

# Handheld Programming Languages and Environments

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## INTRODUCTION

*Mobile commerce* is defined as the exchange or buying and selling of commodities, services, or information on the Internet through the use of mobile, handheld devices such as smart cellular phones and PDAs (personal digital assistants). It is widely acknowledged that mobile commerce is a field of enormous potential. However, it is also commonly admitted that the development in this field is constrained. There are considerable barriers waiting to be overcome. One of the barriers is most software engineers are not familiar with the design and development of mobile applications (Kiely, 2001). This chapter gives a study of handheld computing and programming to help software engineers better understanding this subject. Handheld computing is to use handheld devices to perform wireless, mobile, handheld operations such as personal data management and making phone calls. They can be achieved by using server or client-side handheld computing and programming:

- **Server-side handheld computing and programming:** Server-side handheld computing is to use handheld devices to perform wireless, mobile, handheld operations, which require the supports of server-side computing. The most common applications of server-side handheld programming are the mobile Web contents.
- **Client-side handheld computing and programming:** Client-side handheld computing is to use handheld devices to perform handheld operations, which do

not need the supports of server-side computing. Most client-side handheld programming languages are a version of either C/C++ or Java. Examples of the application development of Java ME, a version of Java, and Palm OS, using a version of C, will be given.

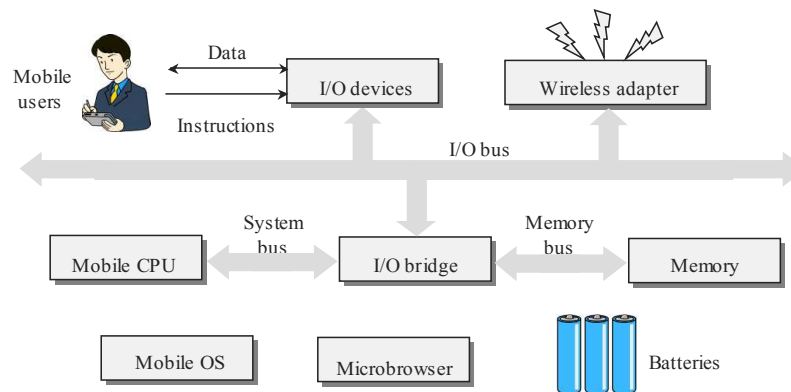
## BACKGROUND

Mobile users interact with mobile commerce applications by using small wireless Internet-enabled devices, which come with several aliases such as handhelds, palms, PDAs (personal digital assistants), pocket PCs, and smart phones. To avoid any ambiguity, a general term, mobile handheld devices, is used in this article. Mobile handheld devices are small general-purpose, programmable, battery-powered computers, but they are different from desktop PCs or notebooks due to the following special features:

- Limited network bandwidth,
- Small screen/body size, and
- High mobility.

Short battery life and limited memory, processing power, and functionality are additional features, but these problems are gradually being solved as the technologies improve and new methods are constantly being introduced. The limited network bandwidth prevents the display of most multimedia on a microbrowser. Though the Wi-Fi and 3G networks go

Figure 1. A system structure of mobile handheld devices



some way toward addressing this problem, the wireless bandwidth is always far below the bandwidth of wired networks. The small screen/body size restricts most handheld devices to using a stylus for input.

Figure 1 shows a typical system structure for handheld devices, which includes the following six major components, (i) a mobile operating system, (ii) a mobile central processor unit, (iii) a microbrowser, (iv) input/output devices, (v) a memory, and (vi) batteries (Hu, Yeh, Chu et al, 2005). Synchronization connects handheld devices to desktop computers, notebooks, or peripherals to transfer or synchronize data. Without needing serial cables, many handheld devices now use either an infrared (IR) port or Bluetooth technology to send information to other devices.

### MAIN FOCUS OF THE CHAPTER

Handheld computing is a fairly new computing area and a formal definition of it is not found yet. Nevertheless, the author defines it as follows:

*Handheld computing is to use handheld devices such as smart cellular phones and PDAs to perform wireless, mobile, handheld operations such as personal data management and making phone calls.*

Again, handheld computing includes two kinds of computing: server and client- side handheld computing, which are defined as follows:

- **Server-side handheld computing:** It is to use handheld devices to perform wireless, mobile, handheld

operations, which require the supports of server-side computing.

- **Client-side handheld computing:** It is to use handheld devices to perform handheld operations, which do not need the supports of server-side computing.

The terms of computing and programming are sometimes confusing and misused. The handheld programming, defined as programming for handheld devices, is different from handheld computing and includes two kinds of programming too:

- **Server-side handheld programming:** It is design and development of handheld software such as CGI programs that reside on the servers.
- **Client-side handheld programming:** It is design and development of handheld software such as Java ME programs that reside on the handheld devices.

### Server-Side Handheld Computing and Programming

Server-side handheld computing and programming usually involve complicated procedures and advanced programming such as TCP/IP network programming. This chapter will focus on the most popular server-side handheld computing and programming, mobile Web contents design and development. For other kinds of server-side handheld computing and programming such as instant messaging and telephony, readers may refer to other technical reports or articles. A database-driven mobile Web site is often implemented by using a three-tiered client/server architecture consisting of three layers as shown in Figure 2: (i) user interface, (ii)



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