A bi-directional mapping between i* and BPMN models in the context of business process management

Rebeca Alves, Carla Silva, Jaelson Castro

Centro de Informática, Universidade Federal de Pernambuco - UFPE, Recife, Brazil
{rsa2, ctlls, jbc}@cin.ufpe.br

Abstract. Business Process Management (BPM) involves identifying, modeling, understanding, rethinking and redesigning business processes so that they can achieve the organization's goals. Using a goal oriented approach to model business process, such as i*, can systematically guide the alignment of the business processes with the strategic goals of the organization. In fact, there are more popular techniques to model business process that are focused on capturing the process activities flow, such as BPMN (Business Process Modeling Notation). However, these techniques don't capture the strategic goals of the organization and, therefore, they don't make explicit the alignment (misalignment) between the processes and fulfillment of these goals. We argue in favor of using both models (i* and BPMN) in a complementary way. This paper proposes a model driven approach to obtain BPMN models from i* models and vice-versa. This bi-directional approach can be useful for practitioners of i* and for practitioners of BPMN in the context of BPM.

Keywords: Framework i*, Business Process Management, Goal Orientation.

1 Introduction

Business processes are those that characterize the organization's actions and represent what an organization does in order to achieve a specific purpose or goal. These processes are supported by other internal processes, resulting in a product or a service that is received by an external client. A suitable management of the business processes is important because an organization is as effective and efficient as their business processes. In this context, in business process management (BPM), modeling business process are essential because these models facilitate the understanding and communication about these processes in a organization, as well as, they serve as basis to perform analysis and improvements in the business processes.

BPM has been increasingly used by the industry. In fact, business process modeling techniques focused in capturing process activities flow, such as BPMN (*Business Process Modeling Notation*) [1], are based on concepts such as activities, events, artifacts, control flow, message flow, gateways, among others. However, these techniques lack in capturing the organization's strategic goals and, therefore, they don't make explicit the alignment (misalignment) between the processes and fulfillment of these goals. Moreover, business processes happen in social organization

environments. Organizations are composed of social actors that possess goals and interests that are pursued through a net of relationships with other actors. A richer business process model should include not only how, when and by whom the processes activities are performed, but also the goals of the actors in charge of performing these activities, as well as the dependencies between these actors in order to achieve their goals [2].

Modeling business processes by using a goal oriented approach, such as the i* framework, helps in aligning the business process improvement towards the satisfaction of the organization's strategic goals. i* models capture the organizational level with emphasis on the motivation and intentionality of the actors in the organizational environment. It brings the social analysis that overcomes the usual information and activities flow view and focuses on the goals that the organization wants to achieve [3]. This way, goal oriented models could complement the traditional business process modeling by using flowchart based approaches, such as UML's activity diagram [4] and BPMN. In this paper we argue in favor of using both approaches, goal oriented and flowchart oriented, to model business processes. In particular, we present a model driven approach to obtain BPMN models from i* models and vice-versa, in order to assure that the business processes will be aligned with the strategic organizational goals. This approach is an extension of the proposal presented in [5] in the sense that we refine the existing heuristics for mapping i* models to BPMN models and add new heuristics for this mapping. Moreover, we create heuristics for mapping BPMN models to i* models. The bi-directional mapping between i* and BPMN models aims to encourage the combined use of both modeling techniques in the context of BPM.

This paper is organized as follows. Section 2 describes the research goals and overviews the approaches used in this work. Section 3 presents the contribution of this work applied to a small example to illustrate the mapping from i* model to BPMN model and vice-versa. In section 4, we discuss the obtained results and section 5 presents current and future works.

2 Objectives of the Research

The use of BPM has grown over the years, mainly in the industry. Since business processes should satisfy organizational goals [6], a goal oriented model of business processes can be transformed into a flowchart model of business processes to ensure the fulfillment of the organization's goals [7].

Although the goal oriented approach is not as used as flowchart based approach to model business processes, the integration of both approaches could facilitate the understanding of organizational goals and contribute to obtain a business process aligned with the goals of the organization.

Several methods to transform i* and BPMN models have been proposed as reported and analyzed in [7]. As a result from this analysis, it was discovered practical challenges that need to be addressed for an effective transformation between i* and BPMN models. In particular, the approach proposed in [5] stands out as being one of the methodologies which provides a consistent mapping from i* models to BPMN

models. However, some issues remain still open, such as how to obtain sub-processes in BPMN models from i* models [7].

The objective of this paper is to provide a more complete and systematic set of mapping heuristics to improve the method presented in [5].

3 Scientific Contributions

The contribution of this work is an improvement of the method defined by [5] to obtain BPMN models directly from i* models and vice-versa. The heuristics to obtain a BPMN model from an i* model is described below:

1. In this step, routines are specified and their scope defined. According to [3], a routine is a subgraph of the SR model that represents a particular course among the alternatives. A scope includes the sub-tasks of a routine, dependencies linked to these sub-tasks and actors linked to these dependencies [5]. It will be created a BPMN model for each routine.
2. Each actor present in a scope is transformed into a participant into the BPMN model.
    a. Actors that do not belong to the same organization become different pools.
    b. Actors that do belong to the same organization become different lanes in the same pool.
3. The internal tasks of the actors present in a scope are included as an activity into the lane/pool of the corresponding participant in the BPMN model.
4. If the task within the scope is decomposed, its subtasks must be analyzed:
    a. If the sub-tasks must be performed in parallel, they become parallel activities in the lane/pool of the corresponding actor.
    b. If the sub-tasks must be performed in sequence, they become activities linked through sequence flows.
5. A task dependency is included as an activity in the lane corresponding to the *dependee* actor and a message flow links this activity with the activity present in the lane corresponding to the *depender* actor.
6. A goal become an end event:
    a. If the goal is a dependency, the end event is included in the lane corresponding to the *depender* actor.
    b. If the goal is an internal element of an actor, the end event is included in the lane/pool of the corresponding actor.
7. The root task related to the chosen routine becomes the initial event that triggers the process.
8. A resource dependency becomes an artifact produced by the activity present in the participant representing the *dependee* actor. Two message flows are added between the activities present in the participants mapped from the *depender* and *dependee* actors. These message flows are placed in opposite directions.
9. When the task is decomposed into more than one level, it will be transformed into a sub-process.

The first three heuristics were defined in the original proposal presented in [5]. The last five heuristics are new and were included to make the method more systematic.

The inverse process is applied to the BPMN model to obtain the i* model. An initial version of these heuristics is presented below:

1. Each participant (lane or pool) in the BPMN model is an actor in the i* model.
2. Message flow links become dependencies. When the activity linked by the message flow produces an artifact, the dependency has a resource as *dependum*. The *dependee* actor of this dependency is the actor producing the resource.
3. A non-empty end event may become, depending on the judgment made by the analyst, an internal goal related to the routine being modeled or a dependency goal. In the former case, the goal is internal to the actor that possesses the end event. In the latter case, the *dependee* of the goal dependency is the actor that possesses the end event.
4. A sequence of activities in the BPMN model must be analyzed, and depending on the judgment made by the analyst, they can become sub-tasks of the same decomposed task or tasks without a father and without sons.
5. Softgoals are not modeled in BPMN, but they can be inferred by searching quality attributes associated to the activities performed by the participants.

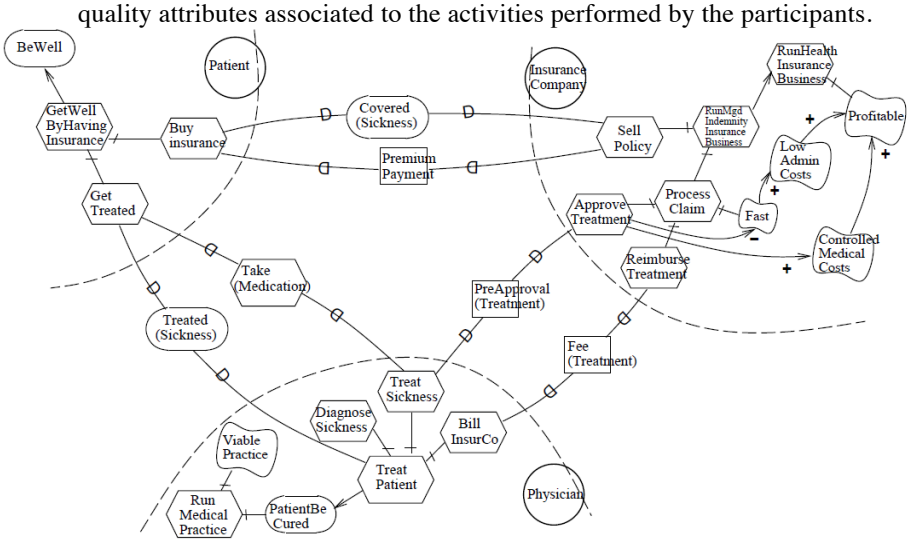

Fig. 1 i* model [3]

3.1 Running Example

The approach was applied to the "Managed Indemnity Insurance" process [3], depicted in Fig. 1. The process is based on management compensation case, where the physician must obtain prior approval to give a treatment to a patient in order to receive payment for the treatment. Fig. 2 presents the BPMN model, obtained after performing the proposed mapping heuristics. We chose the *TreatPatient* routine

present in the Physician actor. Subtasks present in the scope of this routine were included as internal activities in the Physician pool. Patient and Insurance Company actors were also included in the BPMN model as pools, because they are not part of the same organization.

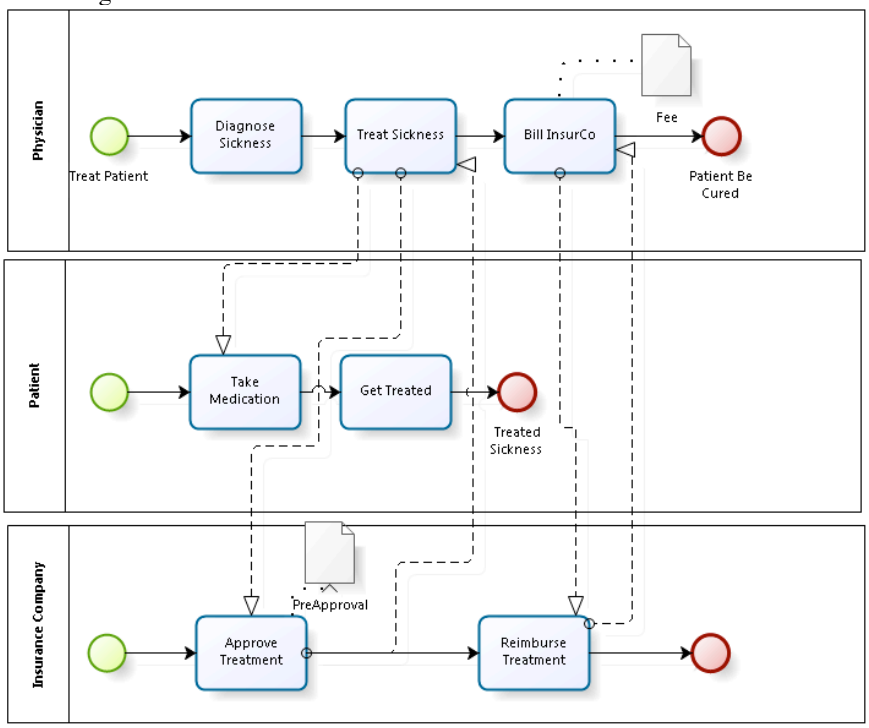

Fig. 2 BPMN model

4 Conclusions

In the previous section, it was presented an initial version of an approach to obtain BPNM models from i* models and vice-versa. The proposed approach aims to make this mapping process more systematic by providing a more complete set of heuristics.

In the example shown, we performed the mapping heuristics and we obtained a BPMN model (Fig. 2) generated from an i* model (Fig. 1) and an i* model (Fig. 3) generated from a BPMN model (Fig. 2). However, the heuristics to perform this last mapping still present some limitations, such as how to obtain goals, softgoals and decomposed tasks, as illustrated by the example.

Although the temporary limitations of our approach, we recognize that obtaining a BPMN model from a goal-oriented model allows understanding the activities of the process within the organization and if these activities are aligned with the strategic goals of the organization. Moreover, using both approaches allows obtaining a richer business process model since BPMN and i* aren't semantically equivalent. In fact,

these approaches capture relevant and complementary business processes information, such as the execution order of the activities (BPMN), goals and softgoals (i*).

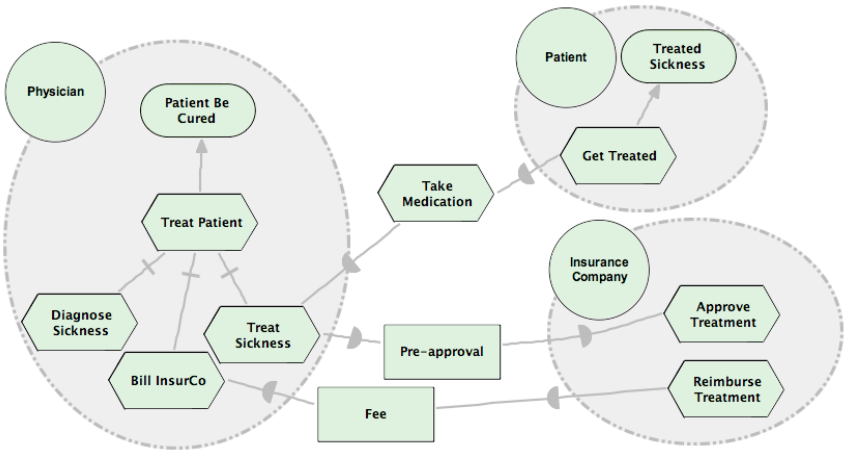

Fig. 3 i* model from BPMN model

5 Ongoing and Future Work

So far, we are working on a more complete set of heuristics to map i* models to BPMN models and vice-versa. We intend to define a more systematic method, reducing human inference during the mapping process, and enabling the automatic generation of one model from another by using model transformations.

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