A communication infrastructure to ease the development of mobile collaborative applications

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ABSTRACT

Mobile workers doing loosely coupled activities typically perform on demand collaboration in the physical workplace. Communication services available in such work scenarios are uncertain, therefore mobile collaborative applications supporting those activities must provide ad hoc communication mechanisms in order to use each cooperation opportunity. Typically, the complexity of implementing such mobile ad hoc communication mechanisms becomes a challenge that jeopardizes the development of mobile collaborative solutions. This article presents a communication infrastructure named HLMP API dealing with that challenge. HLMP API intends to ease the development of such applications through the reuse of communication services. The infrastructure is an application programming interface that implements the HLMP routing protocol and also some awareness mechanisms that are required for mobile loosely coupled work. Developers using this infrastructure do not have to perform low-level programming.

1. Introduction

Advances in wireless communication technologies and mobile computing have opened many opportunities to perform computer supported mobile collaboration activities. Nomad users usually do these activities in a loosely coupled way supported by a mobile collaborative application. Some of the work scenarios where mobile collaborative applications can support nomadic activities are the following ones: hospital work (they support nurses' and physicians' activities) (Pinelle and Gutwin 2006; Morán et al., 2007), education (supporting students' and instructors' work) Casas et al., 2009; Zurita et al., 2008, emergency relief (supporting firefighting and rescue activities) (Monares et al., 2011; McCarthy et al., 2006), m-commerce (supporting salesmen's work) (Jensen, 2007; Tarasewich, 2003) and production processes (supporting engineers' or technicians' activities) (Ochoa et al., 2011; Jupp et al., 2007).

The development of mobile collaborative applications usually addresses several challenges. One of them is the design and implementation of the communication infrastructure that will allow nomad workers to interact with each other in order to perform loosely coupled work (Neyem et al., 2009).

According to Ellis et al. (1991), communication is the basis that allows implementing coordination and collaboration mechanisms. Implementing communication-supporting services in mobile collaborative work scenarios is a major challenge for developers. One of the main reasons is the large number of complex requirements that must be taken into account (Herskovic et al., in press); some of these requirements are managing automatic connection/disconnection of nodes, dealing with a dynamic network topology and providing routing among network nodes.

The need to implement a suitable communication infrastructure as a part of the mobile collaborative application forces developers to focus on basic groupware design issues, such as node identification, message delivery and routing. Implementing appropriate communication services helps ensure that coordination and collaboration services will then be suitable to support loosely coupled activities in terms of usability and performance. However, the high effort and know-how required to implement an adequate communication infrastructure able to support mobile ad hoc collaboration typically jeopardizes the development of the whole project (Neyem et al., 2009).

A typical strategy to address this problem is to use a framework/ middleware that allows developers to reuse already implemented communication services. This saves developers the need to address highly important but secondary issues.

This paper presents an application programming interface named HLMP API, which implements the HLMP routing protocol (Rodríguez-Covili et al., 2010) and various awareness mechanisms which are usually required in mobile collaborative applications. Like other APIs, it provides an interface to reuse the services it

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