Chapter 3.12
Handheld Computing and J2ME Programming for Mobile Handheld Devices

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INTRODUCTION

Mobile commerce or m-commerce is defined as the exchange or buying and selling of commodities, services, or information on the Internet through the use of Internet-enabled mobile handheld devices (Hu, Lee, & Yeh, 2004). It is expected to be the next milestone after electronic commerce blossoming in the late-1990s. Internet-enabled mobile handheld devices are one of the core components of a mobile commerce system, making it possible for mobile users to directly interact with mobile commerce applications. Much of a mobile user's first impression of the application will be formed by his or her interaction with the device, therefore the success of mobile commerce applications is greatly dependent on how easy they are to use. However, programming for handheld devices is never an easy task not only because the programming languages and environments are significantly different from the traditional ones, but also because various languages and operating systems are used by handheld devices and none of them dominates.

This article gives a study of handheld computing, especially J2ME (Java 2 Platform, Micro Edition) programming, for mobile commerce. Various environments/languages are available

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for client-side handheld programming. Five of the most popular are (1) BREW, (2) J2ME, (3) Palm OS, (4) Symbian OS, and (v) Windows Mobile. They apply different approaches to accomplishing the development of mobile applications. Three themes of this article are:

1. Introduction of handheld computing, which includes server- and client- side computing.
2. Brief introductions of four kinds of client-side computing.
3. Detailed discussion of J2ME and J2ME programming.

Other important issues such as a handheld computing development cycle will also be discussed.

BACKGROUND

Handheld computing is a fairly new computing area and a formal definition of it is not found yet. Nevertheless, the authors define it as follows: Handheld computing is the programming for handheld devices such as smart cellular phones and PDAs (personal digital assistants). It consists of two kinds of programming: client- and server-side programming.

The definitions of client- and server- side computing are given as follows:

- **Client-Side Handheld Computing:** It is the programming for handheld devices and it does not need the support from server-side programs. Typical applications created by it include (1) address books, (2) video games, (3) note pads, and (4) to-do list.
- **Server-Side Handheld Computing:** It is the programming for wireless mobile handheld devices and it needs the support from server-side programs. Typical applications created by it include (1) instant messages, (2) mobile Web contents, (3) online video games, and (4) wireless telephony.

This article will focus on the client-side computing. The server-side computing is briefly given next.

Server-Side Handheld Computing

Most applications created by this kind of programming, such as instant messaging, require network programming such as TCP/IP programming, which will not be covered in this chapter. The most popular application of server-side handheld computing is database-driven mobile Web sites, whose structure is shown in Figure 1. A database-driven mobile Web site is often implemented by using a `three-tiered client/server architecture` consisting of three layers:

1. **User Interface:** It runs on a handheld device (the client) and uses a standard graphical user interface (GUI).
2. **Functional Module:** This level actually processes data. It may consist of one or more separate modules running on a workstation or application server. This tier may be multi-tiered itself.
3. **Database Management System (DBMS):** A DBMS on a host computer stores the data required by the middle tier.

The three-tier design has many advantages over traditional two- or single- tier design, the chief one being: the added modularity makes it easier to modify or replace one tier without affecting the other tiers.

CLIENT-SIDE HANDHELD COMPUTING

Various environments/languages are available for client-side handheld programming. Five of the most popular are (1) BREW, (2) J2ME, (3) Palm OS, (4) Symbian OS, and (5) Windows Mobile. They apply different approaches to accomplishing

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