Robust Execution of Mobile Activities in Process-Aware Information Systems

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ABSTRACT

Process management technology constitutes a crucial component of service-oriented environments as it facilitates the composition of services at design time and their orchestration at run time. In this context, high flexibility is required as business functions must be quickly adaptable to cope with dynamic changes in the business. The tremendous proliferation of smart mobile devices over the last years has fostered their prevalence in knowledge-intensive areas. As a result, it is frequently demanded to enhance process-aware information systems with mobile activity support. The latter constitutes process activities (i.e., single process steps) to be executed on smart mobile devices. In general, the technical integration of this activity type with existing process management technology is challenging. If a mobile context shall be additionally considered when executing the activities, the integration gets even more complex. However, the use of such a mobile context offers several advantages. For example, (mobile) activity execution time can be significantly decreased if mobile activities are only assigned to those users whose location is close to the one of the mobile activity. Existing research approaches mainly focus on the partitioning of processes and the distributed execution of the resulting fragments on smart mobile devices. Opposed to this fragmentation concept, this paper proposes an approach to enable the robust and flexible execution of single process activities on smart mobile devices.

KEYWORDS

Exception Handling, Exception Prevention, Human-Centric Mobile Activities, Mobile Context, Mobile Process, Mobile Service, Mobile User Assignment, Mobile Worklist

INTRODUCTION

Daily business routines more and more require mobile access to Information Systems. However, the integration of smart mobile devices into existing infrastructures is laborious and error-prone. In particular, the infrastructure must cope with ad hoc events, various types of exceptions (e.g., connectivity problems), physical limitations of smart mobile devices (e.g., limited battery capacity), misbehavior of users (e.g., instant shutdowns), and the evaluation of data collected by mobile sensors.
In general, proper exception handling constitutes a prerequisite for any mobile activity support. In this context, adaptive and flexible process management technology offers promising perspectives based on a wide range of techniques (Reichert & Weber, 2012; Reichert & Weber, 2013; Kolb & Reichert, 2013; Lanz et al., 2012; Weber et al., 2008). In particular, it allows for the proper handling of run time exceptions. However, execution of process activities on smart mobile devices in the same way as on stationary computers is not appropriate when the specific challenges of mobile environments are not taken into account.

A service-oriented environment should allow for mobile activity support during business process execution. This paper presents an approach developed in the MARPLE (Managing Robust Mobile Processes in a Complex World) project. This approach enables the robust execution of single process activities on smart mobile devices and is based on two fundamental services, a service that assigns mobile users to mobile activities and an exception handling service for mobile activities. These services ensure that mobile activities are (a) only assigned to those mobile users that are particularly appropriate based on a mobile context and (b) do not harm the overall process execution when activity exceptions occur. In this context, a service-oriented architecture was realized that integrates the services with existing process management technology.

Note that implementing a process engine from scratch which provides all functions for creating and executing mobile activities (Schobel et al., 2016a, 2016b) constitutes another option. However, if a process management system is already in use, the introduction of another process engine might not be acceptable, due to high efforts for transferring process models to the new engine. Therefore, the presented approach provides an engine-independent interface for executing mobile activities. For this purpose, the services are implemented in a layer between the process engine and the smart mobile devices. This service layer enables the instantiation, activation, and exception handling of mobile activities.

This paper presents the support of mobile activities and the handling of exceptions during run time without need for manually involving mobile users. Note that this is crucial with respect to higher user acceptance of mobile business processes. Generally, the provisioning of self-healing techniques is crucial for executing mobile activities in the large scale as well as for achieving higher user acceptance.

We firstly discuss fundamental issues arising in the context of mobile environments. Their understanding is crucial for developing the two fundamental services as well as for designing the overall system architecture. In this context, the challenges (e.g., device failures) are considered which must be tackled to ensure robust execution of mobile activities. In detail, challenges are addressed that are related to the mobile environment itself (e.g., a smart mobile device loses its connectivity), related to the business process execution (e.g., missing data caused by activity exceptions), and related to the behavior of the mobile users (e.g., instant shutdowns).

Background

Many domains crave for the integration of smart mobile devices into business process execution (Pryss et al., 2012; Lenz & Reichert, 2007; Pryss et al., 2016). Figure 1 shows a simplified healthcare example illustrating this. It depicts a ward round process for which mobile assistance is required (Pryss et al., 2012; Pryss et al., 2015). For instance, *Prepare Ward Round* constitutes an activity whose mobile support would ease daily work of healthcare professionals.

The use of smart mobile devices during process execution raises several challenges with respect to mobile activity support. For example, if the smart mobile device running the activity *Determine Vital Signs* (see Figure 1) encounters physical problems, overall process execution might be harmed; or if activities succeeding a mobile activity in the flow of control have to access data that is usually
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