Alignment of Business Processes and User Interfaces in the Context of Large Organizations

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ABSTRACT

This paper presents a model-driven traceability-oriented solution to consider impacts on User Interfaces (UI) whenever changes are made on Business Process (BP) and vice-versa. Changes made on BP models or on system UIs require controlled update propagation on related models in order to coherently enable changes. Our solution includes the definition of mappings between BP models and some UI models aiming to guarantee that UIs and BPs are aligned. This solution has been analyzed in the context of a telecommunications organization and insurance contracts of a large bank/insurance organization.

Keywords

Business Process Modeling, Model-Driven Engineering, User-Centered Design

1. INTRODUCTION

The application of a model-driven approach on the definition of clear paths between business process models and user interfaces enables an efficient traceability analysis. Such an analysis has become an effective way to balance the continuous evolution of business and user experience when running the business throughout the organization.

The ability to change business processes is related with the need to identify the impact of these changes on the work of employees when using information systems. Once such a relationship between these two domains is established, it gives some freedom for employees to influence on the user interface definition and use this influence to identify process improvements.

Large organizations with several information systems, which are possible candidates to adopt traceability between business processes and user interfaces, already deal with complex change management issues. Commonly, business analysts are spread in the whole organization, identifying and collecting new requests and demands to adapt to new situations. Any traceability approach should embrace this reality in order to take into consideration several sources of requests for improvement and enable fast adaptation to change. This can be possible if aspects of the user interaction are addressed as well as those of the business context, which is not visible in only one model.

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Task models, for instance, usually describe what a user does when she/he carries out tasks and, in some cases, how a user performs tasks. However, they tend to neglect the complementary organizational aspects of usage situations, usually described in BP models. Meanwhile, BP models represent the business context and cannot be used in isolation as a representation for UI design. For its user-centeredness, task models are a good conduit between BP models and UIs. Indeed, major system usability problems arise from the lack of integration between BP and UI models in the existing strategies to align BP with IT.

The motivation of this work is to innovate on aligning IT with business through UI models by originally calling the term *UI-Business Alignment.*

Our investigation has shown that the current state of IT-business alignment is actually well adopted and accepted by different software methodologies and tools, but there is still a lack of representativity for user interaction. Therefore, in this paper, we present how to bridge the gap between Business Process Management and Human Computer Interaction (HCI).

The remainder of this paper is organized as follows: the second section of this paper presents related works. The third section presents definitions of the main concepts and the association of BP models with task models and UI models. The fourth section presents the application of this strategy in case studies. Finally, we finish with a conclusion and some ideas for future work.

2. RELATED WORKS

There has been a growing interest on UI for the business domain, for instance, the work in [16] designs low-fidelity prototypes based on business process models. Some works on model-driven UI development state that relying only on processes is problematic to represent user interaction [14], thus there is a tendency for a hybrid approach combining task and process models. This characteristic is in accordance with activity theory that values the interactions of individuals with artifacts (in this context, systems) in their everyday activities [6].

In [9], the author advocates that using formal specification languages to describe the system may increase traceability efficiency since it facilitates identifying which traces to follow for a particular element. This kind of formalization is well aligned with our proposal since we adopt UsiXML [18], a UI definition language that provides support to represent models in a structured form and supports the flexibility necessary to define model-driven UIs.

There are approaches that focus on mapping task and UI models to generate UIs, such as the work that specifies the relationships between task model and AUI, and between the AUI and its implementation [8]. Complementarily, there is work in user-

centered design that addresses traceability from requirements of a system to the conceptual architecture of that system [3], which is concerned with user interaction. While this is common in IT initiatives, it is not common to find researches on aligning requirements with enterprise systems, such as the integrated approach presented in [2]. Even though this and many other contributions support the alignment of business processes and IS; they still lack concerns on the UI.

3. MODEL-DRIVEN APPROACH FOR TRACEABILITY

The basis of this research is on the power of models to represent complex problems, their maturity supported by model-driven engineering principles, and the recent contributions in the HCI field to address the user interaction through models. The links between models promote traceability. When an activity in a BP changes, the links between the models determine the revision of the user interactions necessary to execute such activity. It could involve one or more screens, depending on the complexity of each case.

An extensive work is being done on traceability from business process until user interfaces of enterprise systems. This research has reached maturity with a case study in a large bank and insurance company [10]. It was further detailed on how to apply the traceability strategy throughout a model-driven user interface development lifecycle [11]. More attention was dedicated to transforming BP models into task models by specifying a set of transformation rules [12]. To complement, a tool called Usi4Biz (User Interface for Business) was idealized and is being developed to support identifying and analyzing the impact that changes on business processes have on the system UIs and vice-versa [13].

Aiming to support the alignment of UIs with business processes, the proposed solution is to define a framework composed of a methodology to associate business process with UI models and a tool for model traceability. The traceability framework presented here adopts a model-driven approach in which BPs, task models and UI models are mapped. The association of these models through a traceability chain is supported by UsiXML.

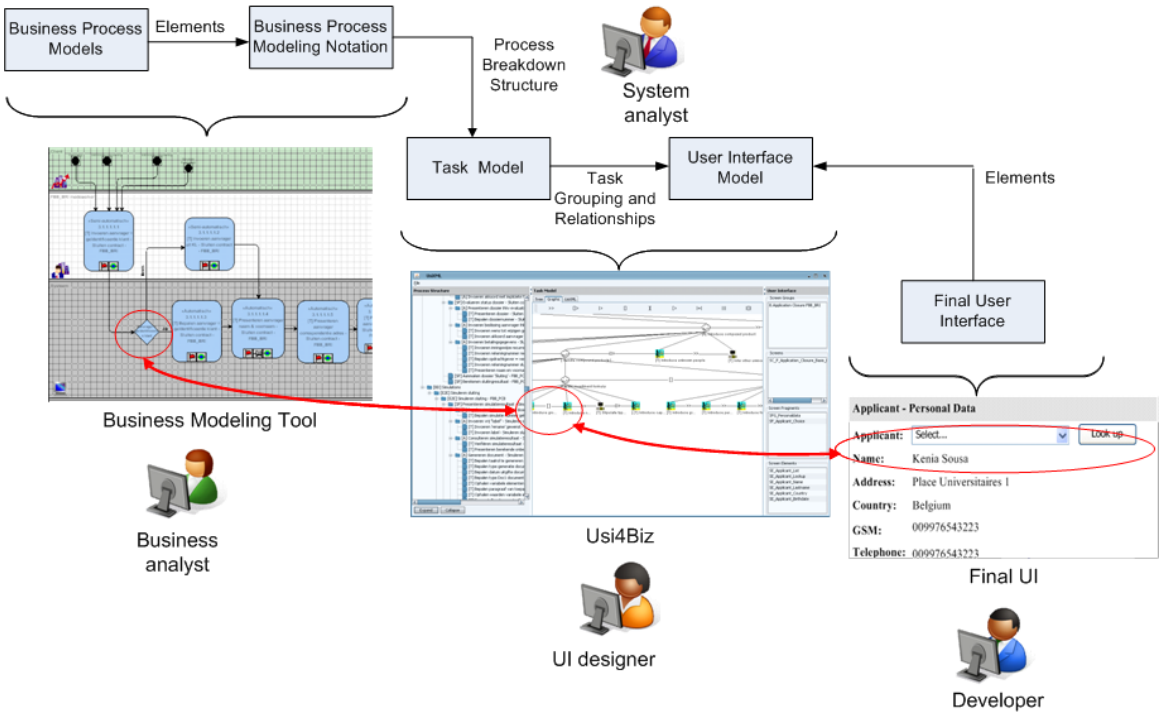

Figure 1. UI-Business Alignment Methodology

This proposal is aimed towards large organizations that are driven by business processes, and want the systems' UIs to be a channel for business improvement in a way that as the processes are created, maintained, and evolved, so are its UIs and vice-versa.

3.1 Methodology

The methodology (Figure 1) is composed of core actions that can be integrated with software development and HCI methods, as applied in the organization, whether traditional or agile. With minor changes on the way they work, highlighting that the core actions are mandatory to guarantee UI-Business alignment.

The core actions start with BP models that can be done in any notation and specified either in details or in high-level. There are a number of different definitions for business processes, our selected definition is that a business process is "a structured, measured set of activities designed to produce a specific output for a particular customer or market" [4]. The BP elements are transformed into BPMN unifying the business representation. The BP breakdown structure is associated with UI models through the hierarchical levels of task models. Each level of the BP is mapped with the different levels in the task models, and the task model is associated with the UI model that has UI components ranging from composable to atomic components, namely: *screen group*, a

group of closely related screens; *screen*, a state of the user interface when executing a task or part of a task; *screen fragment*, a container of related elements; and *screen element*, the most atomic component [13].

This methodology is organized in two types of change propagations:

- **Forward:** In this scenario, changes on BPs may impact task models and UIs. It helps identifying what impact the optimization of processes has on the user interaction. Such changes can be done from a variety of reasons: new of alternative ways of doing things, new business opportunities, organizational changes, new regulations; etc.
- **Backward:** In this scenario, changes on UIs may impact task models and BPs. It helps identifying how the improved usability of UIs suggested by systems users (e.g. customers, employees) impacts BPs. Reasons for such changes include defects to be fixed, better user understanding of the systems' features, new technology, etc.

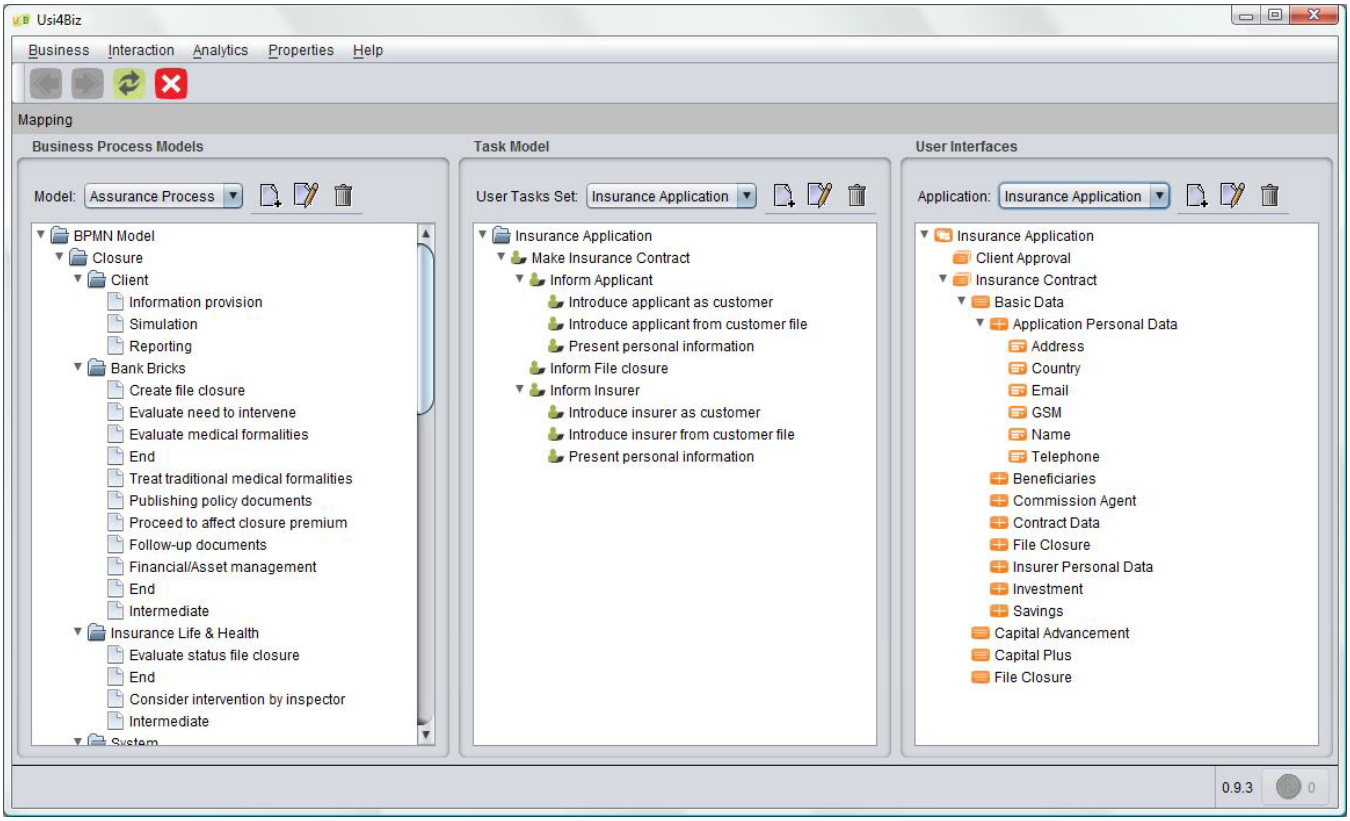

Figure 2. Tool Support for the UI-Business Alignment Methodology

To demonstrate how the alignment is achieved, we use the context of customers requesting insurance contracts, from a case study with a large bank-insurance organization [13]. In this context, when aiming to increase customer satisfaction and optimize the performance of enterprise operations (with a more efficient service through faster responses), business analysts decided to allow customers to follow the status of their requests.

To do that, following the forward approach, business analysts have created a new sub-process called 'Follow request status'. This sub-process is composed of tasks informing that customers can login into the *insurance contract online system* and then view the request status. For each of the newly created tasks and their associations in the sub-process, equivalent elements in the task model are created. Since the task model is mapped to UI components; for each element changed in a task model, it is possible to indicate which UI components should be updated accordingly. In this case, once the task model was created with these new tasks, it was indicated that a new screen 'Follow Request' had to be created in the insurance contract online system to allow customers to follow the status of their requests with the necessary screen elements.

To exemplify the context of the backward approach, we present a change scenario: after some weeks using the updated system, some requests arrived from users at the bank agencies. For the *insurance contract online system*, customers asked to be able to request a second review and send extra documentation (e.g. work contract, bank statement, salary statement) to prove specific financial data in order to improve the type of insurance they want to receive. To address this request, a new screen was created, named 'Request Second Opinion' and the task model was updated with the users tasks to interact with this new screen. Once the task model had been updated, the next step was to update the BPs accordingly. For each added task in the task model, it is possible to indicate the need to add the equivalent activities in the related BP.

The application of this methodology contributes with a stronger relationship between BP and UIs; predicting impact analysis when changes are made on business processes or on UIs; and supporting decision makers with analytical data, such as: who are the users impacted with this change.

3.2 Tool Support

To apply this methodology, a tool called Usi4Biz (User Interface for Business) [11] is being developed to manage models using XML, which enables communication with other tools, such as modeling business processes in commercial tools that provide XML schemas that can be exported.

Usi4Biz is aimed at identifying the impact of changes whenever business processes and UIs are updated. Figure 2 depicts Usi4Biz, in which we present the structure of the tool, not the contents of the models. On the left of the tool there is the BP extracted from the business process XML of a commercial tool, shown in a tree structure. On the middle, there is the task model generated from this business process. On the right, there are the UI components.

The tool can be used to create the network of links between these models. Once they are created, the mapping between these models allows analyzing the impact of changes beforehand. Using the tool, it is possible to select a BP element on the left of the tool and see the impacted elements on task and UI models. The same analysis is possible by selecting task elements and UI components.

This tool is being developed in JavaTM, using a) the Swing [17] library to implement the graphical UI thanks to its standard look and feel presentation in different platforms; b) StAX (Streaming API for XML) [15] to read and write XML content because of its high performance to manipulate a huge amount of XML data, such as external models and UsiXML models; c) the Apache Derby [1] embedded database to store local and temporary data, simplifying the installation and distribution process; d) the Netbeans Visual Library [7] to render visual diagrams, such as task models and navigation models; and e) Jersey [5], the REST web services library to synchronize local data with a centralized repository, accessible by other people in the organization.

4. CASE STUDIES

Applying this approach in two large organizations has demonstrated the consistency of this framework, presented through the lessons learned.

Using the banking industry as our first case study and considering the financial crisis in the global market, there have been several merger situations. Thus, major banks that have faced the need of process integration with other banks; are now, more than ever, struggling to identify inefficiencies in business process that may be significant cost drivers. They are also looking for ways to optimize the time between the process definition and maintenance and its effective implementation.

We conducted interviews with three business analysts, two system analysts and developers, and two UI designers. During the interviews, we asked questions related to their: organizational structure, BPM methodology, communication between business and IT departments, UI design methodology, which helped in the identification of the main issues, along with observation of BP and UI specifications. After understanding their context, we worked with examples of BP and system UIs from insurance contracts. The main detected issues were: lack of correlation between business process and UI design; difficulties in doing impact analysis after changes; and difficulties to find, to keep updated information spread in several artifacts.

The experience in a large bank/insurance organization enabled us to propose a solution for the alignment of business processes and systems UIs, a major issue in this company as well as in many others in the competitive business world.

The case study in the telecommunications industry concerned the application of the UI-Business alignment methodology in two business processes. We conducted interviews with business analysts, UI designers, UI testers, system architects and managers to understand how they work with BPM and UI design.

With an understanding of their organizational context, the main actions performed in this second case study included: application of the methodology on the selected processes and systems in both forward and backward approaches; the integration of this methodology with the company's software development process and process improvement methodology; validation and dissemination of the results of the methodology; and gathering data to perform a cost-benefit analysis of the methodology.

The return on investment from the framework has been analyzed through a sensibility analysis that considers optimistic, pessimistic and probable visions of the future. This analysis demonstrates what are the benefits gained by the organization once it applies the framework to detect improvements on process execution and on user interactions. When improvements are done in business processes and UIs that are performed and used very frequently, such as order management, the return on investment is achieved even faster because of the high influence on stakeholders' daily work.

What was evaluated in both case studies was the feasibility of applying the UI-Business alignment methodology in the context of large organizations. The goal was to assess what are the benefits the framework brings to such organizations. For that, we analyzed processes in the context of these selected organizations, their methodology, standards, profiles of those involved, tools, and addressed questions, such as: How changes in processes impact on the systems' UI. How the work of system users is affected by these mappings and changes, etc.

The main detected advantages of this framework are presented as follows. With *impact analysis*, it is able to produce a list of impacted UIs from business changes; which guides UI designers on what should be updated within complex systems. Therefore, it does not require them to remember all the UIs that, for instance, are used to input, update or show personal data of insurance applicants. Valuing *simplicity*, the methodology has simple actions that can be incorporated with organizational initiatives. To support *traceability*, the models are internally mapped and any attempt to make changes in at least one of them is alerted with warnings about the possible impacts. To provide *adaptable mapping*, it is flexible enough to enable stakeholders (e.g. business analysts, UI designers) to specify at which level of granularity they will map the elements, depending on the complexity of the processes and systems, on the information available and other aspects that directly influence the impact analysis. The *tool support* considers the proposed changes and performs the impact of changes. With a *human-centered* perspective, it advocates a cross-organizational engagement by allowing more stakeholders to be aware of the changes, ranging from software engineers to end-users; among others.

In an HCI perspective, Usi4Biz brings several benefits to UI design:
With a *human-centered* perspective, one of the core aspects of our solution is considering users as active agents, which opens a new channel for users of enterprise systems to suggest improvements on UIs or point out issues that interfere with the progress of their work. This enables business process improvement that can start with actual users (e.g. bank employees using the system at the

bank agency or customers using electronic system on the web at home) who aid to increase productivity within the organization.

Following a *user-centered* perspective, it puts the user point of view forward because it focuses on business process performers, who are also system users, instead of uniquely on the systems, by enabling stakeholders to visualize how the process is performed through UIs.

Focusing on *user interaction*, it acknowledges that BP models represent the business context and BPs are not detailed enough to describe individual behavior and even when it is, the sequence of activities may not represent the user behavior. Therefore the framework uses the task model as a bridge between BP and UIs. Without the task model, linking processes directly with UIs is not optimal because processes with high-level description do not express how activities are actually performed. Task models are recognized for its precision to express user interaction in details (e.g. cancel, save temporarily, undo), which contains essential information to define UIs.

Adhering to an *adaptable UI structure*, it adopts a simple structure of UI components. Therefore, it is applicable in contexts in which the UIs already exist in legacy systems and when UIs cannot be easily changed. In such scenarios, organizations already have their BPs and systems and cannot afford to re-develop their solutions with new technologies, but need to analyze impact of changes on their BPs and systems.

5. CONCLUSIONS

This paper presented a model-driven approach to link business processes and UI models. With this approach, models are mapped in order to more efficiently propagate changes when needed. In addition, the user perspective is considered in alignment with business needs.

As future work, we have identified the need to prepare a guide for the application of this methodology by any stakeholder involved in the software development process, process improvement and user experience. This result will be applied in the context of a project related to a process and system with high visibility in the organization in order to assess in more details the acceptance of stakeholders towards the solution.

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