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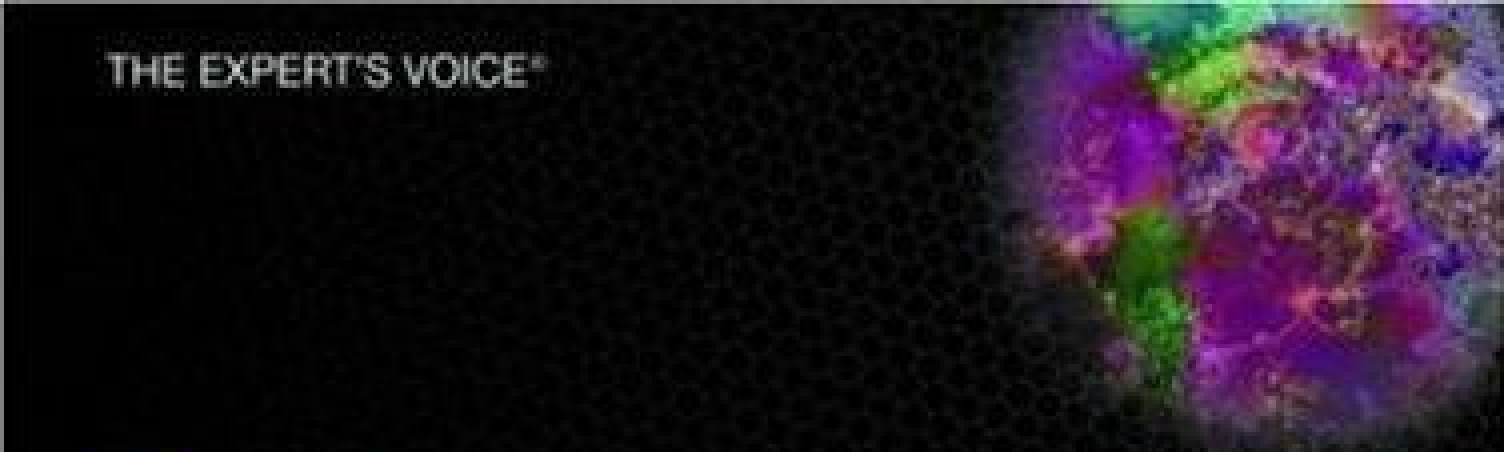

Beginning J2ME

From Novice to Professional

THIRD EDITION

Jonathank Knudsen
and Sing Li

Apress®

Beginning J2ME: From Novice to Professional, Third Edition

SING LI AND JONATHAN KNUDSEN

Apress®

Beginning J2ME: From Novice to Professional, Third Edition

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ISBN (pbk): 1-59059-479-7

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

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Distributed to the book trade in the United States by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013, and outside the United States by Springer-Verlag GmbH & Co. KG, Tiergartenstr. 17, 69112 Heidelberg, Germany.

In the United States: phone 1-800-SPRINGER, fax 201-348-4505, e-mail orders@springer-ny.com, or visit http://www.springer-ny.com. Outside the United States: fax +49 6221 345229, e-mail orders@springer.de, or visit http://www.springer.de.

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To Kimlan

To Andrew and Elena

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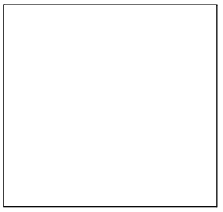
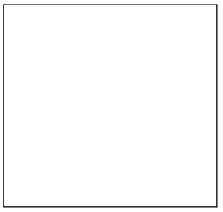
About the Authors



SING LI is a systems consultant, avid open source developer, and active freelance writer. With over two decades of industry experience, Sing is a regular contributor to printed magazines and e-zines. His book credits include *Beginning JavaServer Pages*; *Professional Apache Tomcat 5*; *Pro JSP, Third Edition*; *Early Adopter JXTA*; *Professional Jini*; and numerous others. He is an active evangelist of the mobile Java, VON, and P2P evolutions.



JONATHAN KNUDSEN is the author of several other Java books, including *Learning Java*, *Java 2D Graphics*, and *Java Cryptography*. He is also the author of *The Unofficial Guide to LEGO® MINDSTORMS™ Robots*, but, sadly, was unable to parlay that success into a full-time career. Jonathan has written numerous articles about Java and a few about LEGO robots as well. He is the father of four children and enjoys bicycling and playing the piano. For more information, see `http://jonathanknudsen.com/`.

About the Technical Reviewer

CHRIS HARRIS is from Dublin, Ireland, and received his BS in mathematics and computer science from the Dublin Institute of Technology. He has worked in the wireless software industry for over five years, and has been involved in the Java Community Process as both Specification Lead and Expert Group member. He currently works in Bordeaux, France, for a mobile games company called IN-FUSIO.

Preface

This book describes how to program mobile telephones, pagers, PDAs, and other small devices using Java technology. It is about the Mobile Information Device Profile (MIDP), which is part of the Java 2 Platform, Micro Edition (J2ME). It is concise and complete, describing all of MIDP as well as moving into several exciting advanced concepts such as 3D graphics and cryptography.

This third edition covers MIDP 2.0, and has been updated to track the Java Technology for the Wireless Industry (JTWI 1.0) de facto standard. Every chapter has been revised and meticulously updated, and four completely new chapters have been added.

Who Are You?

You're probably reading this book because you're excited about building wireless applications with Java. This book is aimed at people who already have experience programming in Java. At a minimum, you should understand the Java programming language and the fundamentals of object-oriented programming. Some chapters delve into subjects that in themselves could occupy entire books. These chapters include suggested reading if you want to get up to speed on a particular subject.

If you are unfamiliar with Java, we suggest you read an introductory book or take a course. *Learning Java, Second Edition* (O'Reilly 2002) is a good introduction to Java for programmers who are already experienced in another language such as C or C++.

The Structure of This Book

This book is organized into 18 chapters and one appendix. There are basically three sections. The first two chapters are introductory material. Chapters 3 through 16 provide complete coverage of the MIDP 2.0 and JTWI 1.0 APIs, together with some of the most frequently used optional APIs available. Chapters 17 and 18 cover advanced topics. The complete breakdown of chapters is listed here:

- Chapter 1, "Introduction," provides context and motivation for the rest of the book. J2ME is explained in detail, gradually zooming in to MIDP and JTWI.
- Chapter 2, "Building MIDlets," is intended to be a teaser. It includes an example application that allows you to look up the definitions of words over the Internet using any MIDP device. Along the way you'll learn a lot about developing applications for the MIDP platform.
- Chapter 3, "All About MIDlets," goes into detail about the life cycle and packaging of MIDP applications. It includes coverage of the MIDP 2.0 security architecture.
- Chapter 4, "Almost the Same Old Stuff," describes the pieces of the MIDP API that will be familiar to Java programmers.

- Chapter 5, “Creating a User Interface,” is the first of a handful of chapters devoted to MIDP’s user interface packages. It provides an overview of MIDP’s user interface package and goes into detail about the simple visual components.
- Chapter 6, “Lists and Forms,” picks up where Chapter 5 left off, describing MIDP’s advanced user interface components.
- Chapter 7, “Custom Items,” shows how to create your own form items in MIDP.
- Chapter 8, “Persistent Storage I: MIDP Record Store,” describes MIDP’s mechanism for storing data.
- Chapter 9, “Persistent Storage II: File Connection and PIM API,” covers popular optional APIs for accessing a device’s file system, memory cards, and PIM features.
- Chapter 10, “Connecting to the World,” contains all the juicy details about how MIDP applications can send and receive data over the Internet.
- Chapter 11, “Wireless Messaging API,” describes WMA, a standard component of JTWI 1.0 that can be used to access the rich Short Message Service (SMS) and Cell Broadcast Service (CBS) available on modern wireless networks. This chapter also covers the new WMA 2.0 for working with audio and video messages via Multimedia Messaging Service (MMS).
- Chapter 12, “Bluetooth and OBEX,” provides coverage of the optional API that enables communications of devices through Bluetooth radio Personal Area Networks (PANs) and infrared links.
- Chapter 13, “Programming a Custom User Interface,” describes the low-level API that can be used for specialized application user interfaces.
- Chapter 14, “The Game API,” describes MIDP 2.0 features for creating games, including sprites and tiled layers.
- Chapter 15, “3D Graphics,” includes a hands-on, easy-to-understand introduction to the Mobile 3D Graphics optional API (M3G), providing you with a springboard into the fascinating world of 3D graphics programming on mobile devices.
- Chapter 16, “Sound, Music, and Video: MMAPI,” is about MIDP 2.0 new multimedia capabilities and the Mobile Media API (MMAPI). You’ll learn how to produce simple tones, play sampled audio data, play MP3 music, play video clips, and even take snapshots with your camera-phone.
- Chapter 17, “Performance Tuning,” describes techniques for coping with the limited resources that are available on small devices.
- Chapter 18, “Protecting Network Data,” discusses how to protect valuable data on the insecure Internet. It includes two sample applications that demonstrate cryptographic techniques for protecting data.
- Finally, the appendix, “MIDP API Reference,” contains an API reference for the classes and interfaces that make up MIDP. The method signatures for the public API of each class and interface are listed for handy quick reference.

CHAPTER 1

Introduction

Java 2 Platform, Micro Edition (J2ME) is the second revolution in Java's short history. When Java was introduced in 1995, it looked like the future of computing was in *applets*, small programs that could be downloaded and run on demand. A slow Internet and a restrictive all-or-nothing sandbox security model accounted for the initially slow adoption of applets. Java, as a platform, really took off with the advent of *servlets*, Java programs that run on a server (offering a modular and efficient replacement for the vulnerable CGI). Java further expanded into the server side of things, eventually picking up the moniker of Java 2 Platform, Enterprise Edition (J2EE). This was the first revolution, the blitz of server-side Java.

The second revolution is the explosion of small-device Java, and it's happening now. The market for small devices is expanding rapidly, and Java is important for two reasons. First, developers can write code and have it run on dozens of small devices, without change. Second, Java has important safety features for downloadable code.

Understanding J2ME

J2ME isn't a specific piece of software or specification. All it means is Java for small devices. Small devices range in size from pagers, mobile phones, and personal digital assistants (PDAs) all the way up to things like set-top boxes that are just shy of being desktop PCs.

J2ME is divided into *configurations*, *profiles*, and *optional APIs*, which provide specific information about APIs and different families of devices. A configuration is designed for a specific kind of device based on memory constraints and processor power. It specifies a Java Virtual Machine (JVM) that can be easily ported to devices supporting the configuration. It also specifies a strict subset of the Java 2 Platform, Standard Edition (J2SE) APIs that will be used on the platform, as well as additional APIs that may be necessary. Device manufacturers are responsible for porting a specific configuration to their devices.

Profiles are more specific than configurations. A profile is based on a configuration and provides additional APIs, such as user interface, persistent storage, and whatever else is necessary to develop running applications for the device.

Optional APIs define specific additional functionality that may be included in a particular configuration (or profile). The whole caboodle—configuration, profile, and optional APIs—that is implemented on a device is called a *stack*. For example, a possible future device stack might be CLDC/MIDP + Mobile Media API. See the section "Platform Standardization" later in this chapter for information on JSR 185, which defines a standard J2ME stack.

Currently, there are a handful of configurations and profiles; the most relevant ones for J2ME developers are illustrated in Figure 1-1.

Figure 1-1. *Common J2ME profiles and configurations*

THE JAVA COMMUNITY PROCESS

The Java Community Process (JCP) is designed to ensure that Java technology is developed according to community consensus, and to avoid industry fragmentation. The process is described here:

`http://jcp.org/jsr/all/`

Configurations and profiles first appear in the world as Java Specification Requests (JSRs). You can see a list of current JSRs here:

`http://jcp.org/jsr/all/`

To give you a flavor of what's happening in the J2ME world, Table 1-1 shows some of the configurations, profiles, and optional APIs that are available and under development. This is not a comprehensive list; for more information, check out the JCP web site at `http://jcp.org/`.

Table 1-1. *J2ME Configurations, Profiles, and Optional APIs*

Configurations

JSR	Name	URL
30	Connected, Limited Device Configuration (CLDC) 1.0	`http://jcp.org/jsr/detail/30.jsp`
139	Connected, Limited Device Configuration (CLDC) 1.1	`http://jcp.org/jsr/detail/139.jsp`
36	Connected Device Configuration 1.0.1	`http://jcp.org/jsr/detail/36.jsp`
218	Connected Device Configuration 1.1	`http://jcp.org/jsr/detail/218.jsp`