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A procedural framework for dynamic changes of human interactions in knowledge intensive services

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ABSTRACT

The knowledge intensive service processes should be managed in a human-oriented way since humans who naturally undertake complex operations of an intellectual nature in the processes are the most valuable resources. The most fundamental nature of human work is collaborative and dynamic. Humans interact and communicate with each other to accomplish their jobs in the process. To help them to work together, a strong representation of the process should be provided to facilitate them to clearly understand who they should interact with and what activities need to be performed. For the clear representation, Human Interaction Management (HIM), which has been suggested to comprehensively support human work, adopts a role-based approach to process modeling. It, however, tends to hide elements of interactions although the collaborative human interaction is one of the most fundamental nature of human work. To remedy this problem, a state-driven modeling approach to human interactions was presented. It clearly visualizes the interactions so that humans can be guided through it. However, they do not just follow the previously defined sequence of activities, but continuously work out how they are going to proceed from now on according to the state of things they encounter throughout the life of the work. To fully support the dynamic nature of human work, human interactions should be flexibly managed. Therefore, this paper presents a framework for the flexible management of human interactions. The framework provides a capability to flexibly manage the interactions in a decentralized way by allowing interaction participants to dynamically change the involved interaction based on the continuous negotiation of how to achieve the ultimate goal of the interaction. It will be a basis for realization of decentralized management of human interactions in knowledge intensive service processes.

1. Introduction

Most companies can increase competitiveness and accelerate innovation by receiving help from knowledge intensive service activities that providing valuable external knowledge. Knowledge intensive services are specialized business services that aim to create value-added activities and customized solutions to meet client's requirements by relying heavily on knowledge work (Bettencourt, Ostrom, Brown, & Roundtree, 2002; Miles et al., 1995; Toivonen, 2006). As knowledge work is a high level professional work, humans who contribute to the successful completion of the work are the most valuable resources for service-providing companies (Liebowitz, 2001). They usually undertake complex operations of an intellectual nature in service processes to develop and deliver the requested services (Miles, 2005; Muller & Doloreux, 2009). Therefore, it is necessary to develop a way to model and manage the complex service processes in a human-oriented way.

A radical new business theory of Human Interaction Management (HIM) has been suggested for modeling and managing such human processes (Harrison-Broninski, 2005). To deal with the human processes, HIM lays a role concept at its heart since the role concept is generally regarded to be compatible with general human work behavior. Although there are many different role concepts applied in different systems (Zhu, 2006; Zhu & Zhou, 2008), roles highly relevant to human collaborative systems are addressed in HIM. In this respect, a role can be defined as a set of prescriptions describing how humans should behave with responsibilities required to carry out specific activities (Ashforth, 2001; Bostrom, 1980; King & Sethi, 1998). Humans can be well informed about what objects they can access and which people they can interact with, and ultimately they can be facilitated in accomplishing their jobs meaningfully from the clearly defined roles in the human processes (Zhu & Zhou, 2006).

Various interactions usually concurrently take place in knowledge intensive service processes. The role-based modeling

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approach in HIM, however, tends to hide elements of interaction that are vital to continuing cooperation (Beeson & Green, 2003). HIM simply tries to manage these interactions by creating communication channels so that people can exchange messages repeatedly and in any direction whenever necessary (Harrison-Broninski, 2005). However, one person usually plays several roles in a project and participates in several interactions at a time with one role. It inevitably leads to him or her to be overwhelmed by too many irrelevant messages which come from various participants. Moreover, if a person who is currently playing a certain role is replaced by another person, it will be very hard for the new person to understand the overall status of the involved interactions from the overwhelmed messages. This kind of replacement is usual in general human processes (Harrison-Broninski, 2005). To remedy this problem, our previous work proposed a state-driven modeling approach to human interactions (Seo, Yoon, Lee, & Kim (2011)). The proposed approach allows any participants to easily understand their involved interactions since it can clearly visualize the whole interactions. The visualization helps the participants to interact better with each other in that providing a systematic guideline for performing the interactions.

Although interactions are clearly specified using the state-driven modeling approach, participants in the interactions often face with the situation that the models should be changed. They do not just follow the previously defined sequence of activities in the interaction model, but continuously work out how they are going to proceed from now on according to the state of things they encounter throughout the life of the interaction. Therefore, human interactions should be dynamically changed through agreement among involved participants. Moreover, it should not be a one time thing but happen continually. HIM, of course, already recognizes the dynamic nature of human work and presents a simple pattern for supporting the dynamic changes of role-based models, which is composed of the following three phases: discuss, agree, and implement. However, it does not consider at all how to monitor the operating interactions, how to reach a consensus on changing the interactions, and how to manage the continuously changing interactions. These are essential features to support the dynamic changes of human interactions. Therefore, this paper proposes a framework for decentralized management of the dynamic changes. These changes occur by the interaction participants so should be managed in a decentralized way. This is why this paper focuses on the decentralized management of human interactions. This framework facilitates the participants to change and re-design the ongoing interactions through continuous negotiations. It can ultimately satisfy the dynamic nature of human work which is vital to manage the knowledge intensive service processes in a human-oriented way.

The rest of this paper is organized as follows. Section 2 reviews the related works and Section 3 describes an overview of the state-driven modeling approach to human interactions with an exemplary scenario. Section 4 presents a detailed procedural framework for dynamic changes of human interactions. The implementation of a prototype is presented in Section 5. Section 6 discusses future research directions and concludes the paper.

2. Related works

To facilitate human process modeling by satisfying the dynamic nature of human work, the concept of declarative process modeling approach has appeared against procedural process modeling approach which generally tends to over-specify the processes since it considers a number of modeling assumptions at design time (Lee, 2009). The declarative modeling approach makes execution of human processes flexible by giving process participants as much freedom as possible to do what they would like to do at execution time (Goedertier & Vanthienen, 2007). Medeiros, Vossen, and Weske (1995) stated that process management system should make suggestions about what activities are available for humans and empower them to decide which one they will perform. Hull et al. (1999) presented a declarative process modeling paradigm of Vortex in which the flow of activities is not explicitly specified. Rather, each activity has conditions that determine which ones can be performed for incoming events. If all conditions for a certain activity become true, the activity will be performable (Hull & Su, 1999). Similarly, Goedertier and Vanthienen (2007) suggested a declarative process modeling approach in which a business process is modeled by its state space and a set of rules constraining the transitions in the state space. De Man (2009) presented a case management approach of Cordys which allows process participants to define the process as part of their regular work. They do not always work based of a predetermined sequence of activities, but plan next activities whenever necessary. For that, Cordys enables them to manually select an activity from a list of follow-up activities which are automatically planed by the case management system.

This kind of declarative process modeling is essential to facilitate human processes by satisfying the dynamic nature of human work in that it provides humans with a set of activities that are appropriate in certain situation and allows them to decide which one they want to do. However, it is additionally necessary to allow them to change a running process for handling some exceptions or reducing processing time at execution time. It is not unusual in human processes. Therefore, to fully support the dynamic nature of human work, a flexible process management mechanism is imperative, which can manage the dynamic changes of processes arose from the process participants. There are numerous approaches for the adaptive and flexible process management. Hsu and Kleissner (1996) suggested ObjectFlow which uses a constrained Petri net-based process definition model. Special places, open points, are set up in a process, where adaptation can be made. Users may temporarily change the course of the process flow and define certain sub-models at those predetermined open points during the execution of the overall processes (Reichert & Dadam, 1998). However, it is insufficient for dealing with flexible process management to have only fixed and predetermined open points in the process models (Han, Himminghofer, Schaaf, & Wikarski, 1996). Reichert and Dadam (1998) have argued that the structural changes of the process models at execution time are the norm in computerized processes. Based on this argument, they presented a formal process modeling approach, ADEPT, and a minimal set of change operations, ADEPT flex, that support users in modifying a running process. However, they have largely paid attention to the structural changes of process models, but do not address other issues of the flexible process management such as how to detect exceptions in running processes, how to support problem-solving negotiation among process participants, and how to manage too many modified models for each existing model.

Both declarative modeling and flexible management of human processes are essential requirements for satisfying the dynamic nature of human work. HIM's approach using role-based model can meet the first one by introducing pre- and post-conditions for each activity of each role. As already stated, however, using only the role-based model cannot properly address complicated interactions between human participants. To overcome this problem and enable the complicated interactions to be declaratively described, our previous work presented a state-driven modeling approach in which state transitions are governed by predetermined conditions (Seo et al. (2011)). Therefore, this paper now aims to propose a new framework for the flexible management of human interactions by allowing interaction participants to discover problems in their interactions, achieve an agreement to resolve those problems,