iGraph: Intelligent Enterprise Information Logistics*

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Abstract. Engineers in the automotive domain are confronted with a huge load of information making it difficult for them to identify the information relevant for performing their tasks. Particularly challenging is the alignment of *process information*, such as offices files, checklists, and guidelines with business processes. In previous work, we introduced the concept of *process-oriented information logistics* (POIL) enabling the intelligent delivery of process information along business processes. In this paper, we present iGraph, an application implementing POIL. Specifically, iGraph demonstrates how engineers can be supported with relevant process information during the review of product requirements.

Key words: information logistics, semantic technology

1 Introduction

The amount of information engineers are confronted with, makes it a challenging task to identify and handle the exact information needed to perform their daily work. During a review, for example, engineers not only have to consider office files and best practices, but also guidelines and handbooks. This information may be accessed through shared drives, databases, or enterprise portals. However, engineers are not only interested in quickly accessing information, but additionally require comprehensive and aggregated information when conducting a review.

To tackle this challenge, *information logistics* (IL) concepts have been introduced by researchers and practitioners in recent decades [1]. IL aims at delivering the information to knowledge workers fitting their demands best. *Information awareness* (e.g., awareness of information quality and flows) and, to a smaller extent, *context awareness* (e.g., awareness of the user context for which personalized information shall be delivered) adopt key roles in IL. However, what has been neglected by contemporary IL approaches is *process-awareness*, i.e. the integrated support of business processes and their tasks.

* This paper was done in the niPRO research project. The research is funded by the German Federal Ministry of Education and Research under grant number 17102X10.

This weakness has guided our development of *process-oriented information logistics* (POIL) as a new paradigm for delivering the right process information, in the right format and quality, at the right place, at the right point in time, and to the right people [2]. Specifically, POIL enables a process-oriented and context-aware delivery of relevant process information to knowledge workers [3].

The core component of POIL is a *semantic information network* (SIN) [2], a labeled and weighted digraph comprising unified *information objects* (e.g., guidelines, best practices), *process objects* (e.g., tasks, lanes, events), and the *relationships* (e.g., "is similar to", "is used after") between them. In particular, a SIN allows identifying objects linked to each other in the one or other way, e.g., information objects addressing the same topic or needed when performing a particular process task. Overall, the SIN constitutes the basis for delivering relevant information objects to knowledge workers [2].

Section 2 introduces the application scenario. Section 3 presents iGraph. Section 4 discusses related work. Section 5 concludes with a summary.

2 Application Scenario

The iGraph scenario deals with the review of product requirements documented as functional specifications at a large automotive manufacturer. Goal is to both improve and approve such specifications. The underlying review process is knowledge-intensive as it comprises large amounts of process information, user interaction (e.g., "perform review meeting"), and decision-making (e.g., should the document be approved or not?). Three roles are involved: The *author* provides the specification to be reviewed. The *review moderator* organizes the review meetings. The *reviewer* finally analyzes the provided specification and documents errors, ambiguities, and uncertainties.

Specifically, we consider a scenario with one process schema (modeled with Signavio Process Editor), three process instances (created and managed with the Activiti Business Process Management (BPM) Platform), and about 300 documents (i.e., process information) such as reviews, templates, and guidelines.

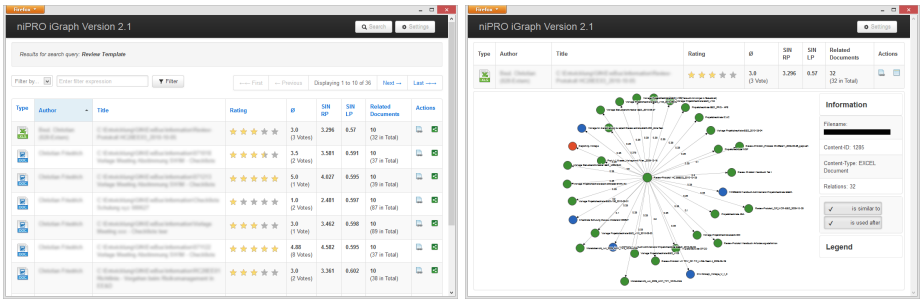
3 The iGraph Application

iGraph[1] is a web-based Java application based on the semantic middleware iQser GIN server 2.0, the web framework Play! 2.1.1, jQuery 1.8.3, D3 3.1.1, HTML5, and CSS3. The three main features of iGraph are as follows: (1) comprehensive *integration* of process information and business processes from heterogeneous data sources, (2) intelligent syntactic and semantic *analysis* of integrated information and process objects, and (3) process-oriented *delivery* of needed process information and business processes to knowledge workers.

iGraph implements the architectural layers of our POIL framework [2]: a *data layer*, a *semantic integration layer*, and an *application layer*. The *data layer* concerns the set of data sources to be integrated. For each data source, a so called

[1] A screencast of iGraph is available at http://nipro.hs-weingarten.de/screencast.

ContentProvider[2] is implemented. Its main task is to transform proprietary process information or business processes into generic information and process objects. The *semantic integration layer*, in turn, is responsible for the syntactic and semantic analysis of information and process objects. For this purpose, we use the semantic middleware iQser GIN server. Goal is to classify and group correlated objects (e.g., filled-out review templates). Finally, user behavior is investigated, for example, the frequency of using certain information in the context of specific process tasks. Details regarding the semantic integration layer can be found in [2]. Finally, the *application layer* concerns the delivery of process information.



(a) Table-based view of iGraph. (b) Graph-based view of iGraph.

Fig. 1. Screenshots of iGraph.

In the following we show how iGraph is used. Particularly, we consider a specific task of the review process: the author prepares a functional specification for the review and needs a review template for guidance.

Goal is to identify relevant information objects supporting the review preparation. For this purpose, iGraph provides a search box. The reviewer enters, for example, the term "template" into the search box and executes the query. Search results are listed in a table-based view (cf. Fig. 1a). Each row represents a search result (i.e., an information object), whereas each column contains detailed metadata of the found information objects, such as the author or title of an object. In order to identify related information objects (e.g., addressing the same topic), iGraph provides a graph-based view (cf. Fig. 1b) showing related information objects starting from a specific information object (e.g., a template).

In order to quickly identify relevant information objects, iGraph provides two fundamental key indicators: the first algorithm determines the link popularity (*SIN LP* for short) of information objects based on the SIN. The second algorithm determines the rate popularity (*SIN RP* for short) of information objects based on user ratings. In [4], we presented both algorithms in detail as well as as an empirical investigation proving that our algorithms can replace the costly and time-intensive human determination of relevant information objects.

[2] Our ContentProviders are available at http://sourceforge.net/directory/?q=nipro.

4 Related Work

Various approaches have been proposed in the field of IL. As examples consider data warehousing (DWH), business intelligence (BI) solutions, decision support systems (DSS), and enterprise content management (ECM). However, these approaches suffer from several weaknesses. For example, DWH rather focuses on the creation of an integrated database. Traditional BI, in turn, addresses data analytics and is usually isolated from business process execution. Conventional DSS support complex business decision-making at the management level. By contrast, ECM deals with the management of information across enterprises referring to related strategies, methods, and tools. Applications enabling IL are available, for example, in the fields of wearable computing [5], weather forecast [6], or the healthcare domain [7]. A more detailed overview can be found in our comprehensive literature survey [1].

5 Summary

This paper presents iGraph, an application applying semantic technology to enable the integration, analysis, and delivery of process information to knowledge workers. The simple visualization of iGraph, both in a table-based and graph-based view, as well as the two key indicators SIN LP and SIN RP make it easy to identify relevant process information during business process execution.

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