

BLUEGUM USE OF BLUETOOTH INTERFACES IN THE ACCESS OF PORTABLE EQUIPMENT

Karen Rezende Caino de Oliveira, Emilena Specht, Luigi Carro

Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil.

ABSTRACT

Portable equipments have been playing an important role in everyday life. Since the sprouting of the cell phone, these devices have been acquiring new functionalities, becoming even more attractive. Among their new characteristics is the coexistence of other types of communication beyond the basic RF link, such as Bluetooth. The main idea of this paper is to explore this extra functionality, as the chosen example is an application that promotes the exchange of contacts of the telephonic catalog between two cell phones users, using the Bluetooth standard. Besides the contact sharing, the application allows to add, to remove and to show the contacts to its user. BlueGum Contact Sharing was developed in J2ME in order to take advantage of Java portability, and tested in the Nokia emulators and devices.

1. INTRODUCTION

Embedded systems represent more than 90% of existing computer systems, and cell phones represent an important part of it. By the use of popular languages, such as Java and C, and the reuse of legacy code, a large demand of smarter, cheaper, and power-conscious embedded systems is developed every day. However, its growing complexity requires developing efforts and better methodologies, integrated with operational systems designed specifically for embedded, such as Symbian OS.

The BlueGum project plans to explore the capacity of Bluetooth communication already present in portable equipment, more specifically in cell phones. This paper presents the application BlueGum Contact Sharing, inserted in the BlueGum project, which promotes the exchange of contacts between two distinct users using the Bluetooth interface. Currently, some devices, such as Nokia Series 40 and 60 devices, are capable to share contacts, but this implies in exchange its SIM cards, send contacts one by one, or use PC manufacturer software as an intermediary.

The development of this application represents an intermediate step to promote backup of data from a mobile device to a PC, therefore backup from net can be more efficient in saving energy then the backup in the device's own memory [1]. In this paper some basics concepts of Bluetooth and J2ME are presented. After that, the application itself is discussed, with a description of the interface, the establishment of connections and access to the contacts. Some comments on the application limitation and the biggest difficulties faced in the project are discussed in the results. After the conclusion, the topics foreseen for future works in the BlueGum are presented.

2. BLUETOOTH: BASIC CONCEPTS

Bluetooth is a wireless technology developed to make data communication possible in short distances among PCs, notebooks, PDAs, cell phones, modems, printers, and others [2]. The Bluetooth technology is royalty-free and follows the standard for wireless communication ad hoc, of short reach and low cost, through radio waves. Bluetooth aims at facilitating the transmission of voice and data in real time, assuring protection against interferences and the security of data transmitted [2]. The Bluetooth devices operate in ISM band, and vary from 2400 to 2483.5 MHz in Europe, United States and Japan, making it an interesting alternative to unify wireless communication in the world.

3. J2ME AND APIS

J2ME is a Java version for small devices and is divided basically in configurations and profiles [3]. The application in this paper is developed using the configuration CLDC and the profile MIDP, a typical structure of portable programs for cell phones. Figure 1 presents the existing basic software in the portable devices of the present time.

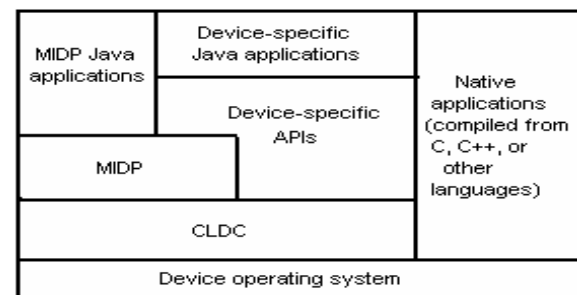


Figure 1: Software Components of portable equipments [3]

The Java APIs for Bluetooth Wireless Technology (JABWT) had been defined by the entity Java Community Process (JCP) in the specification JSR-85, JABWT can be seen as a standard for development of Bluetooth applications in Java programming language, including BlueGum Contact Sharing. These APIs are based on the Bluetooth specification version 1.1 [4].

The Personal Information Management API (PIM) is an optional package of J2ME platform and composes the standard JSR-75. It allows the access and modification of certain permanent databases that may exist in a device, since this supports MIDP profile. Until the recent sprouting of PIM API, in 2004, the J2ME applications did not have access to any databases [5]. BlueGum Contact Sharing is capable to check if the device supports PIM. Currently, the PIM API is in version 1.0

4. BLUEGUM CONTACT SHARING

Despite the proposal of BlueGum Contact Sharing seems simple, there is complexity in the bluetooth connection management and in the access of all contacts. The user must be protected of this complexity and informed in case that something wrong occurs. Therefore, it was a challenge to create a friendly interface.

In the development of this application, parts of other existing applications were reused, to increase security and commercial feasibility. The code part responsible to initialize Bluetooth stack and establish connections was adapted from BlueChat [6] application. EventSharing [7] and PDAPDemo [8] applications helped on developing user interface and accessing the device database using PIM API.

Through BlueGum Contact Sharing, a cell phone user can add and remove contacts, or just request the application to show its telephonic agenda. Despite this function is available directly in the cell phone's menu, this information is useful to observe how PIM API works in a particular device. Also, Nokia Series 40 and Series 60 emulators do not have a menu, they are only capable to run jar files.

BlueGum Contact Sharing uses RFCOMM as the protocol for Bluetooth connections. The application does not allow connections among more than two users at the same time, as RFCOMM acts like a serial protocol. This restriction aims to facilitate the management of connections and data transmission, as well as promoting greater security. Also, after established a definitive connection, both equipment enters in not discoverable mode of Bluetooth, still in order to increase security.

The use of "Exit" option does not result only in an unexpected interruption of the program's execution. In a user terminate call, a hardwired device initiates a procedure for disconnection, informing the user's decision to the other device. In this way, the MIDlet guarantees that a user will be alarmed only when a connection error occurs.

Figure 2 shows the contact sharing of two Nokia Series 60 emulators.

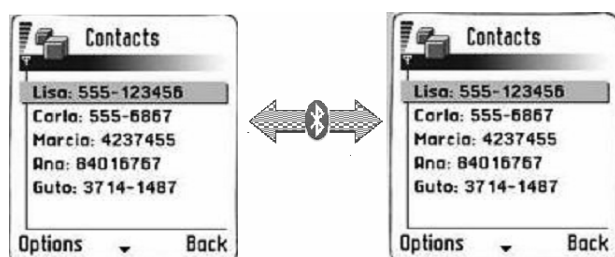


Figure 2: Series 60 emulators sharing contacts

The transference is accomplished by accessing contacts through PIM API. The transmitter creates a vector where it stores the information of each list contact, sending it to the receiver after that. Before receiving the contacts, the receiver also creates a vector, where it will store the new contacts. These are added to the original list only after the act of receiving all contacts. This occurs because the access to the cell phone's database is an operation that consumes a certain amount of time, when it's necessary to compare each contact received with the old ones, to add in the list only contacts not-duplicated. In case of the user's set not support PIM API, an alert is given in the beginning of the application, and the MIDlet automatically finishes its execution.

5. RESULTS

The first version of BlueGum Contact Sharing has approximately 2300 lines of code. About 40% of the code lines had been reused of the BlueChat application, while 12% had been reused of the EventSharing and 20% of PDAPDemo. The archive to jar (executable Java) of the application occupies 45KB.

The techniques applied to increase security on transactions are still not enough, and useful security resources of Bluetooth such as authentication and encryption have not been explored. The BlueGum Contact Sharing can be installed in any equipment that implements MIDP version 2.0. JABWT and PIM API however, it does not have guarantee that the application successfully executes in devices of others manufacturers. Even the Nokia products may present different behaviors in the execution of BlueGum Contact Sharing, because of different APIs implementations [9]

The biggest difficulty in this development has been the understanding of the behavior of the application in a real device or on emulators, and why execution is different depending on the device, as a Java application was expected to be fully portable. The lack of documentation and the fact that these codes were not written for the reuse had increased the difficulty in this work.

6. CONCLUSIONS

Currently, an application of this type does not come embedded in no cell-phone in the market. The reuse of written code parts was very important in terms of time development of this work. Despite the difficulties, without this reuse, the time development of this first application would have been longer. The project foresees the deployment of a version of the BlueGum Contact Sharing in web for free. Among the future works one can find the coding of the user authentication's requirement and encryption in Bluetooth connections, allowing the user to choose contacts of another user, testing and adapting the application to devices of others manufacturers, developing a contact list backup application for PCs and also a template that could be used in any application that made use of Bluetooth communication.

7. REFERENCES

- [1] FRYMAN, J. at al. **Energy-efficient Network Memory for Ubiquitous Devices**. IEEE Computer Society, [S.1.], v.23, n.5, p. 60-70, Oct. 2003.
- [2] HEWLETT-PACKARD COMPANY. **White Paper: Bluetooth Technology Overview**. [S.1.], Apr. 2003.
- [3] KNUDSEN, J. **Wireless Java: Developing with Java 2, Micro Edition**. Berkeley: Apress, 2001.
- [4] MAHMOUD, Q. H. **Part II: The Java APIs for Bluetooth Wireless Technology**. Sun Microsystems web site, [S.1.], Apr. 2003.
- [5] GUIGERE, E. **An overview of the PIM Optional Package**. Sun Microsystems web site, [S.1.], Sep. 2003.
- [6] BEN HUI. **BlueChat**. Mobile Developers Portal web site, [S.1.], Sep. 2005.
- [7] NOKIA CO. **EventSharing MIDlet**. Nokia Forum web site, [S.1.], Oct 2004.
- [8] **PDAPDemo**. Included with the J2ME Wireless Toolkit 2.2 package, Oct. 2005.
- [9] NOKIA CO. **Introduction to the PIM API version 1.1**. Nokia Forum web site, [S.1.], Mar. 2005.