supported from the *Prosecco* project funded by NCBR.

¹ A lightweight and opesource wiki engine, see: www.dokuwiki.org.

mechanisms for created rules. Besides basic syntax highlighting and checking, the tool allows for logical analysis. It is integrated with the Loki knowledge engineering platform [5] that allows for on-the-fly conversion of the SBVR rule base and vocabularies to Prolog. Use of the Prolog-based representation opens up possibilities of formalized analysis of SBVR rules on the semantic level. In this paper, the design and implementation of SBVRwiki is discussed. The preliminary version of the tool was first demonstrated in [2].

The rest of the paper is structured in the following way. In Sect. 2 available tools for SBVR are discussed, along with the motivation for our work. Then, in Sect. 3 the concept of the wiki-based collaborative knowledge engineering is discussed. In Sect. 4 the specification of the proposed SBVRwiki system is introduced, along with the main design assumptions. The main aspects of the implementation of the tool are also presented. The tool is evaluated using practical examples in Sect. 5. The paper is summarized in the final Sect. 6.

2 Related Work and Motivation

Among the currently existing SBVR-supporting tools one can distinguish editors that support text-based creation of dictionaries and business rules providing syntax highlighting and suggestions; modelers that allow for generating models based on SBVR compliant documents; as well as tools that allow a user to import various models and transform them into SBVR syntax. Next three representative examples of such tools are presented.

RuleXpress² is a tool in which a user can define terms, facts and rules using natural language. It does not support SBVR natively but is compliant with and allows a user to import the SBVR definitions of concepts and rules. Moreover, it provides a mechanism of rule quality checking using simple lexical validation. Another advantage of the tool is the FactXpress module that allows for editing the SBVR facts. Although RuleXpress provides an additional web-based interface, it allows only for browsing the content of a knowledge base and does not support editing functionality.

SBeaVeR³ is a plugin for the Eclipse integrated development environment. The tool supports defining terms, facts and business rules in Structured English, provides also syntax highlighting feature as well as allows for syntax verification. As it is implemented as an Eclipse IDE plugin, it is addressed rather to software engineers than to an average enterprise employee. SBeaVeR does not provide any web-based interface for collaborative content editing.

SBVR Lab 2.0⁴ is a web application used to edit concepts and business rules using the SBVR syntax that provides syntax highlighting, simple verification and visualization features. The tool however has several disadvantages, it does not support exporting of the created terms and rules to other formats or a local file. Moreover, all the specified elements are stored in one place and it is not

² See: <http://www.rulearts.com/RuleXpress>.

³ See: <http://sbeaver.sourceforge.net>.

⁴ See: <http://www.sbvr.co>.

possible to separate term glossary from facts or rules, as well as the application does not support dividing a rule set into subsets or categories. Thus, in the case of large, real world examples, rules are not transparent and because of the online verification, the application slows down so much so that typing new rules or searching for a particular data becomes time consuming task.

Considering the limitations of the existing tools supporting SBVR, our primary motivation was to deliver a lightweight tool that would allow for easy creation of the SBVR knowledge bases even for unexperienced users. The tool should support the designer during the identification of the vocabulary and the rule creation process. It should offer syntax highlighting and hinting. Moreover, we opted for a web-based solution that would allow business users and analytics to collaborate using a familiar browser-based interface. To deliver such a solution, we decided to use our experience with Loki, a semantic wiki platform.

3 Collaborative Knowledge Engineering with Loki

The goal of Wiki systems is to provide a conceptually simple tool for massively collaborative online knowledge sharing and social communication. Such a system allows a user to build content in the form of the so-called wiki pages and upload media files. The structure of wikipages is simple and uses special wiki markup (e.g. for structuring content). What is important, is the fact that the pages are human readable plain text documents, making them more accessible than HTML or XML files. Another advantage of Wikis is the integrated version control mechanism, which allows for registering all subsequent versions of every page, as well as to see introduced differences. Thus, all wiki edits may be identified by user names and time stamps, and it is possible to recreate any previous state of the wiki at any given time. Moreover, for more complex application, wikis have access control mechanisms such as ACL (Access Control Lists).

The so-called semantic wikis enrich base wiki technology with the semantic information. They extend the content of wiki pages with semantic annotations, including relations and categories. A very popular implementation is the SemanticMediaWiki [3]. It also enables a user to query the semantic knowledge stored in the wiki with a specific query language providing dynamic wiki pages. More complex systems allow for building an ontology of the domain to which the content of the wiki is related. In this way, semantic wikis turn regular wikis into knowledge management platforms [5].

Loki [5,6] is an example of a semantic wiki that uses an expressive logic-based knowledge representation. It is based on Horn clauses for facts, relations and rules, as well as dynamic queries. It enhances both representation and inference features allowing for a complete rule framework in the wiki. PlWiki [4], the prototype implementation of the Loki approach, uses Prolog-based representation on the knowledge base level. It allows for analyzing the knowledge stored in wiki using procedures specified in the wiki.

In fact Loki was developed as a set of independent plugins for a regular wiki engine called Dokuwiki. It is a fast and flexible platform with low runtime re-

quirements on the server side. It provides back-end for storage and unlimited version control, browser independent web-based operation, as well as user authentication. What makes it favorable from the developer point of view is the modular architecture in which most of the functionality of the system is implemented and integrated by a set of plugins. It allows for extending the basic functionality very easily. Moreover, Dokuwiki is distributed as free software.

Apart from the knowledge represented in the form of facts, relations and rules, companies also use procedures that can be represented as business process models. BPwiki [7] (Business Process Wiki) is a wiki plugin that allows for collaborative modeling and evaluation of business processes in a semantic wiki. It provides an architecture that supports a collaborative, gradual and evaluative design process. BPWiki is an effective tool based on the Loki architecture [6] supporting business process design, involving not only modeling activities, but also supporting cooperation between developers, software architects and business analysts, as well as providing quality measurement tools for constant evaluation of processes in a distributed and collaborative wiki environment.

Such a system combines the advantages of the semantic wiki systems with simple business process design environment. In BPwiki, business process models can be decomposed into subpages and namespaces corresponding to subtasks and subprocesses respectively, and every wiki page provides space for the discussion and comments. The detailed description of the supported features and implementation can be found in [7].

Taking into account the above mentioned solutions, we decided to implement a new SBVR editor as a plugin to Loki. Such a plugin should be integrated with the base Loki system, as well as with the BPwiki plugin. In such a way complex specification of systems including both business processes and rules, along with concept vocabularies could be developed. The detailed specification and design decisions are described in the following section.

4 SBVRwiki Prototype

Based on the previously mentioned motivation as well as the availability of the Loki platform, the main requirements for the SBVRwiki system can be summarized as follows: 1) creation of a new SBVR project composed of vocabularies, facts, and rules using a set of predefined templates, 2) authoring of a project using structured vocabularies, with identified categories, 3) SBVR syntax verification and highlighting in text documents, as well as syntax hinting, 4) visualization of vocabularies and rules as UML class diagrams to boost the transparency of the knowledge base, 5) file export in the form of SBVR XMI, 6) knowledge interchange with the existing P1Wiki platform, 7) integration with the BPwiki plugin for building combined specification of business rules and processes. 8) full support for the SBVR syntax, including at least binary facts, 9) ease of use including templates for creating new sets of facts and rules, and 10) constant assistance during the editing of the SBVR statements, including elimination of common errors, the use of undefined concepts, duplicated entries, etc.

In order to provide this functionality, number of design decisions for the system were taken. First of all the new tool is developed as a web-based solution for online SBVR authoring using a browser-based interface for maximum usability and accessibility. Moreover, a wiki system was selected as storage for the SBVR documents in order to provide collaborative authoring and full version control. Furthermore, we decided to adopt the Loki semantic wiki platform in order to process the SBVR description on the logical level, as well as integrate it with the BPwiki plugin. Using these requirements and assumptions, a prototype implementation called SBVRwiki was developed [10].

SBVR is tightly integrated with Dokuwiki as a plugin implemented in PHP. In fact Dokuwiki offers several classes of plugins that allow for fine-grained processing of the wiki text. SBVRwiki implements two main plugin components for syntax and actions. The *SBVRwiki Action Plugin* is responsible for the file export in the XMI (XML) format. Moreover, it handles the user interface events, and extends the built-in Dokuwiki editor with number hooks that implement shortcuts for common SBVR constructs.

The *SBVRwiki Syntax Plugin* is used to enter SBVR expressions as wiki text. To make it possible, a special wiki markup `<sbvr>` is introduced. Using it a user can enter legal SBVR expressions. The plugin offers rich syntax highlighting, as presented in Fig. 4b. Moreover, vocabularies can be visualized with the dynamic translation to UML class diagrams. The diagrams are then rendered by the wiki using the PlantUML tool⁵, see Fig. 2.

In fact the process of creating a new SBVR projects is supported by a set of simple built in wizards that guide a user. The project starts with the definition of concepts, using them facts can be defined. Finally rules can be authored. Each of these categories is stored as a separate namespace in the wiki. The Lexer module in the plugin detects all the defined tokens which allows not only for proper syntax highlighting, but also for detecting the use of undefined concepts. Full interaction of the user with the plugin can be observed in Fig. 1

The use of wiki as the implementation platform has number of advantages. SBVR expressions can be stored in separate wiki pages, that can be simultaneously edited by a number of users. Moreover, these pages can contain additional information, such as comments, figures, media attachments, and hypertext links to other resources in the wiki and on the Web. The Loki engine can be programmed to select only the relevant parts of this knowledge on the fly.

5 Use Cases and Evaluation

For evaluation purposes, several benchmark cases of SBVR knowledge bases were modeled. This includes the classic EU Rent case provided as a part of SBVR specification [8] and published as a separate document [9]. EU-Rent is a (fictional) international car rental business with operating companies in several countries. In each country it offers broadly the same kinds of cars, ranging from

⁵ See <http://plantuml.sf.net>.

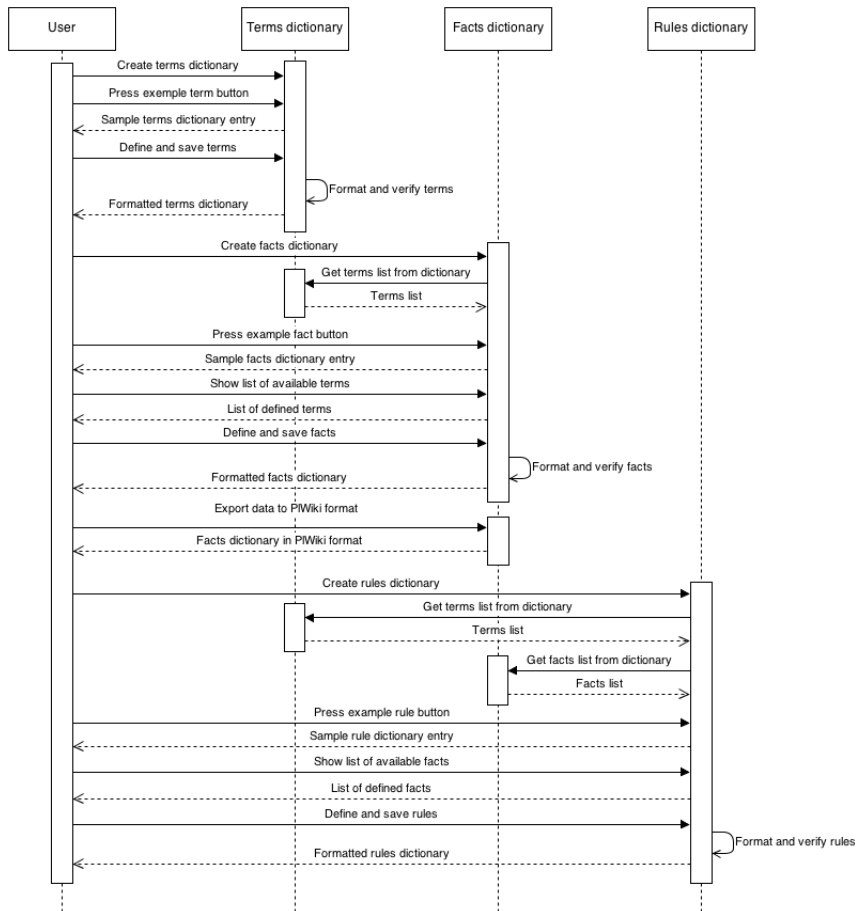


Fig. 1: User Interaction with SBVRwiki

”economy” to ”premium” although the mix of car models varies between countries. Rental prices also vary from country to country. It seeks repeat business, and positions itself to attract business customers. A rental customer may be an individual or an accredited member of a corporate customer. A car rental is a contract between EU-Rent and one person, the renter, who is responsible for payment for the rental and any other costs associated with the rental. Different models of cars are offered, organized into groups. All cars in a group are charged at the same rates within a country. A rental booking specifies: the car group required; the start and end dates/times of the rental; the EU-Rent branch from which the rental is to start. Visualization of parts of the vocabulary modeled by the wiki can be observed in Fig. 2.

Furthermore, SBVRwiki has been recently used in the Prosecco⁶ research project as a tool for authoring SBVR rules. One of the objectives of the project

⁶ See: <http://prosecco.agh.edu.pl>.

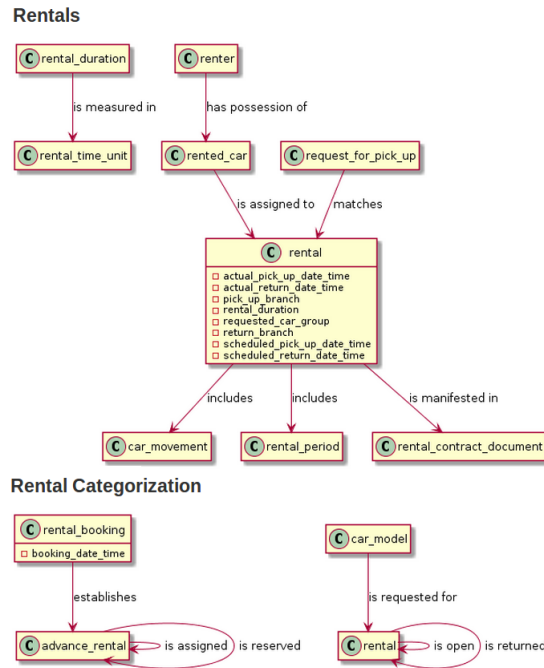


Fig. 2: EU Rent Fact Visualization

is the development of system supporting management of SMEs using designing methods that will significantly improve BPM systems. Rules have been selected as one of such methods and are used for precise and unequivocal specification of the decision processes. In the first phase of the project, the knowledge related to decision-like processes performed within the selected companies was acquired. During this phase, the first three steps of business rule systems development methodology were accomplished: *scoping*, *discovery* and *analysis*. Among those steps, the *discovery* and *analysis* steps played a crucial role. The knowledge discovery was made by a number of structured interviews with employees of the selected companies conducted by knowledge engineers and by deep analysis of the ISO documentation. Despite the fact that schema of interview was based on the proposal described in [1], the acquired knowledge required verification in order to avoid semantic mismatch. This verification was performed during the *analysis* step. For this purpose, the acquired knowledge was expressed with the help of SBVR representation and its modeling was supported by SBVRwiki. The main motivation behind SBVR was the fact that it is based on the modal logics and thus allows for clear representation in controlled natural language that can be easily readable by people without technical or mathematical skills. What is more, SBVRwiki is a web-based tool and therefore the created models may be shared across the internet and accessed by ordinary web browser without installation of any sophisticated software. This may significantly reduce the time

of knowledge verification as the analysts can work collaboratively whereas the knowledge engineers can fix the errors if they have only internet access.

The knowledge modeled in the project contains description of five companies and consists of 213 rules divided into 30 categories. All rules belonging to a certain category were defined in a single wiki page. In turn, all categories related to a single company was created in a single wiki namespace. Figure 3 depicts SBVRwiki in the editor (3a) and render (3b) modes where the facts are defined. The already defined facts may further be used for definition of rules. A built-in rule editor (see Figure 4a) allows for displaying a list of already existing facts and their quick usage in rule definitions by simple selecting them from the list. This significantly speeds the modeling process and prevents from using undefined elements. The complete and correct rules are rendered with the help of colored font as depicted in Figure 4b.

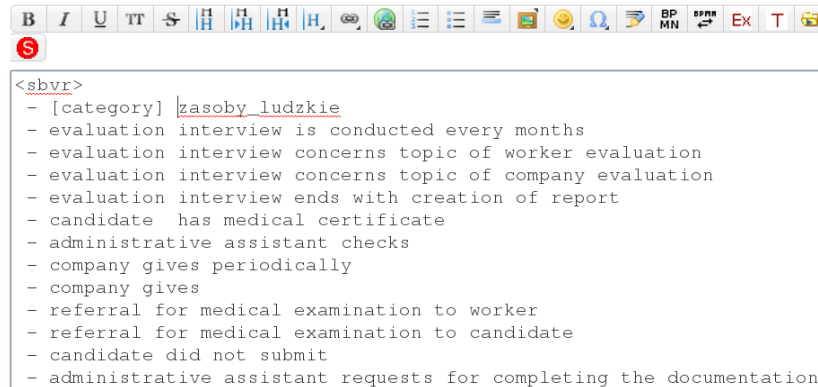
The here discussed prototype meets all the requirements identified at the beginning of Sect. 4. Moreover, wrt existing tools discussed in 2 it can be observed that it offers fully interactive SBVR editing (unlike RuleXpress or SBVR Lab) and lightweight and fast online environment (unlike SBeaVeR). However, the current version of our tool does not support all aspects of the SBVR standard. However, it implements enough of its elements to allow users to create complex models of business rules in Structured English. Limitations include the lack of support for multi-argument facts, polymorphism or additional attributes for the expressions, dictionaries, facts and rules.

6 Summary and Future Work

The original contribution of the paper concerns SBVRwiki, a web-based collaborative tool allowing for rule-based knowledge authoring in SBVR. We presented the design and implementation of the tool and evaluated it using a benchmark use case EU Rent. Moreover, we discussed a practical application of the tool in the Prosecco project. We also discussed related work, and demonstrated how our tool is superior to the existing alternatives. As the tool is a plugin for the Loki semantic wiki, it can be integrated with the BPwiki plugin [7] allowing for specification of systems including both business processes and rules. The use of the Prolog-based representation in Loki opens up possibilities of formalized analysis of SBVR rules on the semantic level. Our future work will also include full support of the SBVR standard and usability improvements.

References

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The screenshot shows a web editor toolbar at the top with various icons for text formatting (bold, italic, underline, strikethrough), alignment, and other functions. Below the toolbar is a text area containing the following SBVR facts:

```
<sbvr>
- [category] zasoby_ludzkie
- evaluation interview is conducted every months
- evaluation interview concerns topic of worker evaluation
- evaluation interview concerns topic of company evaluation
- evaluation interview ends with creation of report
- candidate has medical certificate
- administrative assistant checks
- company gives periodically
- company gives
- referral for medical examination to worker
- referral for medical examination to candidate
- candidate did not submit
- administrative assistant requests for completing the documentation
```

(a) Editor mode

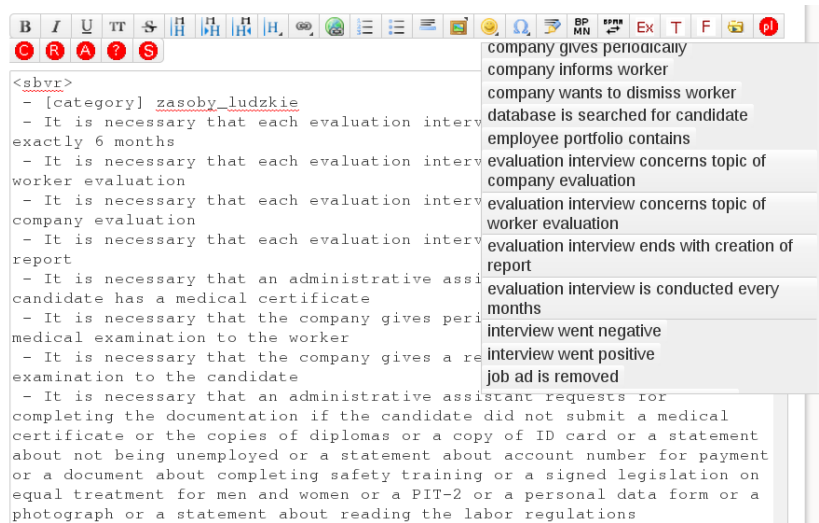
zasoby_ludzkie

1. [evaluation interview is conducted every months](#)
2. [evaluation interview concerns topic of worker evaluation](#)
3. [evaluation interview concerns topic of company evaluation](#)
4. [evaluation interview ends with creation of report](#)
5. [candidate has medical certificate](#)
6. [administrative assistant checks](#)
7. [company gives periodically](#)
8. [company gives](#)
9. [referral for medical examination to worker](#)
10. [referral for medical examination to candidate](#)
11. [candidate did not submit](#)
12. [administrative assistant requests for completing the documentation](#)

(b) Rendered output with syntax highlighting

Fig. 3: Definition of the facts in SBVRwiki

3. Krötzsch, M., Vrandečić, D., Völkel, M., Haller, H., Studer, R.: Semantic wikipedia. *Web Semantics* 5, 251–261 (2007)
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(a) Editor mode

zasoby_ludzkie

1. It is necessary that each evaluation interview is conducted every exactly 6 months
2. It is necessary that each evaluation interview concerns topic of the worker evaluation
3. It is necessary that each evaluation interview concerns topic of the company evaluation
4. It is necessary that each evaluation interview ends with creation of a report
5. It is necessary that an administrative assistant checks if the candidate has a medical certificate
6. It is necessary that the company gives periodically a referral for medical examination to the worker
7. It is necessary that the company gives a referral for medical examination to the candidate
8. It is necessary that an administrative assistant requests for completing the documentation if the candidate did not submit a medical certificate or the copies of diplomas or a copy of ID card or a statement about not being unemployed or a statement about account number for payment or a document about completing safety training or a signed legislation on equal treatment for men and women or a PIT-2 or a personal data form or a photograph or a statement about reading the labor regulations

(b) Rendered output

Fig. 4: Definition of the rules in SBVRwiki

- <http://www.springerlink.com/content/y91w134g03344376/>
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