Chapter XIX
Mobile Peer-to-Peer Collaborative Framework and Applications

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ABSTRACT

This chapter presents the Peer2Me mobile peer-to-peer framework, Peer2Me applications, and discusses the experiences from using the Peer2Me framework. Peer2Me supports mobile collaboration utilizing Bluetooth and Java ME. The framework runs on standard Java ME-enabled mobile phones, thus enabling rapid development of various kinds of collaborative peer-to-peer applications. In this chapter, the author describes some of the developed applications and his experiences from implementing these applications, which include: a file-sharing application, a chat application, a quiz game, a face-to-face meeting scheduler, a real-time game, an automatic business exchange application, and a find the right person application. All of these applications were analyzed for their potential usefulness, and investigated to discover the limitations of the framework, and the underlying technologies. Finally, the author summarizes his analysis to provide a complete picture of the potential and limitations of Bluetooth and Java ME for implementing mobile peer-to-peer applications.

INTRODUCTION

Most peer-to-peer applications and architectures today are designed to work in a fixed and wired infrastructure like the Internet. The development of wireless network technologies, mobile devices and programming environment for mobile devices have made it possible to migrate the peer-to-peer computing to a wireless environment (Kortuem et al., 2001; Maibaum & Mundt, 2002). The downside of bringing peer-to-peer computing to the mobile and wireless platform is that we have to face the
classical challenges of mobile computing related to how to handle wireless communication, how to solve issues related to mobility of the user, and how to overcome the limitations introduced by the portability of the mobile device (Satyanarayanan, 1996). Mobile peer-to-peer computing also offers new opportunities that can be utilized like providing location-based services (Davies et al., 2001; Long et al., 1996) and social computing (Eagle & Pentland, 2005; Holmquist et al., 1998) using short-range networks.

Most wireless devices support some kind of personal area network (PAN) technologies like irDA and/or Bluetooth (Miller & Bisdikian, 2004). PANs are commonly used for transferring data between two mobile devices. A PAN can be seen as a digital sphere around the mobile device enabling a collaborative network for users within range. The digital sphere opens for mobile computer supported cooperative work (mobile CSCW) (Wiberg & Grönlund, 2000; Papadopoulos, 2006). In such environments, the support for mobile peer-to-peer is essential, and the support and establishment of mobile ad hoc networks (MANETs) are necessary. A MANET is a self-configuring network where peers can join and leave the network dynamically making the wireless network topology unstable and unpredictable (Mohapatra, 2004). MANETs can be utilized in situations where persons with mobile devices meet and there is a need for exchange of data.

MANETs opens for new kinds of user-interaction. The interaction between users can either be explicitly initiated by the users; it can be automatically initiated by the mobile devices, or a hybrid of the two (Wang et al., 2006). Such applications can be used for initiating collaboration between users of same interests, e.g., an application for finding people with same research interest at a conference (Wang et al., 2005). Furthermore, MANETs can be used to create application for proximity chats and file exchanges, or simply for leisure like games.

This chapter describes a framework for implementing mobile peer-to-peer applications, explores and evaluates several mobile peer-to-peer applications, and investigates the limitations of Java ME and Bluetooth in this context.

BACKGROUND

This section gives an introduction to the background and important terms used in our framework, and describes related work.

Mobile Computer Supported Cooperative Work

Research within Computer Supported Cooperative Work (CSCW) has grown to be a mature research area. However, there are still problems concerning the use of computers for cooperation that remain unsolved. (Olson et al., 2002) list several advantages of collocating a work force to improve cooperation such as efficient communication paths, less ambiguity in communication, more efficient synchronization of work, and better knowledge management. The advantages from being collocated stem from the fact that collaboration is probably the most complex, advanced, and unstructured form of human-to-human interaction. Current technology is too limited to cope with such complexity and is therefore not sufficient to solve all the problems in the CSCW domain.

(Clarence et al, 1991) describe the different types of CSCW systems/applications in the two dimensions time and place. The time dimension divide CSCW applications either into real time or asynchronous applications, while the place dimension divide such applications into same place or different place. An email-application would according to this model typically be characterised as asynchronous and different place, while a chat-application would be characterised as real time and different place. Most CSCW research has