User’s Guide

J2ME Wireless Toolkit

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Contents

Preface

This document describes how to work with the J2ME Wireless Toolkit.

Who Should Use This Book

This guide is intended for developers creating Mobile Information Device Profile (MIDP) applications with the J2ME Wireless Toolkit. You should already understand how to use, the Mobile Information Device Profile (MIDP), and the Connected Limited Device Configuration (CLDC).

If you need help getting started with Java programming, try the *New to Java Center*:

`http://java.sun.com/learning/new2java/`

For a quick start with MIDP programming, read *Learning Path: Getting Started with MIDP 2.0*:

`http://developers.sun.com/techtopics/mobility/learn/midp/midp20/`

Related Documentation

This book is not a tutorial in MIDP programming, nor is it a tutorial in programming any of the additional APIs that are supported by the toolkit. This section lists related specifications. Although specifications are definitive, they are not always the most accessible kind of information. For a variety of developer-centered articles, try Sun's mobility web site:

http://developers.sun.com/techtopics/mobility/

Topic	Title
Customizing the J2ME Wireless Toolkit	*J2ME Wireless Toolkit Basic Customization Guide*
Release Notes	*J2ME Wireless Toolkit Release Notes*
MIDP 1.0 - JSR 37	*Mobile Information Device Profile for the J2ME™ Platform*
MIDP 2.0 - JSR 118	*Mobile Information Device Profile 2.0*
CLDC 1.0 - JSR 30	*J2ME Connected Limited Device Configuration*
CLDC 1.1 - JSR 139	*J2ME Connected Limited Device Configuration*
WMA 2.0 - JSR 205	*Wireless Messaging API (WMA)*
MMAPI - JSR 135	*Mobile Media API*
JTWI - JSR 185	*Java Technology for the Wireless Industry*
J2ME Web Services JSR 172	*J2ME Web Services Specification*
PDAP Optional Packages - JSR 75	*PDA Optional Packages for the J2ME Platform*
Bluetooth and OBEX - JSR 82	*Java APIs for Bluetooth*
Mobile 3D Graphics - JSR 184	*Mobile 3D Graphics API for J2ME*

How This Book Is Organized

This guide contains the following chapters and appendixes:

Chapter 1 introduces the J2ME Wireless Toolkit and the development features it provides.

Chapter 2 describes the development processes for creating and running MIDlets.

Chapter 3 explains how to work with projects in KToolbar. You'll learn how to adjust project properties, manipulate MIDlets, work with the push registry, and understand the project directory structure.

Chapter 4 describes the emulator and explains how to adjust its options and take advantage of its many features.

Chapter 5 shows how you can examine the performance of your application using the method profiler, memory monitor, and network monitor.

Chapter 6 describes how to sign MIDlet suites and manage keys and certificates.

Chapter 7 details support for running and testing wireless messaging applications.

Chapter 8 explains how the J2ME Wireless Toolkit supports the Mobile Media API.

Chapter 9 contains information about developing 3D graphics content.

Chapter 10 describes how the toolkit implements access to local files and personal information like contacts and calendar appointments.

Chapter 11 covers the toolkit's Bluetooth and OBEX simulation environment.

Chapter 12 shows how to use the web services stub generator.

Chapter 12 shows how to use the web services stub generator.

Appendix A describes the application demonstrations that are included in the J2ME Wireless Toolkit.

Appendix B explains how to use the functionality of the J2ME Wireless Toolkit from the command line.

Appendix C describes internationalization features in the J2ME Wireless Toolkit.

Typographic Conventions

Typeface	Meaning	Examples
`AaBbCc123`	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`

`AaBbCc123`	What you type, when contrasted with on-screen computer output	`%` **`su`**
		`Password:`

AaBbCc123	Book titles, new words or terms, words to be emphasized	Read Chapter 6 in the *User's Guide.* These are called *class* options. You *must* be superuser to do this.
	Command-line variable; replace with a real name or value	To delete a file, type `rm` *filename*.
{*AaBbCc.dir*}	Variable file names and directories.	In the book, {*toolkit*} always refers to the installation directory of the J2ME Wireless Toolkit.

Accessing Documentation Online

The following sites provide technical documentation related to Java technology.

`http://developer.sun.com/`

`http://java.sun.com/docs/`

We Welcome Your Comments

We are interested in improving our documentation and welcome your comments and suggestions. You can email your comments to us at:

`wtk-comments@sun.com`

CHAPTER **1**

Introduction

This book describes how to use the J2ME Wireless Toolkit.

The J2ME Wireless Toolkit is a set of tools that makes it possible to create applications for mobile phones and other wireless devices. Although it is based on the Mobile Information Device Profile (MIDP) 2.0, the J2ME Wireless Toolkit also supports a handful of optional packages, making it a widely capable development toolkit.

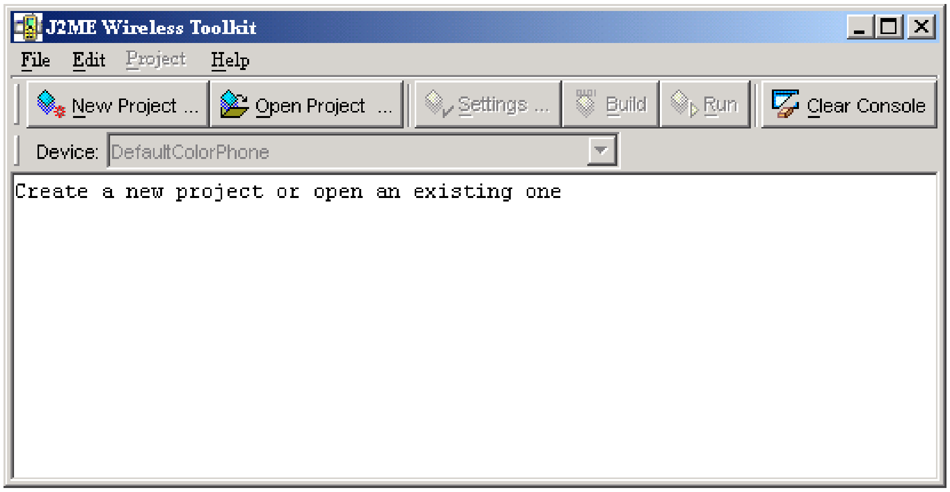
1.1 Quick Start

If you'd like to get started right away, try the demonstration applications that are included with the J2ME Wireless Toolkit.

To run the demonstrations, start KToolbar. On Windows you'll do this by choosing **Start > Programs > J2ME Wireless Toolkit 2.2 > KToolbar**.[1] You'll see a window like this:

[1] Depending on how Windows is configured, you might need to choose **Start > All Programs** instead of **Start > Programs**.

FIGURE 1 The KToolbar window



```
Create a new project or open an existing one
```

Next, click on the **Open Project...** button to open a demonstration application. You'll see a list of all the available applications. Pick one of them and click on the **Open Project** button in the dialog.

Once the application is open, all you need to do is press the **Run** button. The emulator will pop up running the example application.

Most demonstrations are self-explanatory, but some have additional instructions. See Appendix A, "Application Demonstrations," for additional details.

All the source code for the demonstration applications is available in the *{toolkit}*`\apps` directory. Each demonstration has its own project directory. Inside the project directory, the source files are in the `src` directory. For example, the source code for the `games` demonstration is in *{toolkit}*`\apps\games\src` directory.

1.2 The Tools in the Toolkit

The J2ME Wireless Toolkit has three main components:

- *KToolbar* automates many of the tasks involved in creating MIDP applications.
- The *emulator* is a simulated mobile phone. It is useful for testing MIDP applications.
- A collection of *utilities* provides other useful functionality, including a text messaging console and cryptographic utilities.

KToolbar is the center of the toolkit. You can use it to build applications, launch the emulator, and start the utilities. Alternately, the emulator and utilities can be run by themselves, which is useful in many situations. If you want to demonstrate MIDP applications, for example, it's useful to run the emulator by itself.

The only additional tool you need is a text editor for editing source code.

1.3 Toolkit Features

The J2ME Wireless Toolkit supports the creation of MIDP applications with the following main features:

- **Building and packaging**: You write the source code and the toolkit takes care of the rest. With the push of a button, the toolkit compiles the source code, preverifies the class files, and packages a MIDlet suite.
- **Running and monitoring**: You can run a MIDlet suite directly in the emulator or install it using a process that resembles application installation on a real device. A memory monitor, network monitor, and method profiler are provided to analyze the operation of your MIDlets.
- **MIDlet suite signing**: The toolkit contains tools for cryptographically signing MIDlet suites. This is useful for testing the operation of MIDlets in different protection domains.

1.4 Supported Technology

The J2ME Wireless Toolkit supports many standard Application Programming Interfaces (APIs) defined through the Java Community Process (JCP). TABLE 1 shows the APIs and includes links to the specifications.

TABLE 1 Supported JCP APIs in the J2ME Wireless Toolkit

JSR API	Name URL
JSR 139 CLDC 1.1	*Connected Limited Device Configuration* `http://jcp.org/en/jsr/detail?id=139`
JSR 118 MIDP 2.0	*Mobile Information Device Profile* `http://jcp.org/en/jsr/detail?id=118`
JSR 185 JTWI 1.0	*Java Technology for the Wireless Industry* `http://jcp.org/en/jsr/detail?id=185`
JSR 205 WMA 2.0	*Wireless Messaging API* `http://jcp.org/en/jsr/detail?id=205`

TABLE 1 Supported JCP APIs in the J2ME Wireless Toolkit

JSR API	Name URL
JSR 135 MMAPI 1.1	*Mobile Media API* `http://jcp.org/en/jsr/detail?id=135`
JSR 75 PIM and File	*PDA Optional Packages for the J2ME Platform* `http://jcp.org/en/jsr/detail?id=75`
JSR 82 Bluetooth and OBEX	*Java APIs for Bluetooth* `http://jcp.org/en/jsr/detail?id=82`
JSR 172	*J2ME Web Services Specification* `http://jcp.org/en/jsr/detail?id=172`
JSR 184 3D Graphics	*Mobile 3D Graphics API for J2ME* `http://jcp.org/en/jsr/detail?id=184`

CHAPTER 2

Developing MIDlet Suites

This chapter describes how you can use the J2ME Wireless Toolkit to create applications. It begins with a description of toolkit projects, then works through the development process.

There are two basic development cycles you are likely to follow in creating MIDlet suite applications. The first is quicker and simpler; you will probably use it in your initial development. The second cycle is longer but allows for more comprehensive and realistic testing.

Toward the end of the chapter you'll read about how to use the J2ME Wireless Toolkit with advanced development tools like an obfuscator and a debugger. A final section briefly describes how to configure a web server to serve MIDP applications.

2.1 About Projects

In the J2ME Wireless Toolkit, MIDlet suites are organized into *projects*, where the end result of one project is one MIDlet suite. A project contains all of the files that will be used to build a MIDlet suite, including Java source files, resource files, and the MIDlet descriptor.

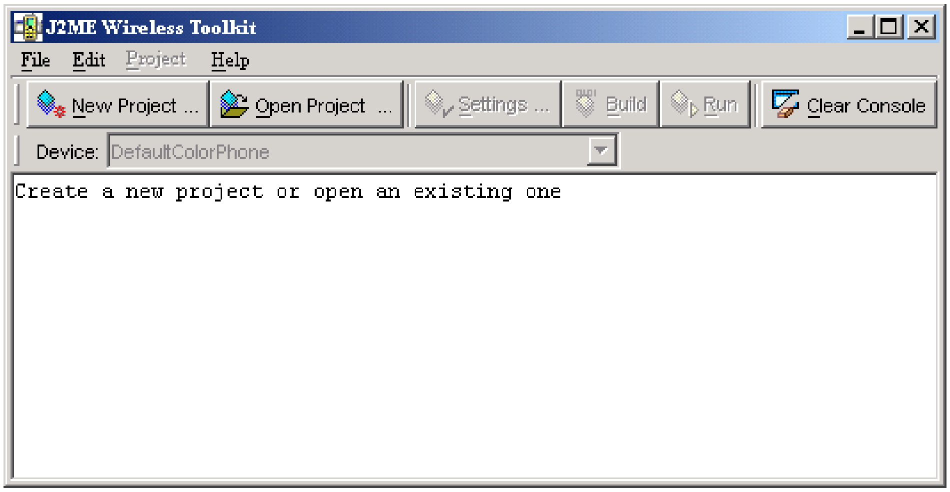
The J2ME Wireless Toolkit works on one project at a time. You can create a new project or open an existing project.

In this chapter you will work with a very simple example project. As you read about each step in the development cycles, you can work along in the toolkit.

To create a new project, first start KToolbar. On Windows, choose **Start > Programs > J2ME Wireless Toolkit 2.2 > KToolbar**.[2] You'll see the KToolbar window.

[2] Depending on how Windows is configured, you might need to choose **Start > All Programs** instead of **Start > Programs**.

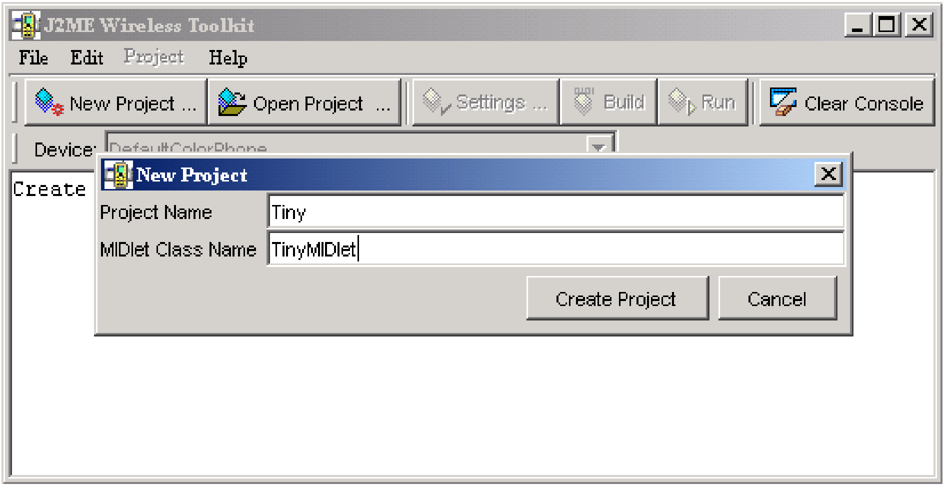
FIGURE 2 The KToolbar window



```
Create a new project or open an existing one
```

Click on **New Project...** The toolkit will ask you for the name of the project and the name of the MIDlet class you will write. Fill in the names and click **Create Project**.

FIGURE 3 Creating a new project

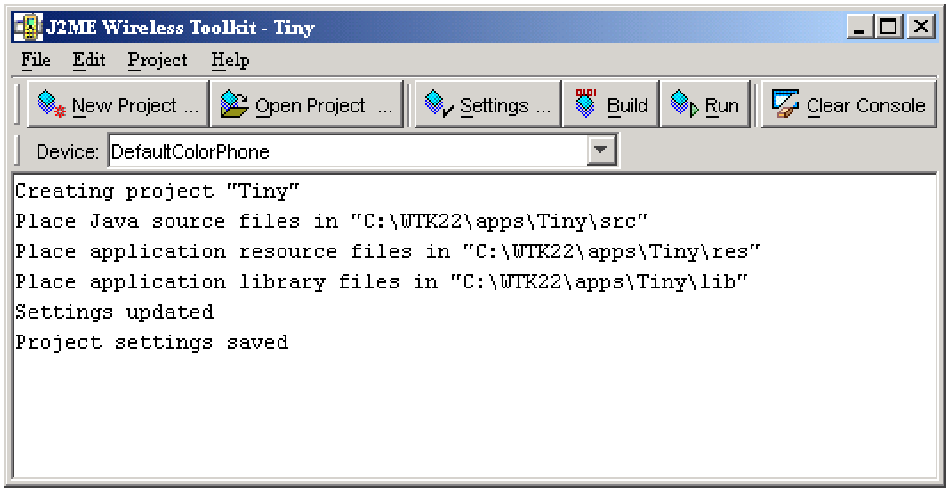


Project Name: Tiny

MIDlet Class Name: TinyMIDlet

The project options automatically pop up, allowing you to set up the build environment for the project. The default options are fine for this example; just click on **OK** to dismiss the window. In the KToolbar console, you'll see some messages telling you exactly where to store the source code and resource files for this project.

FIGURE 4 File locations in the console



Device: DefaultColorPhone

```
Creating project "Tiny"
Place Java source files in "C:\WTK22\apps\Tiny\src"
Place application resource files in "C:\WTK22\apps\Tiny\res"
Place application library files in "C:\WTK22\apps\Tiny\lib"
Settings updated
Project settings saved
```

2.2 The Simple Development Cycle

The simple development cycle looks like this:

Edit source code → Build → Run

1. **Edit source code**. In this step, you create Java source files and resource files that will be used by your application.
2. **Build**. The J2ME Wireless Toolkit compiles and preverifies your Java source files.
3. **Run**. The compiled Java class files are run on the emulator.

If an error occurs when the toolkit attempts to compile your source files, go back and edit them again. If you find a bug when you are testing your application in the emulator, edit the source files to fix the bug.

Now that you understand the simple development cycle at a high level, the rest of this section illustrates how you can accomplish each step using the J2ME Wireless Toolkit.

2.2.1 Edit Source Code

Editing source code is the only step in which the J2ME Wireless Toolkit is no help at all. You will need to use the text editor of your choice to create and edit source code files.

If you are following along with the example project, create a new Java source file `TinyMIDlet.java`. It should be saved in the source directory of your project, which will be *{toolkit}*`\apps\Tiny\src\TinyMIDlet.java` where *{toolkit}* is the installation directory of the toolkit. The contents of the file are a very simple MIDlet:

```
import javax.microedition.lcdui.*;
import javax.microedition.midlet.MIDlet;

public class TinyMIDlet
    extends MIDlet
    implements CommandListener {
  public void startApp() {
    Display display = Display.getDisplay(this);

    Form mainForm = new Form("TinyMIDlet");
    mainForm.append("Welcome to the world of MIDlets!");

    Command exitCommand = new Command("Exit", Command.EXIT, 0);
    mainForm.addCommand(exitCommand);
    mainForm.setCommandListener(this);

    display.setCurrent(mainForm);
  }

  public void pauseApp () {}

  public void destroyApp(boolean unconditional) {}

  public void commandAction(Command c, Displayable s) {
    if (c.getCommandType() == Command.EXIT)
      notifyDestroyed();
  }
}
```

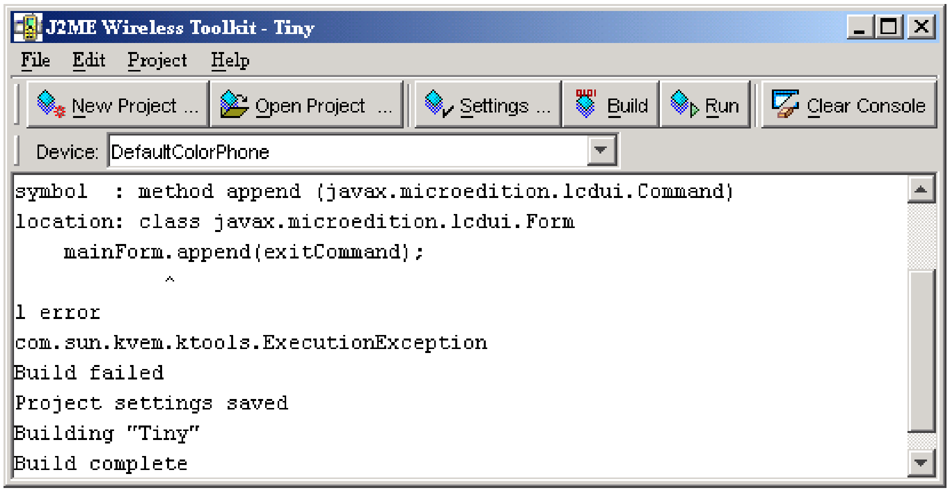
Save the file when you're finished.

2.2.2 Build

The next step is to build your source code. The toolkit makes this part very easy.

In the KToolbar window, click on the **Build** button. Assuming you saved your source file in the right place, the toolkit will find it and compile it. Compilation errors are displayed in the KToolbar console. If you have errors, go back and edit the source code to fix them. Once you've eliminated your errors, the KToolbar console tells you the project was successfully built.

FIGURE 5 Messages about building



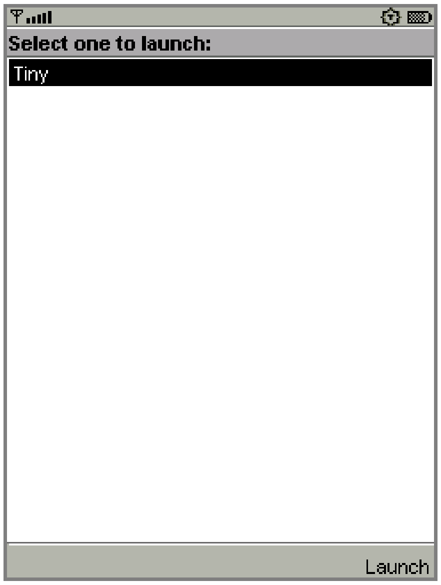
```
symbol  : method append (javax.microedition.lcdui.Command)
location: class javax.microedition.lcdui.Form
    mainForm.append(exitCommand);
            ^
1 error
com.sun.kvem.ktools.ExecutionException
Build failed
Project settings saved
Building "Tiny"
Build complete
```

Behind the scenes, the J2ME Wireless Toolkit also preverifies the compiled class files. MIDlet class files must be preverified before they can be run on a MIDP device or emulator. The toolkit quietly handles this detail for you; you probably won't ever realize it's happening. See the CLDC specification for more information on preverification.

2.2.3 Run

Once the project builds successfully, you are ready to try it out in the emulator. Click on the **Run** button. The emulator pops up and shows a list of all the MIDlets in your project.

FIGURE 6 List of project MIDlets

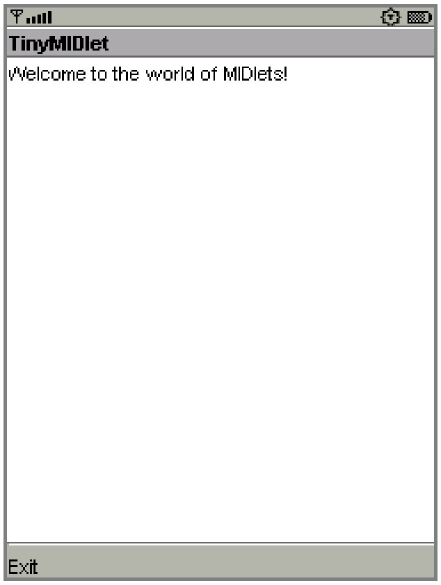


Select one to launch:

Tiny

Choose the MIDlet you want and select **Launch**. If you're following along with the `TinyMIDlet` example, you'll see the fruit of your labors:

FIGURE 7 `TinyMIDlet` in action



TinyMIDlet

Welcome to the world of MIDlets!

2.3 The Full Development Cycle

The second development cycle is slightly more complicated:

Edit source code → Package → Install → Run

1. **Edit source code**. This is the same as in the simple cycle.
2. **Package**. In this step, the J2ME Wireless Toolkit compiles and preverifies the source files (essentially the same as the **Build** step from before). Then it bundles the Java class files and resource files into a MIDlet suite JAR file and a MIDlet suite descriptor.
3. **Install**. MIDlet suites need to be installed before they can be run. You can install the MIDlet suite into the J2ME Wireless Toolkit emulator or a real device.
4. **Run**. As in the simple development cycle, run your application and test for bugs.

In the full development cycle, the first step is identical to the simple development cycle. Editing source code is the same as always. The **Build** step is now incorporated in packaging.

The full development cycle includes two new steps, packaging and installing. Finally, running an installed application is different in important ways from running an application in the simple development cycle.

2.3.1 Package

The J2ME Wireless Toolkit automates the task of packaging a MIDlet suite. The end result of packaging is two files, a MIDlet descriptor and a MIDlet suite JAR. The descriptor is a small text file that contains information about the MIDlet suite. The JAR contains the class files and resources that make up the MIDlet suite. Devices can use the descriptor to learn about the application before downloading the entire JAR, an important consideration in a memory-lean, bandwidth-starved wireless world.

To ask the toolkit to package your MIDlet suite, choose **Project > Package > Create Package** from the KToolbar menu. The MIDlet suite descriptor and JAR are generated and placed in the `bin` directory of your project.

Packaging might involve additional steps. You can use a code obfuscator to shrink the size of the MIDlet suite JAR, a technique that is described later in this chapter. In addition, the J2ME Wireless Toolkit provides tools to allow you to cryptographically sign MIDlet suites. See Chapter 6, “Security and MIDlet Signing,” for more information.

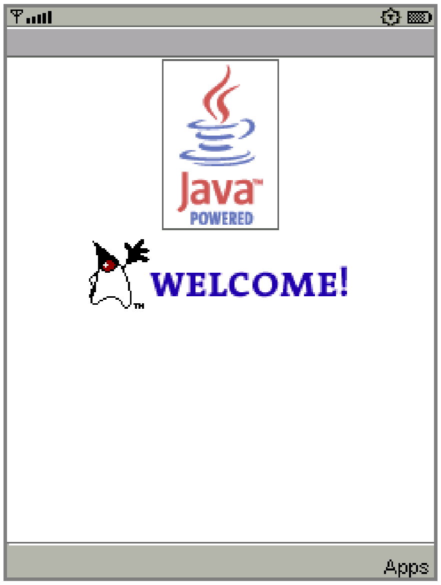
2.3.2 Install

To properly test a MIDlet suite, you should install it into the toolkit's emulator or a real device. When you press the **Run** button in KToolbar, the MIDlet suite is not installed into the emulator. Instead, the emulator runs the MIDlet classes directly.

The emulator also has the capability of installing applications into its memory in a process that resembles how applications are transmitted and installed on real devices. To install applications in the J2ME Wireless Toolkit emulator, choose **Project > Run via OTA**.

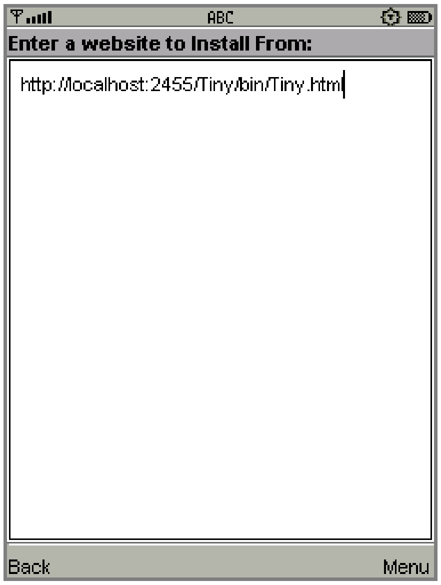
The emulator window pops open, but instead of running your MIDlet classes directly, this time the emulator shows the welcome screen of its Application Management Software (AMS). The emulator's AMS is an example of the type of software that real devices must have to manage MIDlet suites.

FIGURE 8 Emulator AMS welcome screen



Choose **Apps** to go to the main list of installed applications. Select **Install Application** and press the select button on the emulator. The emulator prompts you for the URL location of the application you want to install. The URL is already filled in for you.

FIGURE 9 URL prompt

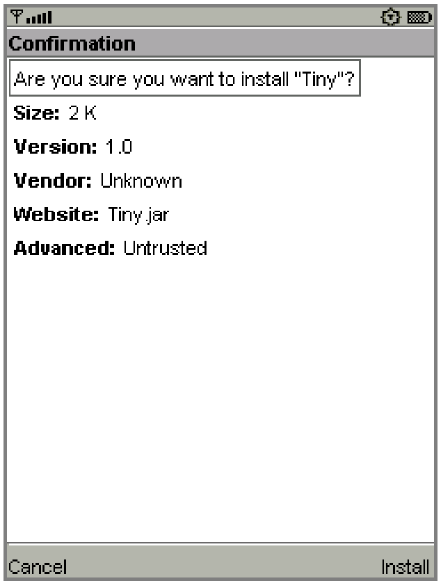


Enter a website to Install From:

http://localhost:2455/Tiny/bin/Tiny.html

Choose **Go** from the menu to begin the installation. The emulator shows a list of the applications it finds at the URL. Choose the only one and select **Install** from the menu. The emulator gives you one last chance to confirm your intentions.

FIGURE 10 Confirming the installation



Confirmation

Are you sure you want to install "Tiny"?

Size: 2 K

Version: 1.0

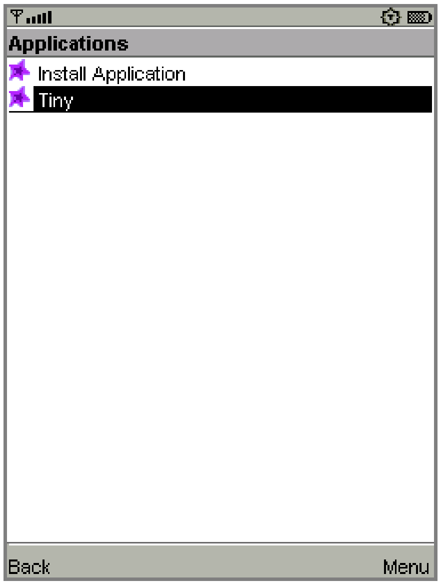
Vendor: Unknown

Website: Tiny.jar

Advanced: Untrusted

Choose **Install** again to finish the installation. You'll be returned to the emulator's installed list of applications, which now includes the application you just installed.

FIGURE 11 The application menu, again



Run via OTA is an extremely useful mechanism that makes it easy to install your MIDlet suite on the toolkit emulator. Some features *must* be tested using this technique, including the push registry and the installation of signed MIDlet suites.

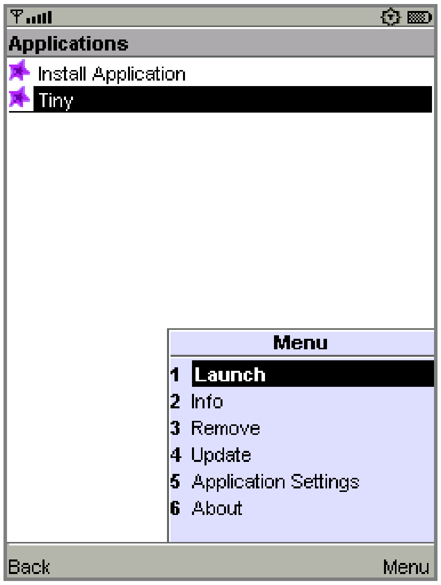
If you want to test your MIDlet suite on a real device, you'll need to install it first. How this happens depends heavily on the device you are using. There are two likely possibilities:

- You can deploy the application on a web server, then transmit the application from server to device using the Over the Air (OTA) protocol described in the MIDP 2.0 specification. This is most likely the same mechanism that users will encounter when they go to purchase or install your application.
- You might be able to transfer the MIDlet suite to the device using a Bluetooth, infrared, or serial connection. This is quite a bit simpler than running a web server, and although it won't give you any insights into the process of installing your application on the device via OTA, it allows you to see how your application performs on the device.

2.3.3 Run

Once the application is installed, running it is simple. Just choose the application from the list and choose **Launch** from the menu.

FIGURE 12 Launching the installed application



Running an application on a real device depends heavily on the device itself. Consult your device documentation for information.

2.4 Using an Obfuscator

An *obfuscator* is a tool that reduces the size of class files. MIDlet suites need to be compact, both to minimize download times and to comply with sometimes stringent limits on JAR size imposed by manufacturers or carriers. Using an obfuscator is one way (not the only way) that you can keep your MIDlet suite JAR small.

You can use an obfuscator in the packaging step of the development cycle. Although the J2ME Wireless Toolkit doesn't come with an obfuscator, it is already configured to use the ProGuard obfuscator. All you need to do is download ProGuard and put it in a place where the toolkit can find it.

ProGuard is published under the terms of the GNU General Public License (GPL). If you are comfortable with the terms of the license, you can download and use ProGuard free of charge.

Installing ProGuard in the J2ME Wireless Toolkit is straightforward:

1. Go to the ProGuard web site, `http://proguard.sourceforge.net/`.
2. Download the latest version.

3. Uncompress the `proguard.jar` file from the `lib` directory of the ProGuard installation to the `bin` directory of your J2ME Wireless Toolkit installation.

Once ProGuard is installed, you can use it by choosing **Project > Package > Create Obfuscated Package**.

In some cases you will need to provide a script file that controls how the obfuscator works. If you are loading classes using `Class.forName()`, for example, you need to tell ProGuard to leave the class names unchanged.

Create a script file using a text editor, then save it under the project's main directory. Consult the ProGuard documentation for information on script files. Next you need to tell the toolkit how to find this file. To do this, edit *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties`, where *{platform}* is the name of your underlying platform (most likely `Windows` or `Linux`). Add a line as follows:

```
obfuscate.script.name: scriptfile
```

Replace "scriptfile" with the name you used for the script file. You will need to quit and restart KToolbar for the change to take effect.

The J2ME Wireless Toolkit also includes support for RetroGuard. If you want to use RetroGuard, you'll need to download it separately and change the toolkit's configuration.

1. Go to the RetroGuard web site, `http://www.retrologic.com/retroguard-main.html`.

2. Download the latest version.

3. Extract the `retroguard.jar` file from downloaded zip file to the `bin` directory of your J2ME Wireless Toolkit installation.

4. Edit *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties` so that it uses the RetroGuard obfuscator plug-in:

```
obfuscator.runner.class.name: com.sun.kvem.ktools.RunRetro
obfuscator.runner.classpath: wtklib\\ktools.zip
```

Retroguard will be used when you create an obfuscated package.

To switch back to ProGuard, edit the obfuscator lines in the `ktools.properties` file as follows:

```
obfuscator.runner.class.name: com.sun.kvem.ktools.RunPro
obfuscator.runner.classpath: wtklib\\ktools.zip
```

If you want to use a different obfuscator, you'll have to implement an obfusctor plug-in yourself. See the *J2ME Wireless Toolkit Basic Customization Guide* for an example of how to implement an obfuscator plug-in.

2.5 Using a Debugger

A variation on running your application is running it with a debugger. A debugger allows you to monitor the running application more closely, set breakpoints, and examine variables.

You will need to supply your own debugger. You can use the `jdb` debugger from J2SE™ or another debugger of your choice.

Begin by choosing **Project > Debug** from the KToolbar menu. Enter the TCP/IP port number that the debugger will use to connect to the emulator. Click on **Debug**. The emulator begins running and waits for a connection from a debugger.

Start up your debugger and attach it to the port you specified. Make sure to set the remote debugger to run in remote mode and to use TCP/IP. For more information, consult the debugger's documentation.

Information about using `jdb` with the J2ME Wireless Toolkit is here:

Debugging MIDlets

`http://developers.sun.com/techtopics/mobility/midp/questions/jdb/`

2.6 Deploying Applications on a Web Server

The MIDP 2.0 specification includes the *Over The Air User Initiated Provisioning Specification*, which describes how MIDlet suites can be transferred over-the-air (OTA) to a device. You can test this type of scenario using the J2ME Wireless Toolkit emulator.

To deploy a packaged MIDP application remotely on a Web server:

1. Change the JAD file's MIDlet-Jar-URL property to the URL of the JAR file. The URL should be an absolute path. For example:

```
MIDlet-Jar-URL: http://your.server.com/midlets/example.jar
```

2. Ensure that the Web server uses the correct MIME types for JAD and JAR files:

   a. For MIDlet suite descriptors, map the `.jad` extension to the `text/vnd.sun.j2me.app-descriptor` MIME type.

   b. For MIDlet suite JARs, map the `.jar` extension to the `application/java-archive` MIME type.

The details of how to configure a Web server depend on the specific software used.

The emulator implements the device behavior during OTA provisioning. You can use the emulator to test and demonstrate the full provisioning process of MIDlet suites from a server to the device. All you need to do is launch the emulator's AMS. (You may already be familiar with the AMS if you have used KToolbar's **Run via OTA** option.

To launch the emulator's AMS, you have two options:

- In the Windows start menu, choose **Start > Programs > J2ME Wireless Toolkit 2.2 > OTA Provisioning**.
- From the command line, run:

```
{toolkit}\bin\emulator -Xjam
```

Now follow the AMS prompts to install your application. This process is very similar to the **Run via OTA** option described earlier in this chapter, except you will need to enter the URL of your own server to install your application.

CHAPTER 3

Working With Projects

In the last chapter, you learned how the J2ME Wireless Toolkit helps you with the MIDP development cycle. This chapter delves more deeply into the details of working with projects, including the following:

- Selecting the target APIs for a project
- Manipulating MIDlet suite attributes, including the list of MIDlets
- Understanding the project directory structure
- Including third-party libraries in a project

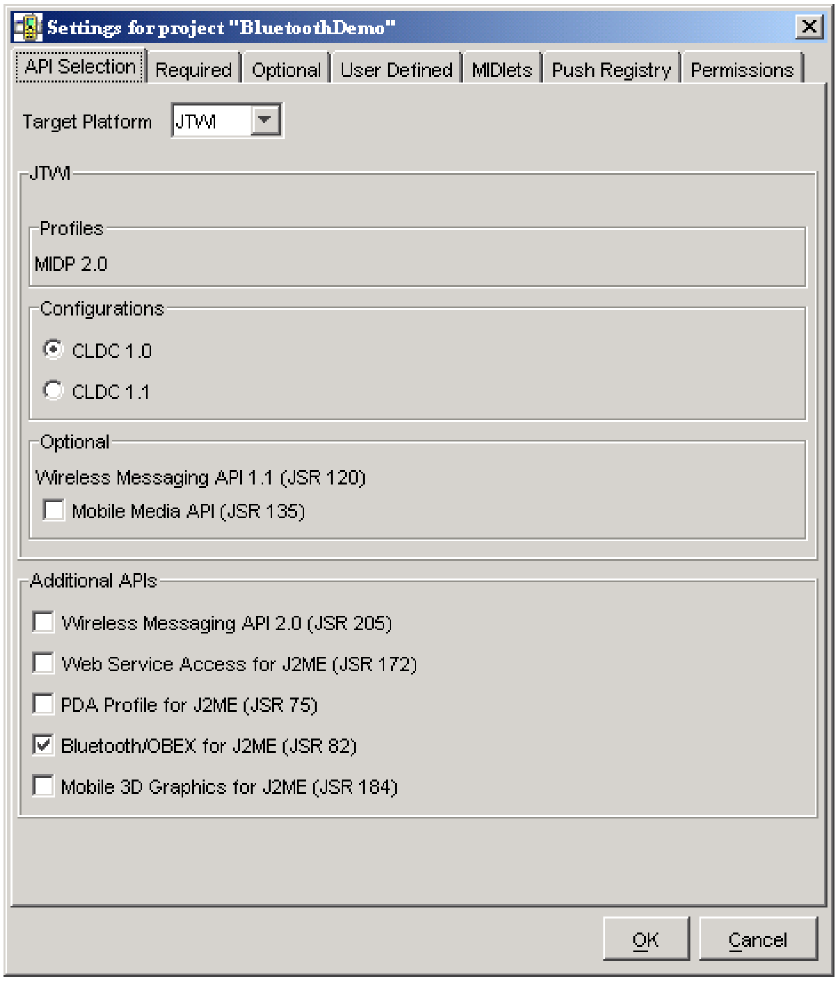
3.1 Selecting APIs

Each project is built against some set of APIs. The J2ME Wireless Toolkit supports many APIs; the full list is detailed in Chapter 1, "Introduction." The toolkit allows you to develop applications for some subset of APIs based on the type of devices you expect to run your software.

For example, even though the toolkit supports JSR 184, the Mobile 3D Graphics API, you might want to develop applications that don't make use of that API. The project's **API Selection** settings make it possible to choose only the APIs you want to use.

To see how this works, launch KToolbar and open a project. Then click on **Settings...** to bring up the following window:

FIGURE 13 The project settings window



Target Platform JTWI

JTWI

Profiles

MIDP 2.0

Configurations

● CLDC 1.0

○ CLDC 1.1

Optional

Wireless Messaging API 1.1 (JSR 120)

□ Mobile Media API (JSR 135)

Additional APIs

□ Wireless Messaging API 2.0 (JSR 205)

□ Web Service Access for J2ME (JSR 172)

□ PDA Profile for J2ME (JSR 75)

☑ Bluetooth/OBEX for J2ME (JSR 82)

□ Mobile 3D Graphics for J2ME (JSR 184)

On the **API Selection** tab, the **Target Platform** setting controls the appearance of the rest of the tab. Choose the setting that best suits your need, and tweak your selection with the controls below. For example, if you're developing applications for JTWI-compliant devices, choose **JTWI** from the combo box. Then use the controls below to specify which version of CLDC you want to use and whether MMAPI should be present.

The toolkit applies your selections when you compile your source code.

Note – API selections do not apply to the emulator. The emulator always supports all the available APIs. The API selections you make in the project settings apply only to building a project. In essence, the API selections choose which classpath the toolkit uses for compiling and preverifying your source files.

3.2 Changing MIDlet Suite Attributes

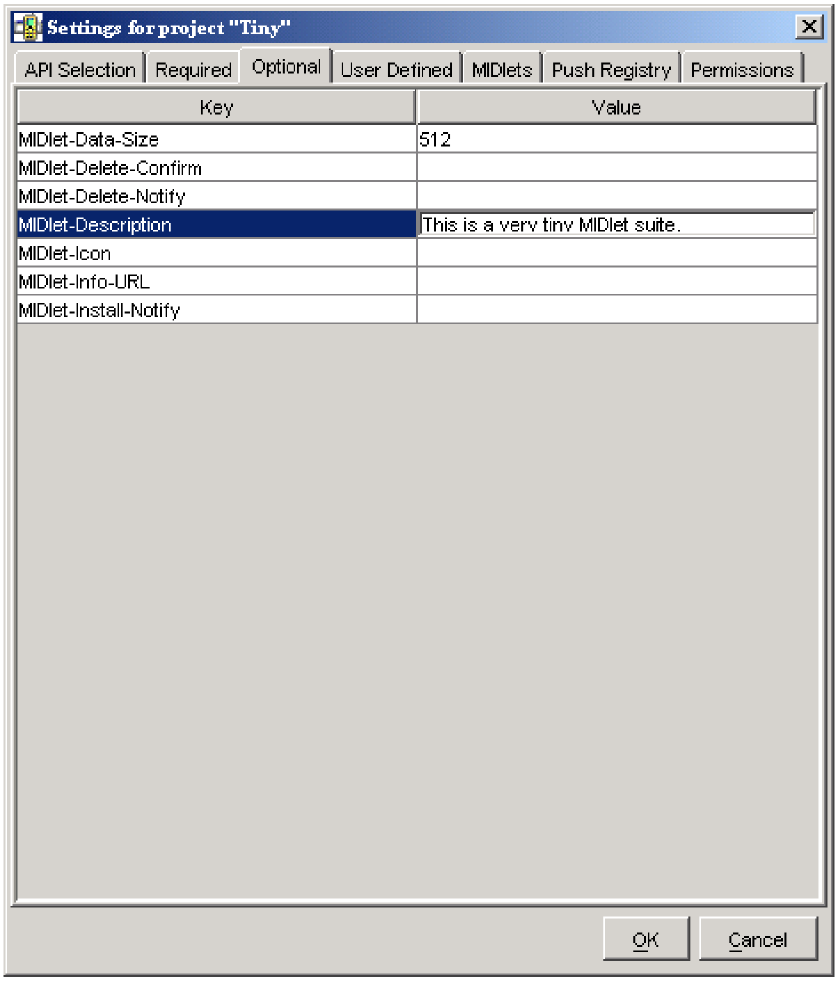
The project settings window also allows you to control the MIDlet suite attributes, which are stored in the descriptor as well as the manifest file of the MIDlet suite JAR.

To see the attributes, run KToolbar and open a project. Then click on **Settings...**. The three tabs that define attributes are **Required**, **Optional**, and **User Defined**.

Consult the MIDP 2.0 specification for the definitions of the required and optional attributes. The J2ME Wireless Toolkit takes care of most of the details. In the early stages of development, you might not have to worry about the attributes at all. Once your application is stable and you’re starting to think about deploying on real devices and going to market, you should come back and adjust the values.

To adjust a value on the **Required** or **Optional** tabs, click on the cell next to the attribute key you wish to change. Type in the new value.

FIGURE 14 Editing MIDlet suite attributes



Key	Value
MIDlet-Data-Size	512
MIDlet-Delete-Confirm	
MIDlet-Delete-Notify	
MIDlet-Description	This is a very tiny MIDlet suite.
MIDlet-Icon	
MIDlet-Info-URL	
MIDlet-Install-Notify	

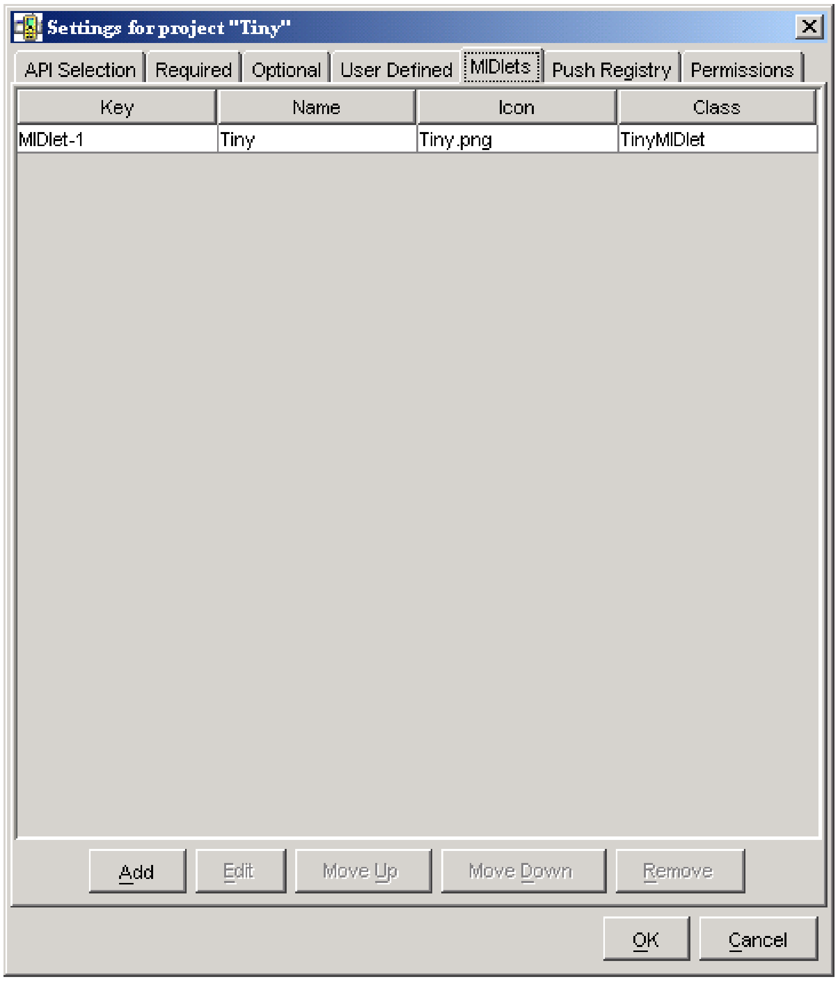
To create new user-defined attributes, click on the **User Defined** tab. Press **Add** and fill in the key name. You can then edit the attribute value by clicking in the value column next to the key, just as you would with required or optional attributes.

Select an attribute and click on **Remove** if you wish to remove the key and value entirely.

3.3 Manipulating MIDlets

The project settings also provide a way to add or modify the MIDlets that are contained in the current MIDlet suite project. To see how this works, start KToolbar and open an existing project. Click on **Settings...** and choose the **MIDlets** tab. You will see a list of all MIDlets in the project. If you just created a new project, the toolkit automatically fills in the first MIDlet entry.

FIGURE 15 The list of MIDlets in a project



Key	Name	Icon	Class
MIDlet-1	Tiny	Tiny.png	TinyMIDlet

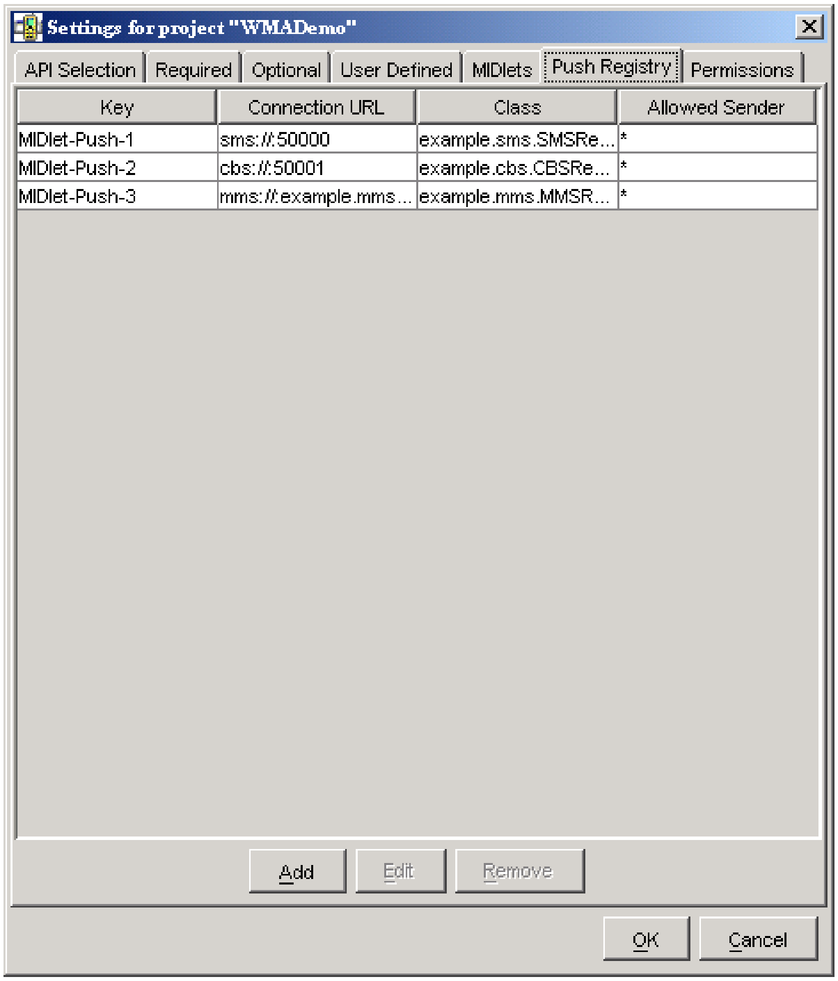
To add a new MIDlet, click on **Add**. Fill in the name, icon file name, and class name. You can leave the icon file name blank if you wish. To change values or remove MIDlet entries, use the **Edit** and **Remove** buttons.

The MIDlet names are presented to the user in the order shown when the MIDlet suite is launched. You can modify the order by selecting a MIDlet and clicking **Move Up** or **Move Down**.

3.4 Using the Push Registry

You can also use project settings to work with a MIDlet suite's push registry settings. Click on **Settings...** and choose the **Push Registry** tab.

FIGURE 16 Project push registry settings



Key	Connection URL	Class	Allowed Sender
MIDlet-Push-1	sms://:50000	example.sms.SMSRe...	*
MIDlet-Push-2	cbs://:50001	example.cbs.CBSRe...	*
MIDlet-Push-3	mms://:example.mms...	example.mms.MMSR...	*

To add an entry to the push registry, press **Add** and fill in values for the connection URL, MIDlet class, and allowed sender. To edit an entry, select the entry and press the **Edit** button. To remove a push registry entry, select it and press **Remove**.

If you do make push registry entries for your application, make sure you also enter the appropriate permissions. See Chapter 6, "Security and MIDlet Signing," for details.

3.5 Project Directory Structure

Projects have a standard directory structure. The project itself is represented by a directory in *{toolkit}*`\apps`. For example, the `demos` project is contained in *{toolkit}*`\apps\demos`. Inside a project directory, the following directories are used:

TABLE 2 Project directory structure

Directory	Description
`bin`	The MIDlet suite descriptor and JAR are placed in this directory when you package the project. This directory also contains the unpackaged manifest information and might include an HTML file that is used internally when you do **Run via OTA**.
`classes`	This directory is used by the toolkit to store compiled class files.
`lib`	Place a third-party library in this directory to include it in this project.
`res`	Images, sounds, and other resource files go in this directory. They are packaged into the root of the MIDlet suite JAR.
`src`	Place source files in this directory.
`tmpclasses`	This directory is used by the toolkit.
`tmpsrc`	This directory is used by the toolkit.

In addition, the project directory contains a `project.properties` file which contains information about the project.

If you want to remove temporary directories and files from the project, choose **Project > Clean** from the KToolbar menu.

3.6 Using Third-Party Libraries

The J2ME Wireless Toolkit allows you to incorporate third-party libraries in your applications. Using third-party libraries can cut down on your development time by providing functionality you don't wish to build yourself, but you should keep a close eye on the size of your MIDlet suite JAR.

When you use a third-party library in your application, your JAR will expand by the size of the third-party library. You can use an obfuscator to reduce the code size, and a good obfuscator will even eliminate whatever parts of the library you are not using. Even with the use of an obfuscator, a third-party library will probably still be larger than your own custom code, carefully written from scratch. You have to evaluate the tradeoff between reducing your development time and the size of your MIDlet suite JAR.

3.6.1 Third-Party Libraries for One Project

Any library files placed in your project's `lib` directory will be included in the building and packaging of your project. Libraries should be JAR or Zip files of Java classes.

For example, if you installed the J2ME Wireless Toolkit in `C:\WTK22` and your application is called `Tiny,` the class library would go in `C:\WTK22\apps\Tiny\lib`. When you build, run, debug, and package your project, the class files in the `lib` directory are used.

3.6.2 Third-Party Libraries for All Projects

Some devices have libraries available to all installed MIDlet suites. A manufacturer, for example, can make additional APIs available on all their devices. In this case, you want to be able to use these libraries when you build and test your application. You don't want the libraries to be included in your packaged MIDlet suite because you will be installing the MIDlet suite on devices where the library is already present.

You can accomplish this by placing libraries in the *{toolkit}*`\apps\lib` directory. For example, if you installed the J2ME Wireless Toolkit in `C:\WTK22,` you would place the class libraries in `C:\WTK22\apps\lib`. Libraries in this directory are available for all projects.

3.7 Configuring KToolbar

KToolbar includes some advanced configuration options. You can use these options by editing the *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties` file. To see the effects of your changes, restart KToolbar.

3.7.1 Setting the Application Directory

By default, the J2ME Wireless Toolkit stores applications in directories under *{toolkit}*`\apps`. You can change this by adding a line to `ktools.properties` of the following form:

`kvem.apps.dir:` *<application_directory>*

Any backslash ('\') characters in the directory's path should be preceded by another backslash. Also, the directory's path should not contain any spaces.

For example, to set the application directory to `D:\dev\midlets`, you would use:

```
kvem.apps.dir: D:\\dev\\midlets
```

3.7.2 Setting the javac Encoding Property

By default, the Java compiler uses the encoding set in the J2SE environment that you are running. For information on how to override the default source file encoding, see Appendix C, "Internationalization."

3.7.3 Working with Revision Control Systems

Using the `filterRevisionControl` property, you can configure KToolbar to recognize and ignore auxiliary files created by the SCCS, RCS and CVS revision control systems.

To recognize and ignore auxiliary files, include the following line in `ktools.properties`:

```
kvem.filterRevisionControl: true
```

As a result, you prevent KToolbar from treating revision control files as source and resource files. For example, KToolbar would treat a file named `src\SCCS\s.MyClass.java` as being an SCCS revision control file and not a Java source file.

CHAPTER 4

Using the Emulator

The J2ME Wireless Toolkit emulator simulates a MIDP device on your desktop computer. It is a convenient way to see how your application performs in a MIDP environment and gives you a tight development cycle that is entirely contained on your desktop computer.

The emulator does not represent a specific device, but it provides correct implementations of its supported APIs.

4.1 Emulator Skins

A *skin* is a thin layer on top of the emulator implementation that provides it with a certain appearance, screen characteristics, and input controls. The J2ME Wireless Toolkit comes with skins that represent different kinds of devices.

TABLE 3 Emulator skins

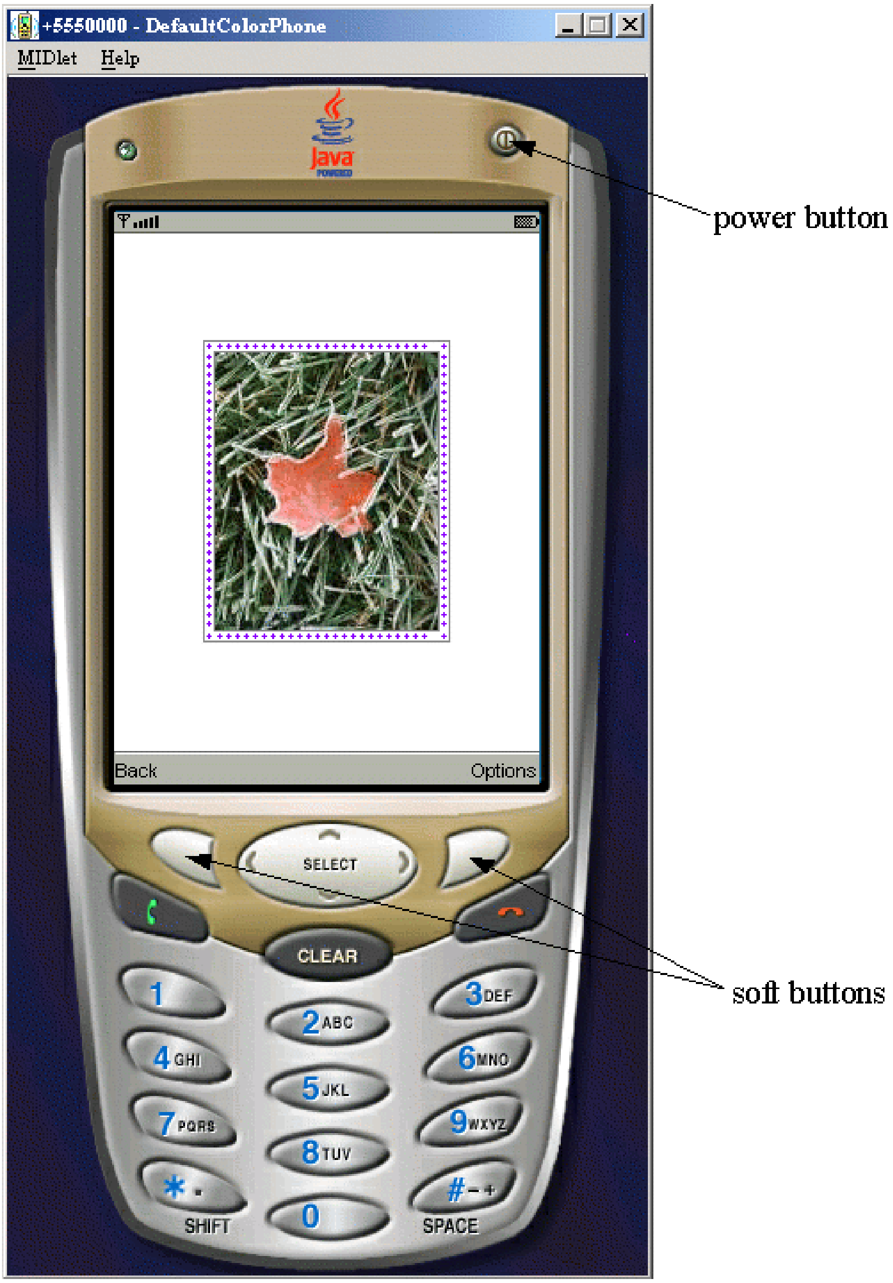
Name	Screen size	Canvas size	Colors	Input
DefaultColorPhone	240 x 320	240 x 289	4096	ITU-T
DefaultGrayPhone	180 x 208	180 x 177	4096	ITU-T
MediaControlSkin	180 x 208	180 x 177	4096	ITU-T
QwertyDevice	636 x 235	540 x 204	4096	Qwerty

You can create your own emulator skins if you wish. See the *Basic Customization Guide* for details.

4.2 Using the Emulator

The emulator looks and acts like a mobile phone. In this section you'll learn how to control the emulator. Although the description and figures are based on the DefaultColorPhone skin, all the skins operate in a similar way.

FIGURE 17 The `DefaultColorPhone` emulator skin



You can use the mouse to click on the buttons to press them. Most buttons also have keyboard shortcuts, which are generally easier to use. Keyboard numbers 0 through 9 correspond to the emulator's 0 through 9 buttons. Some less obvious keyboard shortcuts are in the following table.

TABLE 4 Keyboard shortcuts

Emulator button	Keyboard key
Left soft button	F1
Right soft button	F2
Power button	Esc
SELECT	Enter

Entering text works much as it does on many real devices. Press a number key multiple times to get the letter you want. For example, press the 5 key twice for the letter K. When you are entering text, the asterisk key (*) switches between upper case, lower case, numbers, and symbols. The indicator at the top of the screen shows your current mode. The pound key (#) enters a space.

Alternately, you can just type on your keyboard to enter text. Although this is convenient for entering text, you must remember that it is a convenience your users will most likely be lacking.

4.3 Setting Emulator Preferences

You can adjust the emulator settings to more closely resemble a specific device or to test your application under different resource conditions.

4.3.1 Network Proxies

The emulator uses your desktop network connection. For example, if the emulator runs a MIDlet that makes an HTTP connection, the emulator attempts to make the HTTP connection using the desktop's network setup.

If your development computer is behind a firewall, you might use a proxy server to make HTTP connections. If you're not sure, try examining your browser's settings to see if it uses proxy servers.

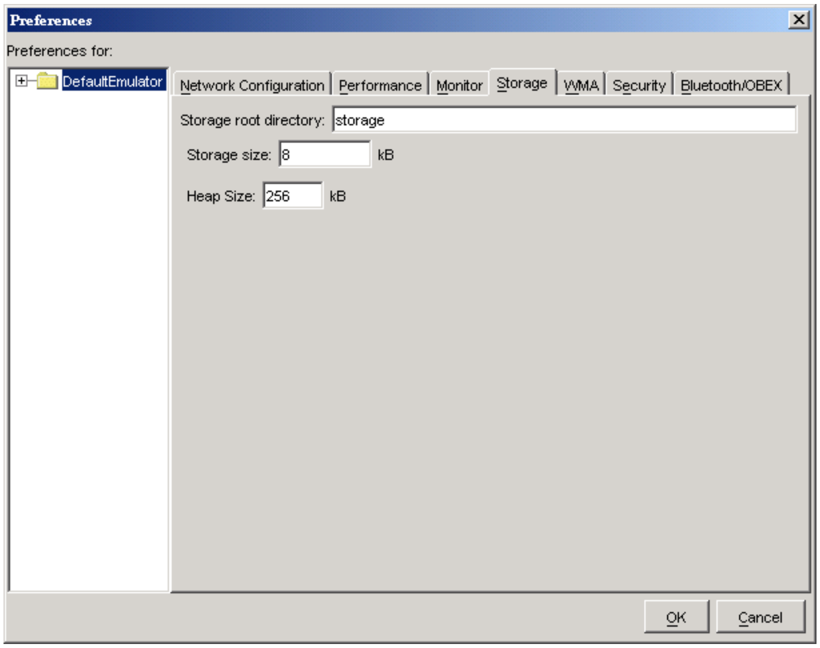
If you are using proxy servers, you need to configure the emulator to use the same proxy servers. To do this, choose **Edit > Preferences...**. On the **Network Configuration** tab, fill in the names and port numbers for the proxy server you wish to use. You can also select which version of HTTP you wish to use.

4.3.2 Heap Size

The *heap* is memory where your application's objects are stored. Many real devices have limited heap size. You can set a maximum heap size to more closely simulate the conditions on a real device. Choose **Edit > Preferences...** from the KToolbar menu and selecting the **Storage** tab. Fill in the maximum heap size in the **Heap Size** field. Remember, one kilobyte (kB) is 1024 bytes.

If you don't specify a heap size, the default is 2 megabytes.

FIGURE 18 The storage tab of the KToolbar preferences



Storage root directory: storage

Storage size: 8 kB

Heap Size: 256 kB

4.3.3 Storage and Cleaning

The emulator has persistent storage, which by default is placed in *{toolkit}*`\appdb\`*{skin}* in files with a `.db` extension. For example, the persistent storage for the `DefaultColorPhone` emulator skin is stored in *{toolkit}*`\appdb\DefaultColorPhone`. There is no limit on the size of the persistent storage.

Note – If multiple instances of the same emulator skin run simultaneously, the J2ME Wireless Toolkit will generate unique file paths for each one. For example, a second instance of `DefaultColorPhone` might have a file path name of *{toolkit}*`\appdb\DefaultColorPhone.1089982856218`.

The toolkit enables you to choose a different location for the storage files, and you can limit the size of the storage. This is useful if you wish to test your application's behavior when a small amount of persistent storage is available.

To adjust the persistent storage settings, choose **Edit > Preferences...** and click on the **Storage** tab. Enter the name of the directory you wish to use for persistent storage. You can only enter a relative path, and the directory you specify is created in the *{toolkit}*`\appdb` directory.

If you wish, you can enter a limit in kilobytes for the size of the persistent storage. Bear in mind that the storage implementation has some overhead in addition to the space your application uses. For example, if you enter 8 kB for the persistent storage size, 8192 bytes is available for both your application data and the storage overhead.

If you wish to erase the persistent storage of the emulator, choose **File > Utilities...** from the KToolbar menu. Click on the **Clean Database** button to wipe the persistent storage clean.

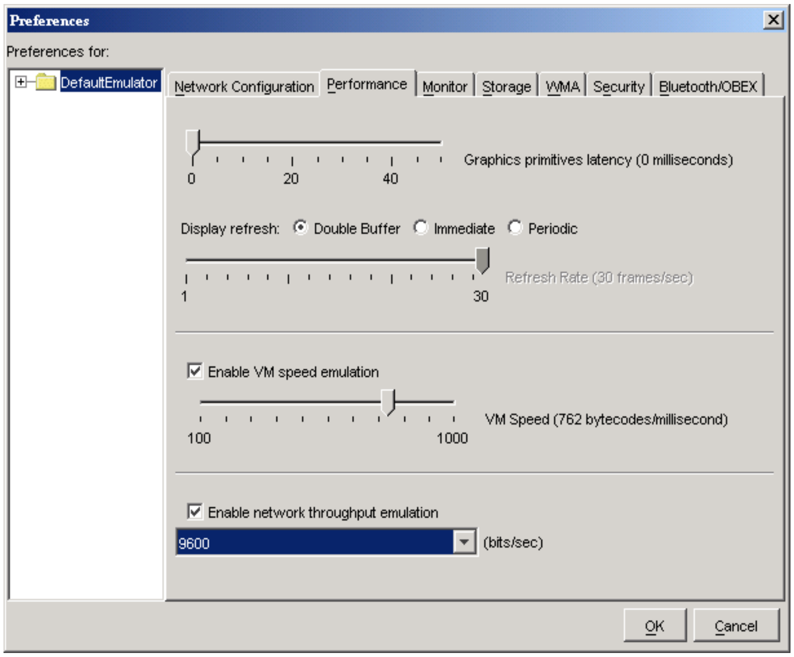
4.3.4 Adjusting Emulator Performance

The emulator uses many of the resources of your desktop computer, including its display and network connection. Compared to the desktop-based emulator, a real MIDP device usually has a slower processor, less memory, and a slower network connection, and might have a different type of display.

The J2ME Wireless Toolkit allows you to simulate the constrained environment of a real device. Although the emulator does not represent a real device, adjusting the performance settings gives you useful information about how your application performs under varying runtime conditions.

Choose **Edit > Preferences...** and click on the **Performance** tab.

FIGURE 19 Adjusting the emulator's performance



Preferences

Preferences for: DefaultEmulator

Graphics primitives latency (0 milliseconds)

Display refresh: ● Double Buffer ○ Immediate ○ Periodic

Refresh Rate (30 frames/sec)

☑ Enable VM speed emulation

VM Speed (762 bytecodes/millisecond)

☑ Enable network throughput emulation

9600 (bits/sec)

Adjust the **Graphics primitives latency** to have an effect on the amount of time that elapses between your application's calls to drawing methods in the `Graphics` class and when the drawing actually takes place.

To change the screen characteristics, choose one of the **Display refresh** types. If you choose a **Periodic** type, you will also need to specify the **Refresh Rate**.

To simulate the slower speed of a real device, check **Enable VM speed emulation** and choose the speed you want.

You can adjust the simulated network speed by checking **Enable network throughput emulation** and choosing a speed.

4.4 Pausing and Resuming

MIDlets have a life cycle that is defined by the MIDP specification. MIDlets can be started and stopped by the device. Furthermore, external events like incoming phone calls can cause the device to pause a MIDlet.

The emulator provides a simple mechanism to pause and resume running MIDlets. This is very helpful for testing your application's behavior when it is paused.

When the emulator is running, choose **MIDlet > Pause** from the emulator window's menu. The running MIDlet is paused and the screen displays an "Incoming Call..." message.

To resume the MIDlet's operation, choose **MIDlet > Resume** from the menu.

4.5 Running the Emulator Solo

During development, you will most often run the emulator directly from KToolbar by pressing the **Run** button or using the **Project > Run via OTA** feature. For testing or demonstrations, you might wish to run the emulator by itself. Several different approaches are described in this section. The program group created by the J2ME Wireless Toolkit installer includes several items that pertain to running the emulator by itself.

To run an application directly, which is analagous to pressing KToolbar's **Run** button, choose the **Run MIDP Application...** item. The toolkit prompts you to locate a MIDlet descriptor file on your local disk. Note that the corresponding MIDlet suite JAR must also be present.

To run the emulator's Application Management Software (AMS), choose the **OTA Provisioning** item, which is roughly analagous to KToolbar's **Run via OTA** feature. The emulator pops up with the AMS welcome screen, and you can install applications by typing in a URL.

To change the emulator's preferences, choose the **Preferences** item from the toolkit program group. This pulls up the same preferences window as choosing **Edit > Preferences...** from the KToolbar menu.

The J2ME Wireless Toolkit utilities are also accessible without running KToolbar. Just choose the **Utilities** item.

Finally, you can change which emulator skin is used by default. Choose the **Default Device Selection** item, and choose one of the available emulator skins. Next time you launch the emulator the selected skin is used.

You can also run the emulator from a command prompt. See Appendix B, "Command Line Reference," for more information.

4.6 Using Third Party Emulators

Third party companies, like device manufacturers and wireless carriers, sometimes create device emulators that are compatible with the J2ME Wireless Toolkit. You can gain experience running your application on a wider variety of implementations by installing additional emulators into the toolkit. The procedure is usually to unpack or install the third party emulator, then copy its directory into the `<toolkit>/wtklib/devices` directory. Next time you run KToolbar, the emulator is available.

A partial listing of some of the currently available emulators is available here:

`http://developers.sun.com/techtopics/mobility/midp/articles/emulators/`

CHAPTER 5

Monitoring Applications

The J2ME Wireless Toolkit provides several tools to monitor the behavior of your applications. These tools are helpful in debugging and optimizing your code.

- The *profiler* lists the frequency of use and execution time for every method in your application.
- The *memory monitor* shows the usage of memory while your application runs.
- The *network monitor* shows network data transmitted and received by your application. It supports many network protocols including HTTP, HTTPS, SMS, and CBS.
- *Tracing* outputs low-level information to the KToolbar console.

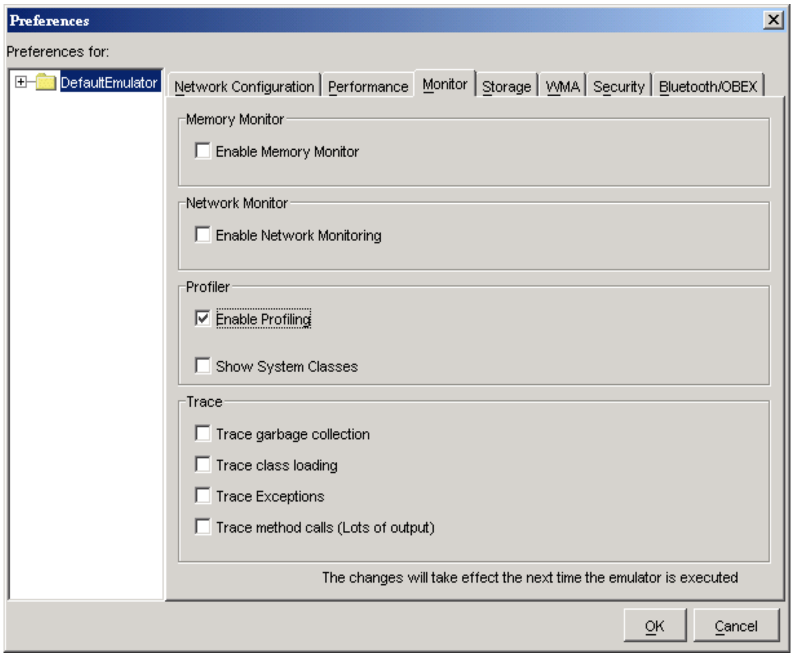
Note – Monitoring features might slow down the execution of your application.

5.1 Using the Profiler

The profiler keeps track of every method in your application. For a particular run, it figures out how much time was spent in each method and how many times each method was called. After you finish running your application and shut down the emulator, the profiler pops up, allowing you to browse through the method call information.

To turn on the profiler, choose **Edit > Preferences...** from the KToolbar menu. Click on the **Monitor** tab. If you are interested in seeing profiling information for all the system implementation methods, check **Show System Classes**. Otherwise, the profiler shows only system methods that contain calls to your application methods.

FIGURE 20 Turning on the profiler



Preferences

Preferences for: DefaultEmulator

Network Configuration | Performance | Monitor | Storage | WMA | Security | Bluetooth/OBEX

Memory Monitor

□ Enable Memory Monitor

Network Monitor

□ Enable Network Monitoring

Profiler

☑ Enable Profiling

□ Show System Classes

Trace

□ Trace garbage collection

□ Trace class loading

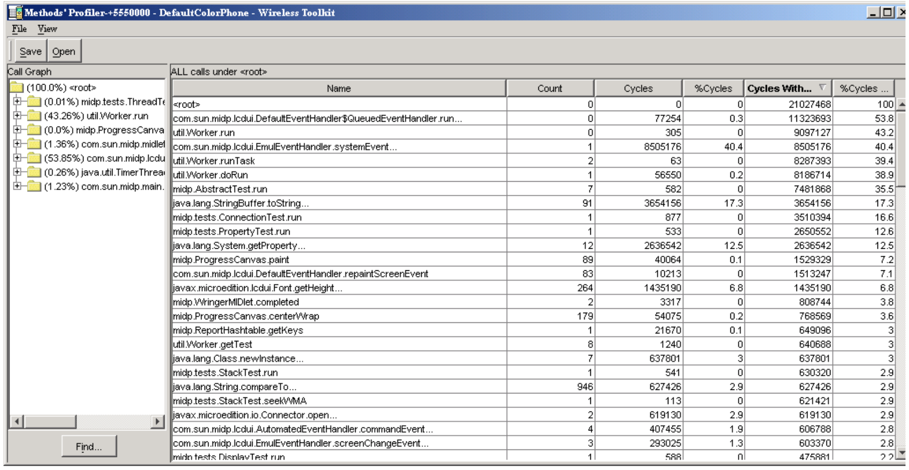
□ Trace Exceptions

□ Trace method calls (Lots of output)

The changes will take effect the next time the emulator is executed

Now run your application by clicking on the **Run** button. Interact with your application as you normally would. When you're finished, shut down the emulator. The profiler pops up with information about all the method calls in your application.

FIGURE 21 The method profiler



Methods' Profiler-+5550000 - DefaultColorPhone - Wireless Toolkit

Call Graph

- (100.0%) <root>
  - (0.01%) midp.tests.ThreadTe
  - (43.26%) util.Worker.run
  - (0.0%) midp.ProgressCanva
  - (1.36%) com.sun.midp.midlet
  - (53.85%) com.sun.midp.lcdu
  - (0.26%) java.util.TimerThrea
  - (1.23%) com.sun.midp.main.

ALL calls under <root>

Name	Count	Cycles	%Cycles	Cycles With...	%Cycles ...
<root>	0	0	0	21027468	100
com.sun.midp.lcdui.DefaultEventHandler$QueuedEventHandler.run...	0	77254	0.3	11323693	53.8
util.Worker.run	0	305	0	9097127	43.2
com.sun.midp.lcdui.EmulEventHandler.systemEvent...	1	8505176	40.4	8505176	40.4
util.Worker.runTask	2	63	0	8287393	39.4
util.Worker.doRun	1	56550	0.2	8186714	38.9
midp.AbstractTest.run	7	582	0	7481868	35.5
java.lang.StringBuffer.toString...	91	3654156	17.3	3654156	17.3
midp.tests.ConnectionTest.run	1	877	0	3510394	16.6
midp.tests.PropertyTest.run	1	533	0	2650552	12.6
java.lang.System.getProperty...	12	2636542	12.5	2636542	12.5
midp.ProgressCanvas.paint	89	40064	0.1	1529329	7.2
com.sun.midp.lcdui.DefaultEventHandler.repaintScreenEvent	83	10213	0	1513247	7.1
javax.microedition.lcdui.Font.getHeight...	264	1435190	6.8	1435190	6.8
midp.WringerMIDlet.completed	2	3317	0	808744	3.8
midp.ProgressCanvas.centerWrap	179	54075	0.2	768569	3.6
midp.ReportHashtable.getKeys	1	21670	0.1	649096	3
util.Worker.getTest	8	1240	0	640688	3
java.lang.Class.newInstance...	7	637801	3	637801	3
midp.tests.StackTest.run	1	541	0	630320	2.9
java.lang.String.compareTo...	946	627426	2.9	627426	2.9
midp.tests.StackTest.seekWMA	1	113	0	621421	2.9
javax.microedition.io.Connector.open...	2	619130	2.9	619130	2.9
com.sun.midp.lcdui.AutomatedEventHandler.commandEvent...	4	407455	1.9	606788	2.8
com.sun.midp.lcdui.EmulEventHandler.screenChangeEvent...	3	293025	1.3	603370	2.8
midp.tests.DisplayTest.run	1	588	0	475881	2.2

The profiler displays two types of information:

- Method relationships are shown in a hierarchical list, the **Call Graph**.

- The right side of the profiler shows the execution time and number of calls for each method and its descendants.

Note – The profiling values obtained from the emulator do not reflect actual values on a real device.

5.1.1 The Call Graph

The call graph shows a hierarchy of method calls. Methods that call other methods are shown as folders. Double-click on a method to open it and see the methods it calls. Methods that do not call any other method are shown as gray circles.

You can search for a particular class or method name. Click on **Find...** and fill in a name. The search is performed from the current selection in the call graph to the end. If you want to search the entire call graph, check **Wrap** before you click on the **Find** button.

As you click on different nodes in the call graph, the right side of the profiler shows details about the methods for that node.

5.1.2 Execution Time and Number of Calls

The right side of the profiler window displays detailed information about methods. You can see the method name, the number of times it was called, and the amount of time that the emualtor spent in the method. The execution time is described in four distinct ways:

- **Cycles** shows the amount of processor time spent in the method itself.
- **%Cycles** is the percentage of the total execution time that is spent in the method itself.
- **Cycles with Children** is the amount of time spent in the method *and* its called methods.
- **%Cycles with Children** shows the time spent in the method and its called methods as compared to the total execution time.

Click on any column to sort by that column. Click a second time to switch the sort between ascending and descending.

The right pane shows the methods contained in the currently selected node in the call graph. If you want to see every method, click on the **<root>** node in the call graph.

5.1.3 Saving and Loading Profiler Information

To save your profiler session, click on the **Save** button in the profiler window. Choose a file name.

To load a profiler session, choose **File > Utilities...** from the KToolbar menu. Click on **Open Session** in the **Profiler** box. When you select a file, the profiler window appears with all the session information.

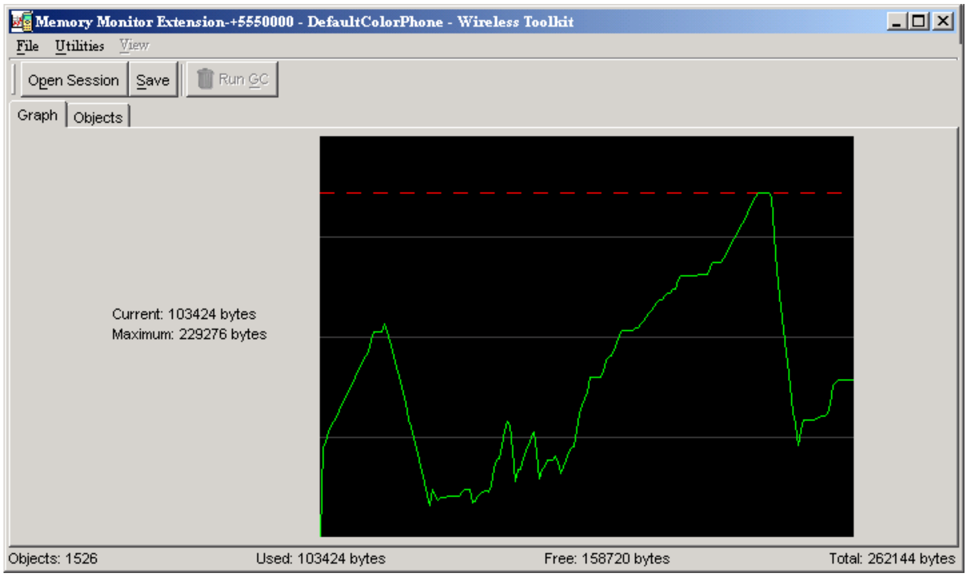
5.2 Using the Memory Monitor

Memory is scarce on many MIDP devices. The J2ME Wireless Toolkit includes a memory monitor that makes it easy to examine the memory usage of your application. You can see the total memory used by your application and a detailed listing of the memory usage per object.

To turn on the memory monitor, choose **Edit > Preferences...** from the KToolbar menu. Click on the **Monitor** tab. Check **Enable Memory Monitor**.

Next time you run the emulator, the memory monitor window pops up, displaying a graph of your application's memory usage over time. The memory monitor slows down your application startup because every object created is recorded.

FIGURE 22 The memory monitor graph


Memory Monitor Extension-+5550000 - DefaultColorPhone - Wireless Toolkit
File
Utilities
View
Open Session
Save
Run GC
Graph
Objects

Current: 103424 bytes
Maximum: 229276 bytes

Objects: 1526 Used: 103424 bytes Free: 158720 bytes Total: 262144 bytes

The memory monitor graph shows the following information:

- **Current**. The current amount of memory used by the application.

- **Maximum**. The maximum amount of memory used since program execution began, shown in the graph by a broken red line.
- **Objects**. The number of objects in the heap.
- **Used**. The amount of memory used.
- **Free**. The amount of unused memory available.
- **Total**. The total amount of memory available at startup.

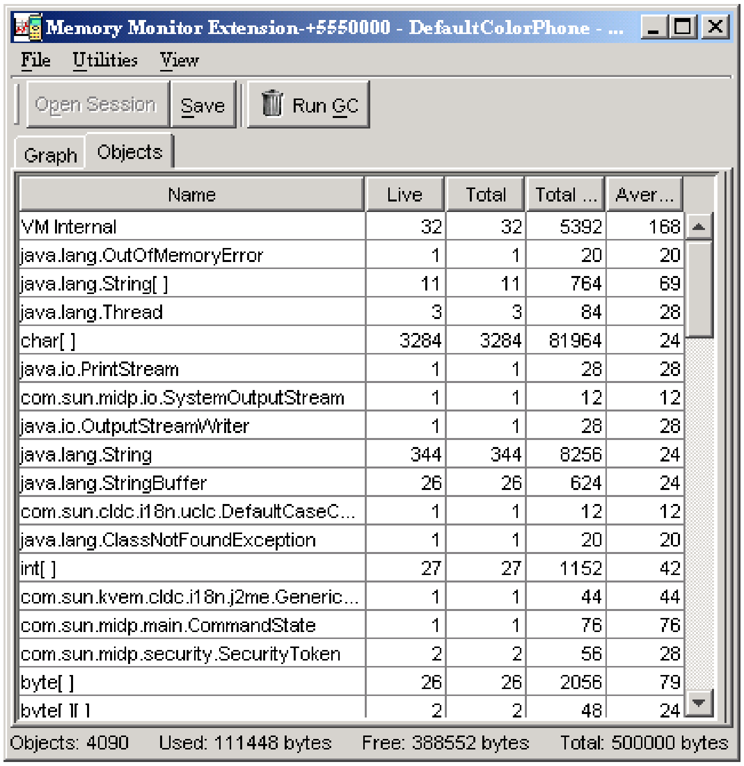
Remember, you can modify the heap size using the **Storage** tab of the KToolbar preferences. See Chapter 3, "Working With Projects," for details.

To request the system to perform a garbage collection, click on **Run GC**.

Note – The memory usage you observe with the emulator is not going to be exactly the same as memory usage on a real device. Remember, the emulator does not represent a real device. It is just one possible implementation of its supported APIs.

To see details about the objects in your application, click on the **Objects** tab in the memory monitor window.

FIGURE 23 The memory monitor objects display



Name	Live	Total	Total ...	Aver...
VM Internal	32	32	5392	168
java.lang.OutOfMemoryError	1	1	20	20
java.lang.String[ ]	11	11	764	69
java.lang.Thread	3	3	84	28
char[ ]	3284	3284	81964	24
java.io.PrintStream	1	1	28	28
com.sun.midp.io.SystemOutputStream	1	1	12	12
java.io.OutputStreamWriter	1	1	28	28
java.lang.String	344	344	8256	24
java.lang.StringBuffer	26	26	624	24
com.sun.cldc.i18n.uclc.DefaultCaseC...	1	1	12	12
java.lang.ClassNotFoundException	1	1	20	20
int[ ]	27	27	1152	42
com.sun.kvem.cldc.i18n.j2me.Generic...	1	1	44	44
com.sun.midp.main.CommandState	1	1	76	76
com.sun.midp.security.SecurityToken	2	2	56	28
byte[ ]	26	26	2056	79
byte[ ][ ]	2	2	48	24

Objects: 4090 Used: 111448 bytes Free: 388552 bytes Total: 500000 bytes

You'll see a table with the following columns:

- **Name**. The class name of the objects.
- **Live**. The number of instances. Some of these might be eligible for garbage collection.
- **Total**. The total number of objects that have been allocated since the application began.
- **Total Size**. The total amount of memory used by the objects.
- **Average Size**. The average object size, calculated by dividing the live instances into the total size.

Click on any column header to sort on that column.

You can search for a specific class name by choosing **View > Find...** from the memory monitor window menu.

5.2.1 Saving and Loading Memory Monitor Information

To save your memory monitor session, click on the **Save** button. Choose a file name.

To load a memory monitor session, choose **File > Utilities...** from the KToolbar menu. Click on **Open Session** in the **Memory Monitor** box. When you select a file, the memory monitor window appears with all the session information.

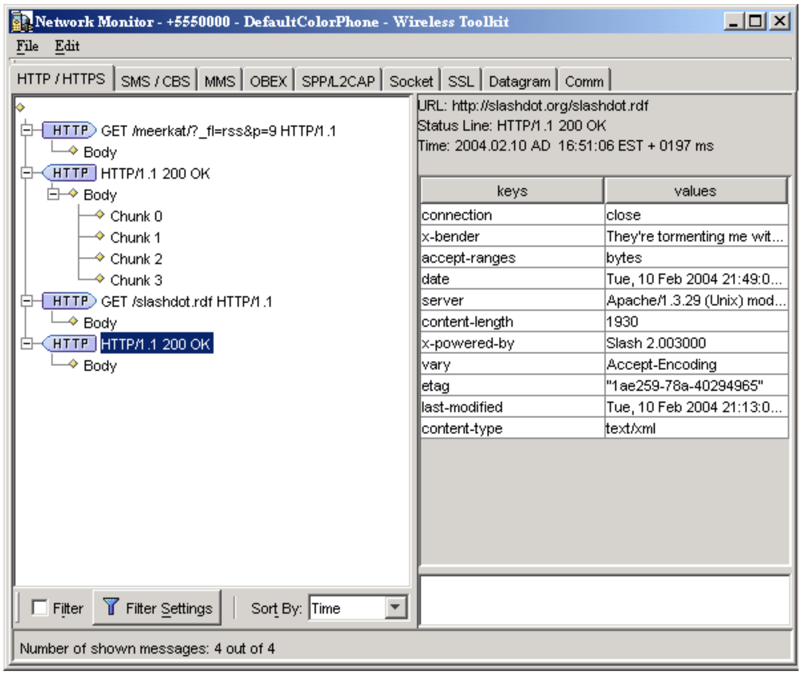
5.3 Using the Network Monitor

MIDP applications, at a minimum, are capable of HTTP network connections, but many other types of network connections are also possible. The network monitor provides a convenient way to see the information your application is sending and receiving on the network. This is helpful if you are debugging network interactions or looking for ways to optimize network traffic.

To turn on the network monitor, choose **Edit > Preferences...** from the KToolbar menu. Click on the **Monitor** tab. Check **Enable Network Monitoring**.

Next time you run the emulator, the network monitor window pops up.

FIGURE 24 The network monitor



```
HTTP GET /meerkat/?_fl=rss&p=9 HTTP/1.1
    Body
HTTP HTTP/1.1 200 OK
    Body
        Chunk 0
        Chunk 1
        Chunk 2
        Chunk 3
HTTP GET /slashdot.rdf HTTP/1.1
    Body
HTTP HTTP/1.1 200 OK
    Body
```

URL: http://slashdot.org/slashdot.rdf
Status Line: HTTP/1.1 200 OK
Time: 2004.02.10 AD 16:51:06 EST + 0197 ms

keys	values
connection	close
x-bender	They're tormenting me wit...
accept-ranges	bytes
date	Tue, 10 Feb 2004 21:49:0...
server	Apache/1.3.29 (Unix) mod...
content-length	1930
x-powered-by	Slash 2.003000
vary	Accept-Encoding
etag	"1ae259-78a-40294965"
last-modified	Tue, 10 Feb 2004 21:13:0...
content-type	text/xml

Number of shown messages: 4 out of 4

When your application makes any type of network connection, information about the connection is captured and displayed. The figure shows two HTTP requests and responses.

The display on the left side shows a hierarchy of messages and message pieces. Click on a message or a portion of a message to see details in the right side of the network monitor.

Message bodies are shown as raw hexadecimal values and the equivalent text.

Note – You can examine messages that are still in the process of being sent. Incomplete messages are indicated by bold highlighting in the message tree.

5.3.1 Filtering Messages

Filters are useful for examining some subset of the total network traffic. Filter settings are specific to the network protocol used.

Press the **Filter Settings** button to use the filter. Change the filter settings to suit your needs.

TABLE 5 Network monitor filter settings

Network Protocol	Filter Settings
HTTP/HTTPS	Enter text to match the various parts of HTTP messages: URL, status line, headers, or body. For example, entering "slashdot" in the **URL** field would filter to show only messages whose URL contained "slashdot".
SMS/CBS	You can specify a protocol, message type, and direction to match. Furthermore, you can enter text to match in the sender, receiver, and message content.
MMS	Enter text to match the direction, sender, receiver, and copied (cc) and blind copied (bcc) receivers. In addition, you can filter on the subject, content ID, content location, MIME type, and encoding.
OBEX/SPP/L2CAP	You can filter using the URL or header content.
Socket/SSL/ Datagram/Comm	Enter text to match in either the connection string (URL) or content.

When you are done entering filter settings, press **OK** to return to the network monitor. The **Filter** checkbox is checked, indicating that a filter is in use. To disable the filter and see all messages, uncheck the checkbox.

5.3.2 Sorting Messages

To arrange the message tree in a particular order, click on the **Sort By** combo box and choose a criteria.

- **Time**. Messages are sorted in chronological order of time sent or received.
- **URL**. Messages are sorted by URL address. Multiple messages with the same address are sorted by time.
- **Connection**. Messages are sorted by communication connection. Messages using the same connection are sorted by time. This sort type enables you to see messages grouped by requests and their associated responses.

Sorting parameters are dependent on the message protocol you choose. For instance, sorting by time is not relevant for socket messages.

5.3.3 Saving and Loading Network Monitor Information

To save your network monitor session, choose **File > Save** or **File > Save As...** from the network monitor window menu. Choose a file name.

To load a network monitor session, choose **File > Utilities...** from the KToolbar menu. Click on **Open Session** in the **Network Monitor** box. When you select a file, the network monitor window appears with all the session information.

5.3.4 Clearing the Message Tree

To remove all messages from the network monitor, choose **Edit > Clear** from the network monitor menu.

CHAPTER 6

Security and MIDlet Signing

MIDP 2.0 includes a comprehensive security model based on protection domains. MIDlet suites are installed into a protection domain which determines access to protected functions. The MIDP 2.0 specification also includes a recommended practice for using public key cryptography to verify and authenticate MIDlet suites.

For definitive information, consult the MIDP 2.0 specification. For an overview of MIDlet signing using the J2ME Wireless Toolkit, read this article:

Understanding MIDP 2.0's Security Architecture

`http://developers.sun.com/techtopics/mobility/midp/articles/permissions/`

If you need more background on public key cryptography, try this article:

MIDP Application Security 1: Design Concerns and Cryptography

`http://developers.sun.com/techtopics/mobility/midp/articles/security1/`

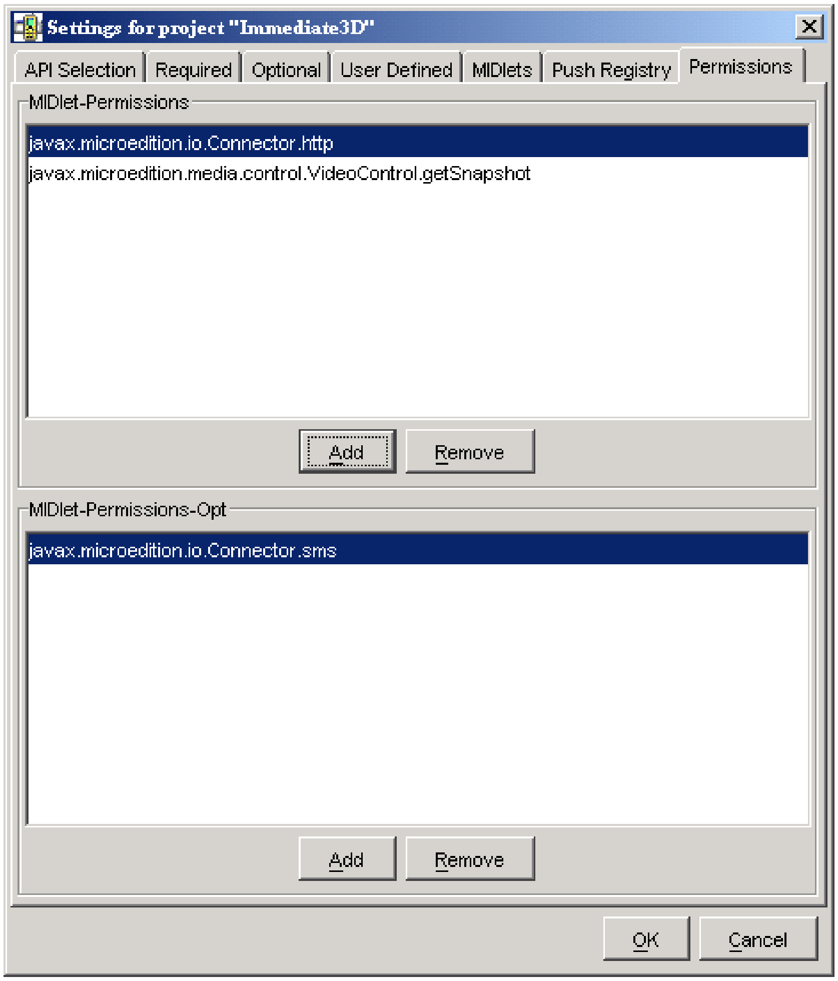
This chapter describes support for protection domains, permissions, and MIDlet signing in the J2ME Wireless Toolkit.

6.1 Permissions

MIDlets must have permission to perform sensitive operations, like connecting to the network. Permissions have specific names, and MIDlet suites can indicate their need for certain kinds of permissions through attributes in the MIDlet suite descriptor.

In the J2ME Wireless Toolkit, you can add these permission attributes to a project by clicking on the **Settings...** button in KToolbar. Select the **Permissions** tab. The **MIDlet-Permissions** box shows permissions which the MIDlet must possess, while the **MIDlet-Permissions-Opt** box contains permissions that the MIDlet would like to have but does not need absolutley.

FIGURE 25 MIDlet suite permissions



MIDlet-Permissions

javax.microedition.io.Connector.http
javax.microedition.media.control.VideoControl.getSnapshot

MIDlet-Permissions-Opt

javax.microedition.io.Connector.sms

To add a permission to either box, click on **Add** and choose the permission you want to add. To remove a permission, highlight it and click on **Remove**.

6.2 Protection Domains

The J2ME Wireless Toolkit includes four protection domains:

- MIDlets in the minimum domain are denied all permissions.
- The untrusted domain provides a high level of security for applications whose origins and authenticity cannot be determined. The user is prompted frequently when the application attempts a sensitive operation
- The trusted domain is a happy place for MIDlets where all permissions are granted.
- The maximum domain is equivalent to trusted.

When you press the **Run** button to run your application in the emulator, your code runs in the untrusted protection domain by default. You can change which protection domain is used by choosing **Edit > Preferences...** from the KToolbar menu. Select the **Security** tab. You can now choose the default protection domain from the combo box.

Things are different when you use **Run via OTA**. Your packaged MIDlet suite is installed directly into the emulator, and it is placed in a protection domain at installation time. The emulator uses public key cryptography to determine the protection domain of installed MIDlet suites.

If the MIDlet suite is not signed, it is placed in the untrusted domain. If the MIDlet is signed, it is placed in whatever protection domain is associated with the root certificate of the signing key's certificate chain.

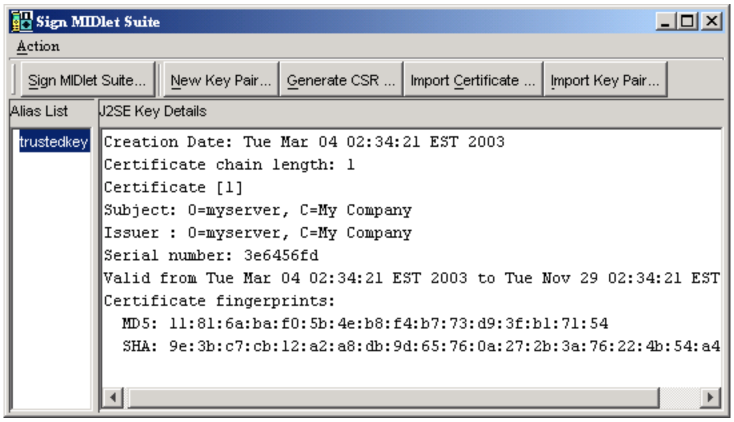
For example, suppose Respectable Software, a hypothetical company, wants to distribute a cryptographically signed MIDlet suite. Respectable Software buys a signing key pair from Super-Trustee, a hyptothetical certificate authority. Using the signing key, Respectable Software signs the MIDlet suite, and distributes their certificate with the MIDlet suite. When the MIDlet suite is installed on the emulator, or on a device, the implementation verifies Respectable's certificate using its own copy of Super-Trustee's root certificate. Then it uses Respectable's certificate to verify the signature on the MIDlet suite. Assuming everything checks out, the device or emulator installs the MIDlet suite into whatever protection domain is associated with Super-Trustee's root certificate.

The J2ME Wireless Toolkit provides tools to sign MIDlet suites, manage keys, and manage root certificates.

6.3 Signing a MIDlet Suite

To sign a MIDlet suite, you must package it first. Then choose **Project > Sign** from the KToolbar menu. The signing window appears.

FIGURE 26 The MIDlet suite signing window



```
Creation Date: Tue Mar 04 02:34:21 EST 2003
Certificate chain length: 1
Certificate [1]
Subject: O=myserver, C=My Company
Issuer : O=myserver, C=My Company
Serial number: 3e6456fd
Valid from Tue Mar 04 02:34:21 EST 2003 to Tue Nov 29 02:34:21 EST
Certificate fingerprints:
  MD5: 11:81:6a:ba:f0:5b:4e:b8:f4:b7:73:d9:3f:b1:71:54
  SHA: 9e:3b:c7:cb:12:a2:a8:db:9d:65:76:0a:27:2b:3a:76:22:4b:54:a4
```

Signing is very easy. Just select the key you want to use in the **Alias List** and click on the **Sign MIDlet Suite...** button.

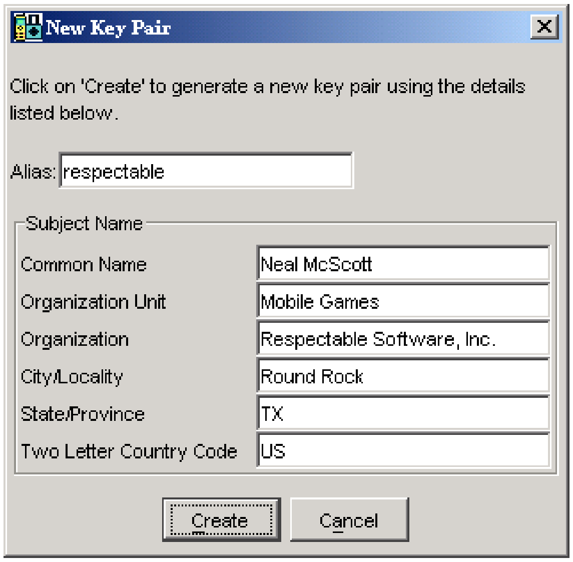
6.4 Managing Keys

The MIDlet signing window can also be used to manage keys.

6.4.1 Creating a New Key Pair

To create an entirely new key pair, click on **New Key Pair...** The toolkit prompts you for a key alias and information that will be associated with the key pair.

FIGURE 27 Creating a new key pair



Click on 'Create' to generate a new key pair using the details listed below.

Alias: respectable

Subject Name

Common Name	Neal McScott
Organization Unit	Mobile Games
Organization	Respectable Software, Inc.
City/Locality	Round Rock
State/Province	TX
Two Letter Country Code	US

After you click on **Create**, the toolkit prompts you to choose a protection domain. The connection between the key pair you just created and a protection domain might seem oblique, but it makes perfect sense:

- The toolkit creates a self-signed root certficate using the key pair you just created.
- The root certificate is added to the emulator's list of root certificates.
- The toolkit needs to associate the root certificate with a protection domain.

Now imagine what happens when you install a MIDlet suite signed with your new key:

- The implementation examines the certificate chain in the MIDlet suite descriptor. In this case the certificate chain is a single certificate, the self-signed root.
- The implementation tries to find the root of the certificate chain in its internal list. This succeeds because the root certificate was added when you create the key pair.
- The implementation considers the certificate valid and uses it to verify the signature on the MIDlet suite.
- The MIDlet suite is installed into whatever protection domain you picked.

6.4.2 Getting Real Keys

The ability to create a key pair and sign a MIDlet within the J2ME Wireless Toolkit environment is for testing purposes only. When you run your application on an actual device, you must obtain a signing key pair from a certificate authority recognized by the device.

The procedure for signing MIDlet suites with real keys works like this:

1. Generate a new key pair. In the J2ME Wireless Toolkit you can do this by pressing **New Key Pair...** in the MIDlet signing window, as described above.
2. Generate a Certificate Signing Request (CSR). Press **Generate CSR...** in the signing window. To change the location of the CSR file, enter a new path or press **Browse...** and choose a new file location. Press **Create** to write the CSR file. After the CSR is written, you'll see a message that indicates success.
3. Send the CSR to a certificate authority (CA). The CA will need more information from you to verify your identity. You will also need to pay the CA for the certificate they generate for you.
4. Once the CA has verified your identity and taken your money, you will receive a certificate from the CA that certifies your public key.
5. Import the certificate into the J2ME Wireless Toolkit by pressing **Import Certificate...** in the MIDlet signing window.

You can now use your own private key to sign MIDlet suites. The J2ME Wireless Toolkit will take care of the details of placing the signature and your certificate into the MIDlet suite.

6.4.3 Importing an Existing Key Pair

You may have keys in a J2SE keystore that you would like to use for MIDlet signing. In this case, you need to import your signing keys to the J2ME Wireless Toolkit so that you can sign your MIDlet suite. To do this from the MIDlet signing window, click on **Import Key Pair...** Select a file that contains a J2SE keystore. You will be prompted for the keystore passphrase. Then select the alias for the key pair you wish to import. Finally, you will need to select a protection domain for the key pair's root certificate.

6.4.4 Removing a Key Pair

To remove a key pair from the MIDlet signing window, select its alias and choose **Action > Delete Selection**.

6.5 Managing Certificates

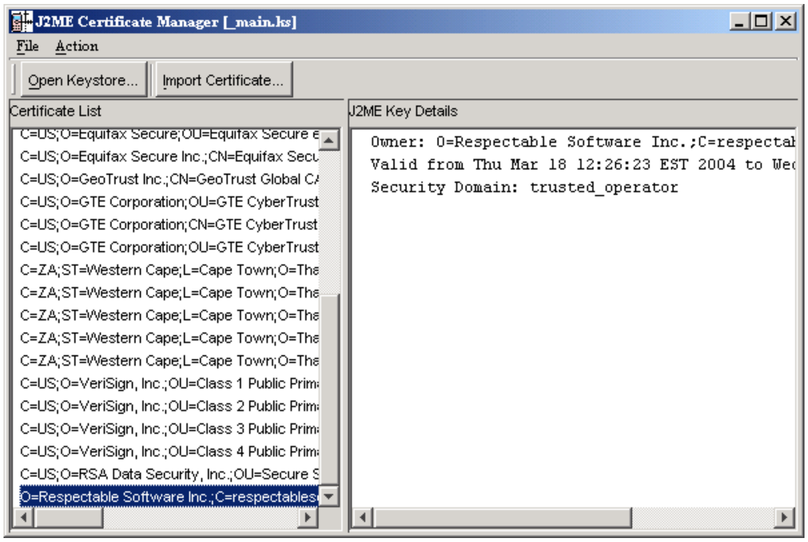
You've already heard about the emulator's list of root certificates. In this section, you'll learn how you can manage this list using the J2ME Wireless Toolkit.

Real devices have similar lists of root certificates, although they cannot usually be modified by the user. When you want to deploy your application on a real device, you'll have to use signing keys issued by a certificate authority whose root certificate is present on the device. Otherwise, the device will be unable to verify your application.

While you're developing your application, the toolkit's certificate management utility provides a convenient way to manipulate the emulator's list of root certificates for testing purposes.

Choose **File > Utilities...** from the KToolbar menu. Click on the **Manage Certificates** button to open up the certificate manager window.

FIGURE 28 The certificate manager



```
C=US;O=Equifax Secure;OU=Equifax Secure e
C=US;O=Equifax Secure Inc.;CN=Equifax Secu
C=US;O=GeoTrust Inc.;CN=GeoTrust Global CA
C=US;O=GTE Corporation;OU=GTE CyberTrust
C=US;O=GTE Corporation;CN=GTE CyberTrust
C=US;O=GTE Corporation;OU=GTE CyberTrust
C=ZA;ST=Western Cape;L=Cape Town;O=Tha
C=ZA;ST=Western Cape;L=Cape Town;O=Tha
C=ZA;ST=Western Cape;L=Cape Town;O=Tha
C=ZA;ST=Western Cape;L=Cape Town;O=Tha
C=ZA;ST=Western Cape;L=Cape Town;O=Tha
C=US;O=VeriSign, Inc.;OU=Class 1 Public Prim
C=US;O=VeriSign, Inc.;OU=Class 2 Public Prim
C=US;O=VeriSign, Inc.;OU=Class 3 Public Prim
C=US;O=VeriSign, Inc.;OU=Class 4 Public Prim
C=US;O=RSA Data Security, Inc.;OU=Secure S
O=Respectable Software Inc.;C=respectables
```

```
Owner: O=Respectable Software Inc.;C=respectab
Valid from Thu Mar 18 12:26:23 EST 2004 to We
Security Domain: trusted_operator
```

Each certificate is shown as a single line in the left part of the window, the **Certificate List**. When you click on a certificate, its details are shown in the right part of the window. You'll also see the certificate's associated protection domain.

6.5.1 Importing Certificates

You can import certficates either from certificate files or from J2SE keystore files.

To import a certificate from a file, click on **Import Certificate...** in the certificate manager window. After you locate the certificate file, choose which protection domain is associated with the certificate.

To import a certificate from a J2SE keystore, choose **Action > Import J2SE Certificate** from the menu in the certificate manager window. First, choose a protection domain for the certificate. Then select the keystore file and enter the keystore password. Finally, select the alias for the certificate you wish to import.

6.5.2 Removing Certificates

To remove a certificate from the list, select the certificate and choose **Action > Delete Selection**.

CHAPTER 7

Using the Wireless Messaging API

The J2ME Wireless Toolkit supports the Wireless Messaging API (WMA) with a sophisticated simulation environment. WMA 1.1 (JSR 120) enables MIDlets to send and receive Short Message Service (SMS) or Cell Broadcast Service (CBS) messages. WMA 2.0 (JSR 205) includes support for MMS messages as well.

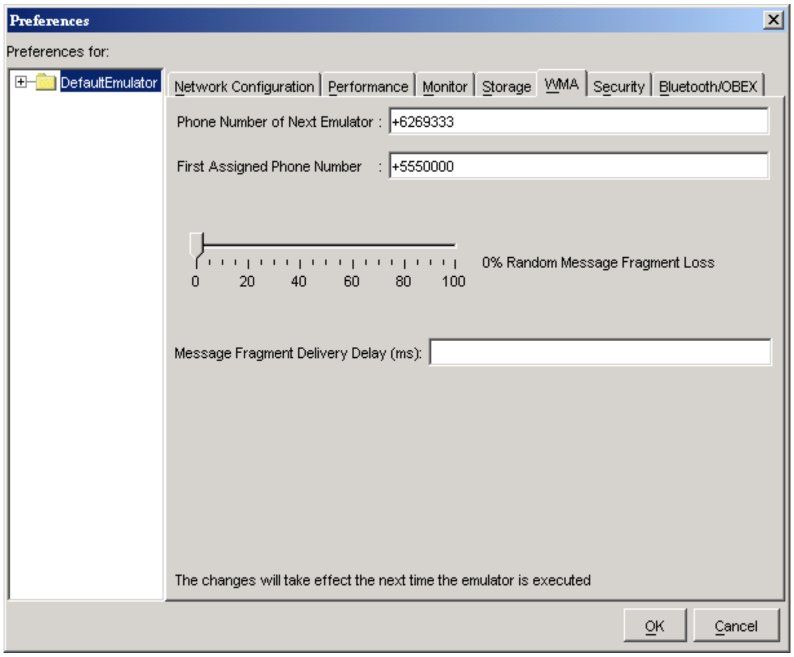
This chapter describes the tools you can use to develop WMA applications. It begins by showing how to configure the emulator's support of WMA. Next, you'll learn about the WMA console, a handy utility for testing WMA applications. The chapter concludes with a brief description of the network monitor's WMA support.

7.1 Setting Emulator Phone Numbers

Each running instance of the emulator has a simulated phone number that is shown in the title bar of the emulator window. The phone numbers are important because they are used as addresses for WMA messages. By default, the first emulator instance has a phone number of +555000. Subsequent instances of the emulator will have unique numbers in ascending order: +5550001, +5550002, +5550003, etc.

You can affect the assigned phone numbers by choosing **Edit > Preferences...** from the KToolbar menu and clicking on the **WMA** tab.

FIGURE 29 Setting WMA preferences



Phone Number of Next Emulator : +6269333

First Assigned Phone Number : +5550000

0% Random Message Fragment Loss

Message Fragment Delivery Delay (ms):

The changes will take effect the next time the emulator is executed

The **Phone Number of Next Emulator** field is just what it sounds like. If you fill in a number for this field, the next emulator instance will have that number.

If the **Phone Number of Next Emulator** is already in use, or if the field is blank, then the **First Assigned Phone Number** is used for the next emulator instance. Subsequent instances count up.

For example, suppose you fill in +6269333 for the **Phone Number of Next Emulator** and +5550000 for the **First Assigned Phone Number**. If you launch four emulator instances, their numbers will be +6269333, +5550000, +5550001, and +5550002.

7.2 Simulating an Unreliable Network

Long messages are sent by splitting them up, sending the fragments separately, and reassembling the fragments on the receiving end. You can simulate some of the hazards of the wireless network in the J2ME Wireless Toolkit. As before, choose **Edit > Preferences...** from the KToolbar menu and click on the **WMA** tab.

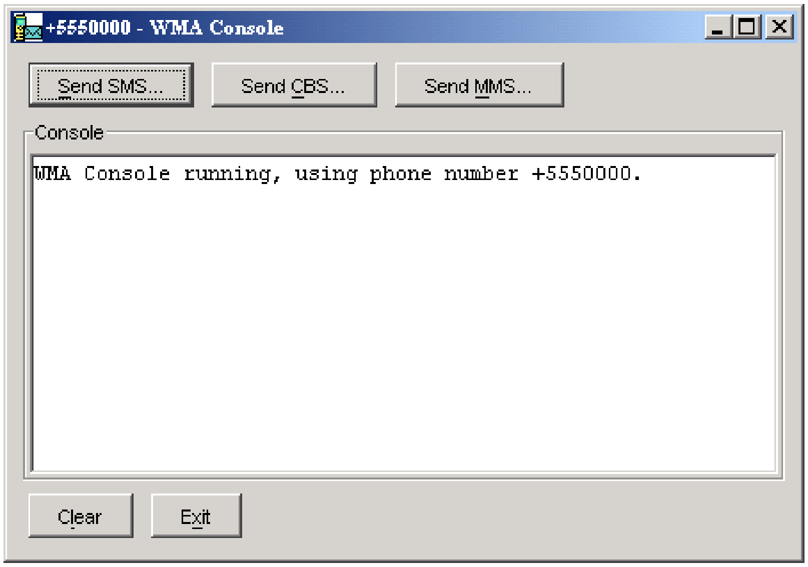
If you'd like the toolkit to lose some message fragments, adjust the **Random Message Fragment Loss** slider to the desired percentage. If you would like to simulate a delay between the time message fragments are sent and received, enter the delay in milliseconds in the **Message Fragment Delivery Delay** field.

7.3 Sending Messages With the WMA Console

The WMA console is a handy utility that allows you to send and receive messages. You can, for example, use the WMA console to send SMS messages to a MIDlet running on the emulator.

To launch the WMA console, choose **File > Utilities...** from the KToolbar menu. Click on **Open Console** in the **WMA** box.

FIGURE 30 The WMA console

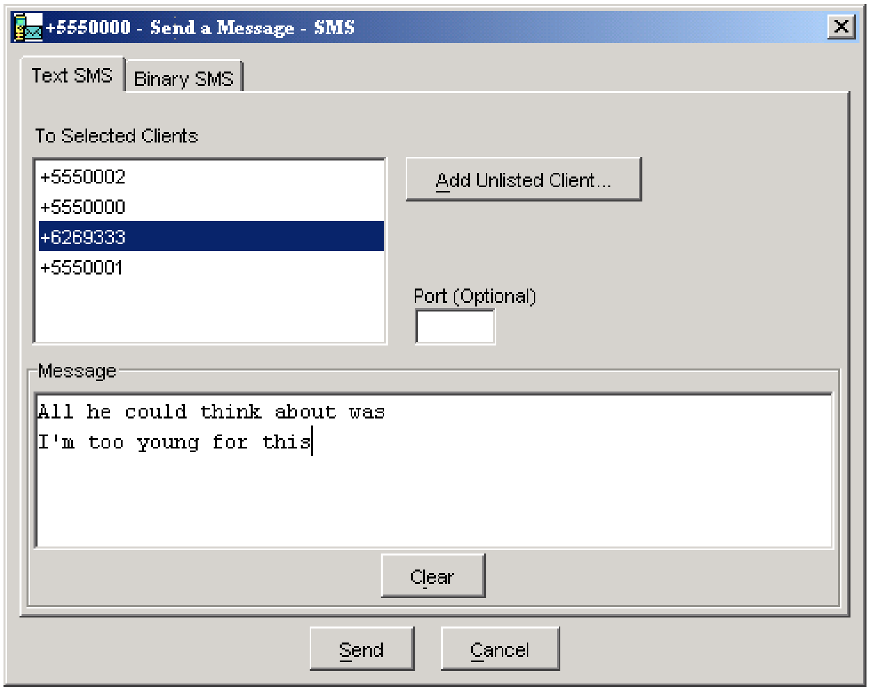


```
WMA Console running, using phone number +5550000.
```

7.3.1 Sending a Text SMS Message

To send a text SMS message, click on **Send SMS...** The send window pops up.

FIGURE 31 Sending a text message



To Selected Clients

+5550002
+5550000
+6269333
+5550001

Port (Optional)

Message

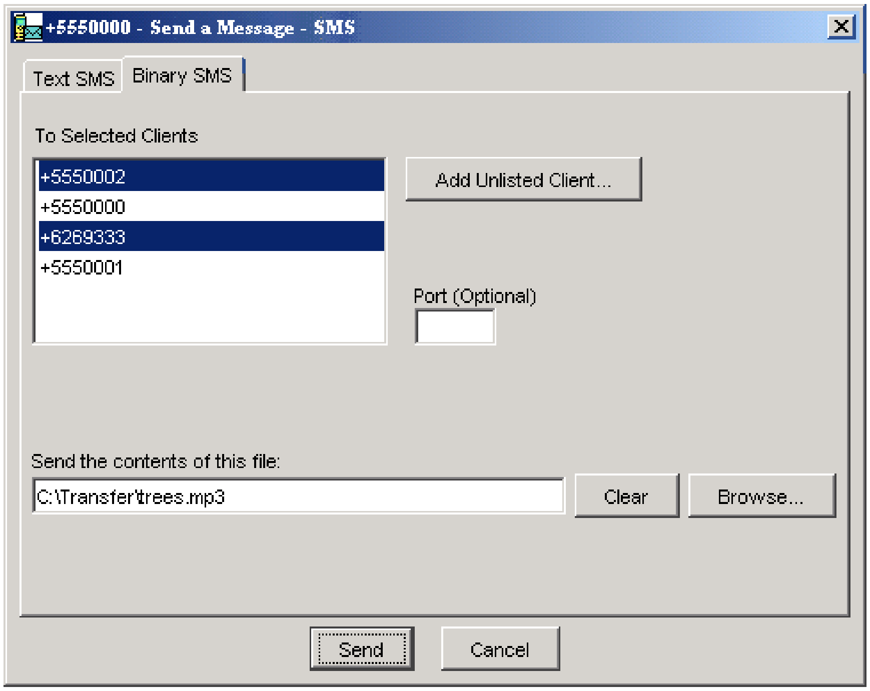
```
All he could think about was
I'm too young for this
```

The window automatically lists the phone numbers of all running emulator instances. Select a destination (Control-click to select multiple destinations) and enter a port number if you wish. Type your message and click **Send**.

7.3.2 Sending a Binary SMS Message

You can use the WMA console to send the contents of a file as a binary message. Click on **Send SMS...** to bring up the send window. Click on the **Binary SMS** tab.

FIGURE 32 Sending a binary message



To Selected Clients

+5550002
+5550000
+6269333
+5550001

Send the contents of this file:

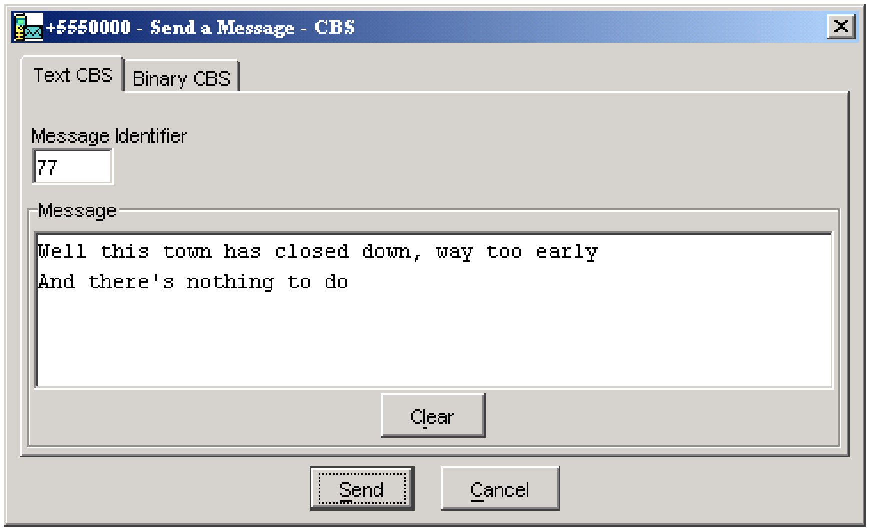
C:\Transfer\trees.mp3

Selecting recipients is the same as for sending text SMS messages. You can type in the path of a file directly, or click on **Browse...** to open up a file chooser.

7.3.3 Sending Text or Binary CBS Messages

Sending CBS messages is similar to sending SMS messages except that you don’t need to choose recipients. To send a text or binary CBS message, click on **Send CBS...** in the WMA console. The send window pops up.

FIGURE 33 Sending CBS messages



Message Identifier: 77

Message:

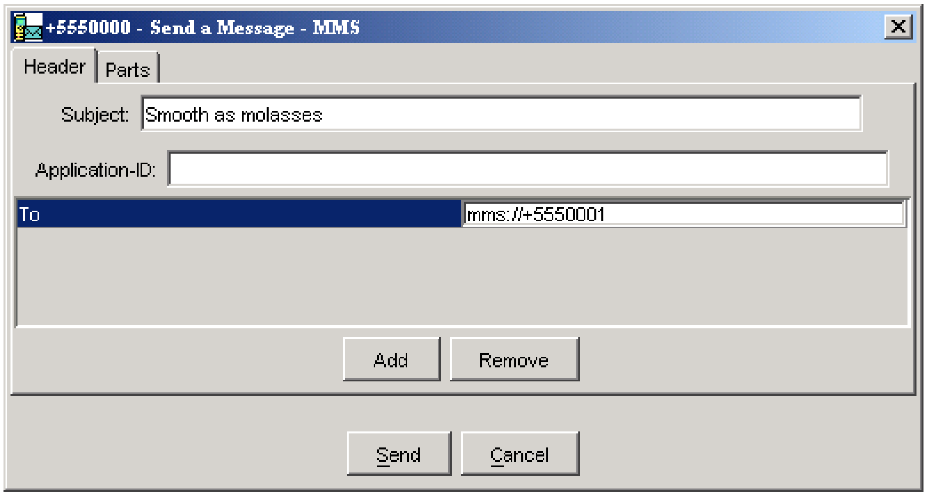
```
Well this town has closed down, way too early
And there's nothing to do
```

7.3.4 Sending MMS Messages

MMS messages consist of one or more files, usually images or sounds. MMS message can be sent to multiple recipients. To send an MMS message from the WMA console, click on the **Send MMS...** button.

The window for composing MMS messages has two tabs, one for recipients and one for content. Begin by filling in a subject and recipient. If you wish to add more recipients, click on the **Add** button. For example, to send a message to a running emulator whose number is +5550001, you would fill in the **To** line as `mms://+5550001`. To remove a recipient, first select its line, then click on **Remove**.

FIGURE 34 Adding recipients for an MMS message



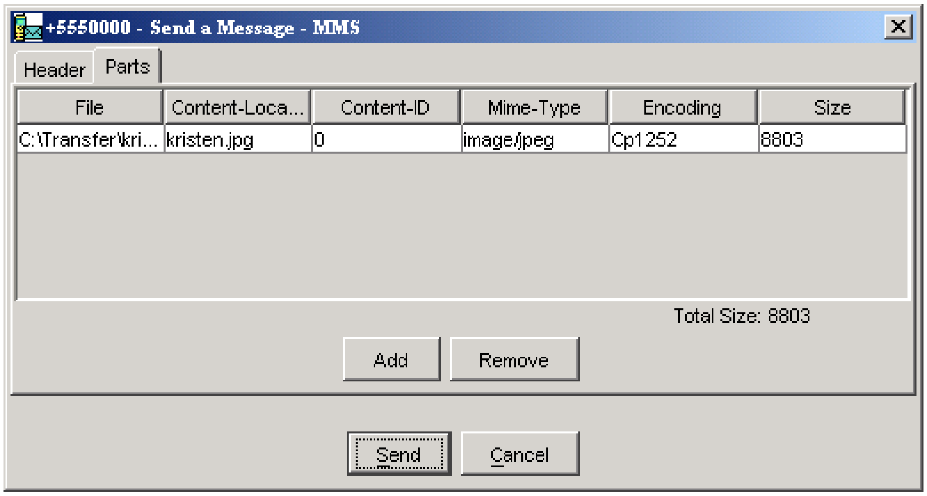
Subject: Smooth as molasses

Application-ID:

To mms://+5550001

To add media files to the message, click on the **Parts** tab. Click on **Add** to add a part to the message. To remove a part, select it and press **Remove**.

FIGURE 35 Adding parts to an MMS message



File	Content-Loca...	Content-ID	Mime-Type	Encoding	Size
C:\Transfer\kri...	kristen.jpg	0	image/jpeg	Cp1252	8803

Total Size: 8803

7.4 Receiving Messages in the WMA Console

The WMA console can also receive messages. If you look at the WMA console window, you'll see it has its own phone number in the title bar. You can send messages to the WMA console from your applications running on the emulator.

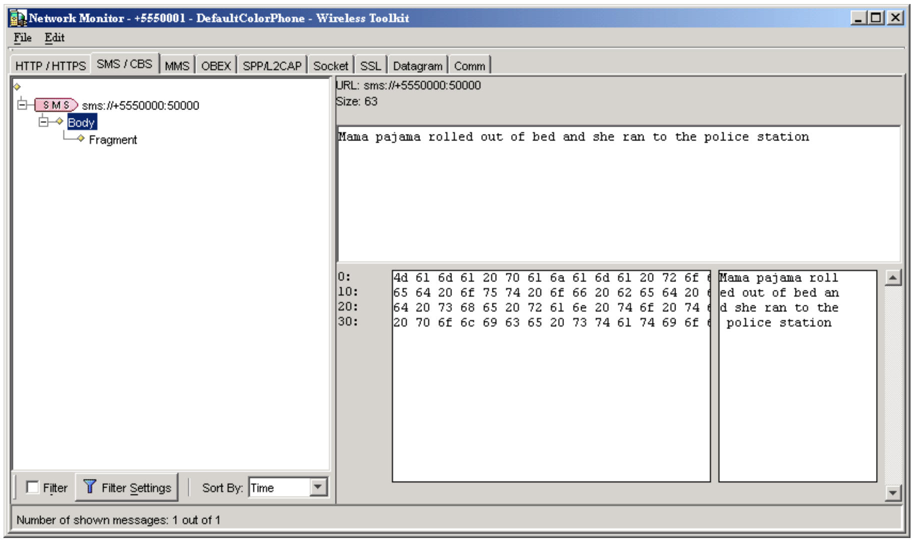
Received messages are shown in the WMA console's text area.

7.5 Using the Network Monitor with WMA

The network monitor was fully described in Chapter 5, "Monitoring Applications." You can use the network monitor to track WMA messages that are sent to or from the emulator.

Click on the **SMS/CBS** or **MMS** tabs to see WMA messages. Information about the messages and their fragments is shown in the left pane of the network monitor. Click on a message or message fragment to see its details in the right pane.

FIGURE 36 Using the network monitor to view a WMA message



URL: sms://+5550000:50000
Size: 63

```
Mama pajama rolled out of bed and she ran to the police station
```

```
0:      4d 61 6d 61 20 70 61 6a 61 6d 61 20 72 6f    Mama pajama roll
10:     65 64 20 6f 75 74 20 6f 66 20 62 65 64 20    ed out of bed an
20:     64 20 73 68 65 20 72 61 6e 20 74 6f 20 74    d she ran to the
30:     20 70 6f 6c 69 63 65 20 73 74 61 74 69 6f     police station
```

Number of shown messages: 1 out of 1

CHAPTER **8**

Using the Mobile Media API

The Mobile Media API (MMAPI) provides a standard API for rendering and capturing time-based media, like audio or video. The API was designed to be flexible with respect to the media formats, protocols, and features supported by various devices.

8.1 Supported Formats and Protocols

The emulator's MMAPI implementation supports the following media types:

TABLE 6 Supported MMAPI media formats

MIME Type	Description
audio/midi	MIDI files
audio/sp-midi	Scalable Polyphony MIDI
audio/x-tone-seq	MIDP 2.0 tone sequence
audio/x-wav	WAV PCM sampled audio
image/gif	GIF 89a (animated GIF)
video/mpeg	MPEG video
video/vnd.sun.rgb565	Video capture

8.2 Using MediaControlSkin

The J2ME Wireless Toolkit comes with an emulator skin, `MediaControlSkin`, that is focused on multimedia playback and control. The skin includes buttons with symbols representing play, stop, volume up and volume down, and other commands. To see the usefulness of `MediaControlSkin`, try it out with the `mmademo` demonstration application.

8.3 Media Capture

The J2ME Wireless Toolkit emulator supports audio and video capture. Audio capture is supported by using the capture capabilities of the system upon which the emulator runs.

Video capture is supported by simulating a camera input.

See the `mmademo` example application for details and source code that demonstrates how to capture audio and video.

8.4 Well-Behaved MIDlets

MIDlets have a life cycle that is defined in the MIDP specification. MIDlets can be paused by events such as incoming phone calls. A well-behaved MIDlet releases important device resources when it is paused and reallocates or restarts those resources when the MIDlet is resumed. In the MMAPI arena, any `Player`s that are rendering content should be stopped when a MIDlet is paused.

The J2ME Wireless Toolkit will print a message to the console if you pause a MIDlet and it does not stop its running `Player`s. You can test this feature yourself using the `PausingVideoTest` MIDlet in the `mmademo` demonstration application. See Appendix for details.

The warning message is printed once only for each running emulator.

CHAPTER 9

Working With Mobile 3D Graphics

This chapter provides a brief overview of working with 3D graphics content.

9.1 JSR 184 Overview

JSR 184 is a specification that defines the Mobile 3D Graphics (M3G) API for J2ME. This API provides 3D functionality in a compact package that's appropriate for CLDC/MIDP devices. The API provides two methods for displaying 3D graphics content. The *immediate mode* API makes it possible for applications to directly create and manipulate 3D elements. Layered on top of this is a *scene graph* API, also called *retained mode*, that makes it possible to load and display entire 3D scenes that have been designed ahead of time. Applications are free to use whichever approach is most appropriate or to use a combination of the retained mode and immediate mode APIs. The JSR 184 specification also defines a file format (`.m3g`) for scene graphs.

For more information, consult the JSR 184 specification:

`http://jcp.org/en/jsr/detail?id=184`

JSR 184 provides a standard API for CLDC/MIDP devices, enabling a new generation of 3D applications. The immediate mode API, in turn, is compatible with OpenGL ES, a standard lightweight API for 3D graphics. See `http://khronos.org/` for more information on OpenGL ES.

9.2 Immediate Mode

Immediate mode is appropriate for applications that generate 3D graphics content algorithmically, like scientific visualizations or statistical graphs. The application creates 3D objects and manipulates them directly.

For an example of immediate mode, see the `Life3D` MIDlet in the `Demo3D` example application.

9.3 Retained Mode

Most applications, particularly games, will use the retained mode or scene graph API. In this approach, a graphic designer or artist uses 3D modeling software to create a scene graph. The scene graph is saved in the JSR 184 file format. The scene graph file is bundled with the application. At runtime, the application uses the scene graph API to load and display the file.

Applications can manipulate parts of a loaded scene graph to animate characters or create other effects. The basic strategy is to do as much work as possible in the modeling software. At runtime, the application can grab and manipulate parts of the scene graph, which can also include paths for animation or other effects.

For an example of retained mode, see the `retainedmode` MIDlet in the `Demo3D` example application.

9.4 Trading Quality for Speed

One of the challenges of MIDP development is the constrained environment of typical devices. Compared to desktop computers, MIDP devices have slow processors and little memory. These challenges extend into the arena of 3D graphics. To accomodate a wide variety of implementations, the JSR 184 specification provides various mechanisms to make the display of a 3D scene as efficient as possible.

One approach is *scoping*, a technique where you tell the 3D graphics implementation when objects are not going to interact with each other. For example, if you defined a scene graph for a house, you could use scoping to specify that the light in the basement doesn't affect the appearance of the bedroom on the second floor. Scoping makes the implementation's job easier by reducing the number of calculations required to show a scene.

In general, however, the best way to improve the rendering speed of 3D scenes is to make some compromises in quality. The Mobile 3D Graphics API includes *rendering hints* so that applications can suggest how the implementation can compromise quality to improve rendering speed.

9.5 Creating Mobile 3D Graphics Content

Most mobile 3D applications will use scene graphs in resource files to describe objects, scenes, and characters. Usually it is not programmers but graphic designers or artists who create the scene graphs, using standard 3D modeling tools.

Several vendors offer tools for authoring content and converting files to the JSR 184 format. Superscape (`http://superscape.com/`) is one such vendor.

Because it is relatively difficult to create and manipulate 3D graphics content in an application using the immediate mode API, most applications rely as much as possible on a scene graph file. By putting as much as possible into the scene graph file at design time, the application's job at runtime will be considerably simplified.

CHAPTER 10

Using the PIM and FileConnection APIs

The J2ME Wireless Toolkit supports JSR 75, the PDA Optional Packages for the J2ME Platform. JSR 75 includes two independent APIs:

- The `FileConnection` optional package allows MIDlets access to a local device file system.
- The Personal Information Management (PIM) optional package includes APIs for manipulating contact lists (address book), calendars, and to-do lists.

This chapter describes how the J2ME Wireless Toolkit implements the `FileConnection` and PIM APIs.

10.1 The `FileConnection` API

On a real device, the `FileConnection` API typically provides access to files stored in the device's memory or on a memory card.

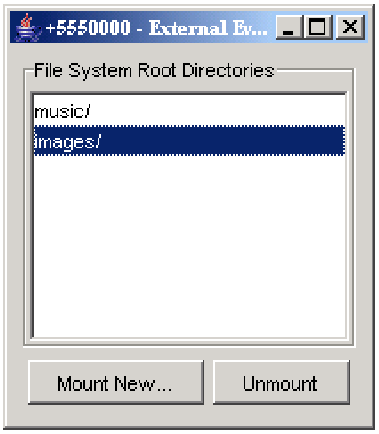
In the J2ME Wireless Toolkit emulator, the `FileConnection` API allows MIDlets to access files stored on your desktop computer's hard disk.

The files that can be accessed using `FileConnection` are stored in subdirectories of *{toolkit}*`\appdb\`*{skin}*`\filesystem`. For example, the `DefaultColorPhone` emulator skin comes with a root directory installed called `root1`, which contains a file called `Readme`. The full path of the file is *{toolkit}*`\appdb\DefaultColorPhone\filesystem\root1\Readme`.

Note – If multiple instances of the same emulator skin run simultaneously, the J2ME Wireless Toolkit will generate unique file paths for each one. For example, a second instance of `DefaultColorPhone` might have a file system path name of *{toolkit}*`\appdb\DefaultColorPhone.1089982856218\filesystem`.

Each subdirectory of `filesystem` is called a *root*. The J2ME Wireless Toolkit provides a mechanism for managing roots. While the emualtor is running, choose **MIDlet > External events** from the emulator window's menu. You'll see a utility window for adding and removing roots.

FIGURE 37 Managing filesystem roots



The mounted roots and their contents are available to applications using the `FileConnection` API.

To add a new root directory, click on **Mount New...** and fill in a name for the directory. To make a directory inaccessible to the `FileConnection` API, select it in the list and click **Unmount**.

10.2 The PIM API

The J2ME Wireless Toolkit emulator stores contact, calendar, and to-do information in standard files on your desktop computer's hard disk. All information is stored in *{toolkit}*`\appdb\`*{skin}*`\pim`. This directory is shared by all running emulators. Lists are stored in subdirectories of the `contacts`, `events`, and `todo` directories. For example, a contact list called Contacts is contained in *{toolkit}*`\appdb\`*{skin}*`\pim\contacts\Contacts`.

Inside the list directory, items are stored in vCard or vCalendar format (see `http://www.imc.org/pdi/`). Contacts are stored in vCard format, while calendar and to-do items are both stored in vCalendar format.

CHAPTER 11

Using the Bluetooth and OBEX APIs

The J2ME Wireless Toolkit emulator supports JSR 82, the Java APIs for Bluetooth. JSR 82 includes two independent APIs:

- The Bluetooth API provides an interface to Bluetooth wireless networking, including device discovery and data exchange.
- The OBEX API allows applications to use the Object Exchange (OBEX) protocol over Bluetooth or other communication channels.

This chapter describes how the J2ME Wireless Toolkit implements the Bluetooth and OBEX APIs.

11.1 Bluetooth Simulation Environment

The J2ME Wireless Toolkit emulator allows you to develop and test application that use Bluetooth without having actual Bluetooth hardware. The toolkit simulates a Bluetooth environment for running emulators. Multiple emulator instances can discover each other and exchange data using the Bluetooth API.

For an example, see the documentation of `BluetoothDemo` in Appendix A, "Application Demonstrations."

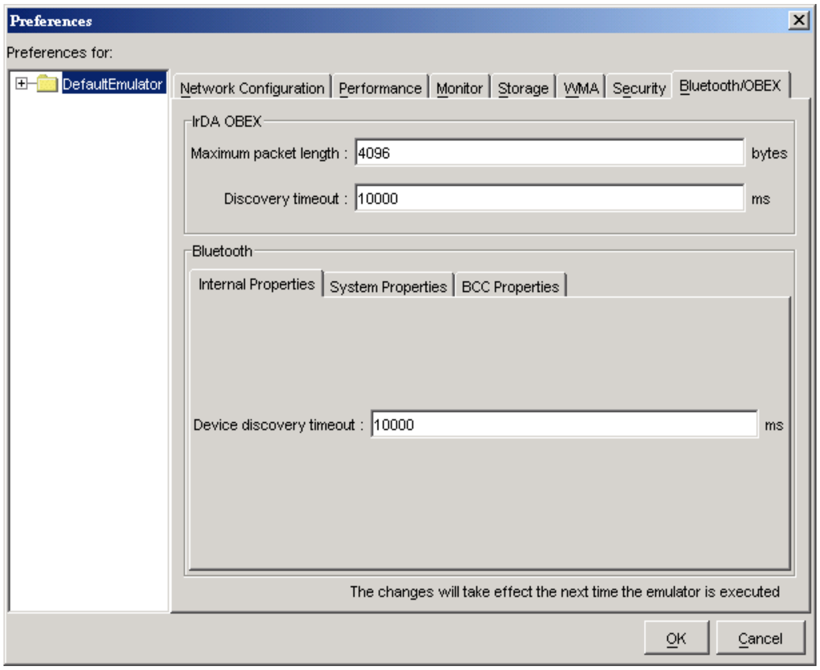
11.2 OBEX Over Infrared

The J2ME Wireless Toolkit implements OBEX transfer over simulated Bluetooth and infrared connections. The simulated infrared connection follows the IrDA standard (see `http://www.irda.org/`). Simulated infrared transfers can take place between multiple running emulators.

11.3 Setting OBEX and Bluetooth Preferences

The J2ME Wireless Toolkit allows you to configure the Bluetooth and OBEX simulation environment. Choose **Edit > Preferences...** from the KToolbar menu to see the following window.

FIGURE 38 Bluetooth and OBEX preferences



Maximum packet length : 4096 bytes

Discovery timeout : 10000 ms

Device discovery timeout : 10000 ms

The changes will take effect the next time the emulator is executed

11.3.1 OBEX Preferences

Devices using IrDA in the real world discover other devices by “listening”. You can configure how long the J2ME Wireless Toolkit emulator waits to discover another device using the **Discovery timeout** field in the **IrDA OBEX** section of the preferences window. Enter a value in milliseconds.

At the API level, the discovery timeout value determines how long a call to `Connector.open("irdaobex://discover...")` will block before it returns or throws an exception.

The maximum packet length affects how much data is sent in each packet between emulators. Shorter packet values will result in more packets and more packet overhead.

11.3.2 Bluetooth Discovery Timeout

In the **Bluetooth** section of the preferences window, the **Device discovery timeout** is the amount of time, in milliseconds, the emulator will wait while attempting to locate other devices in the simulated Bluetooth environment.

11.3.3 Bluetooth System Properties

The **System Properties** tab in the **Bluetooth** section of the preferences contains properties that can be retrieved in an application using the `getProperty()` method in `javax.bluetooth.LocalDevice`.

The Bluetooth properties are fully described in the JSR 82 specification.

11.3.4 Bluetooth BCC Properties

The Bluetooth Control Center (BCC) controls Bluetooth settings. Some devices may provide a GUI to customize Bluetooth settings. In the J2ME Wireless Toolkit, the BCC is configured using the **BCC Properties** tab of the Bluetooth preferences. The properties are as follows:

TABLE 7 BCC properties

Property	Description
Enable Bluetooth support	If this property is disabled, then `LocalDevice.getLocalDevice()` throws a `BluetoothStateException` and no connections can be created. This is useful to test the behavior of your application on devices that support JSR 82 but may have the Bluetooth feature turned off.
Device is discoverable	This property indicates whether or not this emulator can be discovered by other emulators.
Friendly name	The friendly name is a human-readable name for the emulator in the simulated Bluetooth environment. If the name is left blank, the emulator will not support the “friendly name” feature.
Encryption	This property determines whether connection encryption is supported (`on`) or not (`off`). In addition, the `force` settings means all connected must be encrypted. See the documentation for `RemoteDevice`’s `encrypt()` method for details.
Authorization	This is similar to the Encryption property. See `RemoteDevice`’s `authorize()` method.
Authentication	This is similar to Encryption and Authorization. See `RemoteDevice`’s `authenticate()` method.

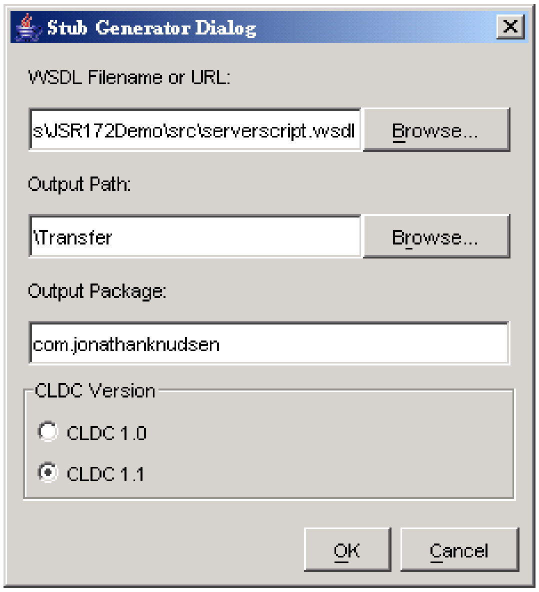
CHAPTER 12

Using Web Services

The J2ME Wireless Toolkit emulator supports JSR 172, the J2ME Web Services Specification. JSR 172 provides APIs for accessing web services from J2ME applications. It also includes an API for parsing XML documents.

The J2ME Wireless Toolkit provides a stub generator that automates creating source code for accessing web services. To get to the stub generator, choose **File > Utilities...** from the KToolbar menu. Click on **Stub Generator**.

FIGURE 39 The web services stub generator



WSDL Filename or URL: s\JSR172Demo\src\serverscript.wsdl

Output Path: \Transfer

Output Package: com.jonathanknudsen

CLDC Version

○ CLDC 1.0

● CLDC 1.1

The **WSDL Filename or URL** should point to the WSDL file for the web service you want to access. The **Output Path** indicates the location where you want the stub files to be placed. **Output Package** indicates the Java language package name for the stub files. Finally, choose whether you want to generate CLDC 1.0 or CLDC 1.1 stubs.

Press **OK** to generate the stub files.

APPENDIX **A**

Application Demonstrations

This appendix describes the application demonstrations that are bundled with the J2ME Wireless Toolkit.

A.1 Overview

The J2ME Wireless Toolkit includes demonstration applications that highlight some of the technologies and APIs that are supported by the emulator.

The following table lists all the demonstration applications that are included in this release. The demonstrations that are new or enhanced in this release are marked with NEW.

The goal of these demonstrations is to give you a glimpse of the API features of the emulator and the enhancements throughout the toolkit.

Most demonstration applications are simple to run. The next section contains instructions for running most demonstrations. Demonstrations that have additional documentation are linked in the table below.

The source code for every demonstration application is available in the *{toolkit}*`\apps` directory. Subdirectories contain projects, and each project has a `src` directory that contains Java source code. For example, if the toolkit is installed in

`\WTK22`, the source code for the SMS sender MIDlet (`example.sms.SMSSend`) in `WMADemo` is contained in
`\WTK22\apps\WMADemo\src\example\sms\SMSSend.java`.

TABLE 8 Application demonstrations

	Demonstration	APIs	Description	Special Instructions
	Audiodemo	MMAPI 1.1	Demonstrates audio capabilities, including mixing and playing audio with an animation	
NEW	BluetoothDemo	JSR 82 Bluetooth	Demonstrates device discovery and data exchange using Bluetooth	Section A.3
	Demo3D	JSR 184 Mobile 3D Graphics	Contains MIDlets that demonstrate how to use 3D graphics, both immediate mode and retained mode	Section A.4
	Demos	MIDP 2.0	Includes various examples: animation, color, networking, finance, and others	
	FPDemo	CLDC 1.1	Simple floating point calculator	
	Games	MIDP 2.0	Includes `TilePuzzle`, `WormGame`, and `PushPuzzle`	
	JSR172Demo	Web services	Demonstrates how to use the JSR 172 API to connect to a web service from a MIDlet	Section A.5
NEW	mmademo	MMAPI 1.1	Demonstrates MMAPI features, including tone sequences, MIDI playback, sampled audio playback, and video	Section A.6
	NetworkDemo	MIDP 2.0	Shows how to use datagrams and serial connections	
NEW	ObexDemo	JSR 82 OBEX	Demonstrates transferring data using OBEX over IrDA	Section A.7
NEW	PDAPDemo	JSR 75 PIM and FileConnection	Shows how to manipulate contacts, calendar items, and to-do items. Demonstrates accessing local files.	Section A.8

TABLE 8 Application demonstrations

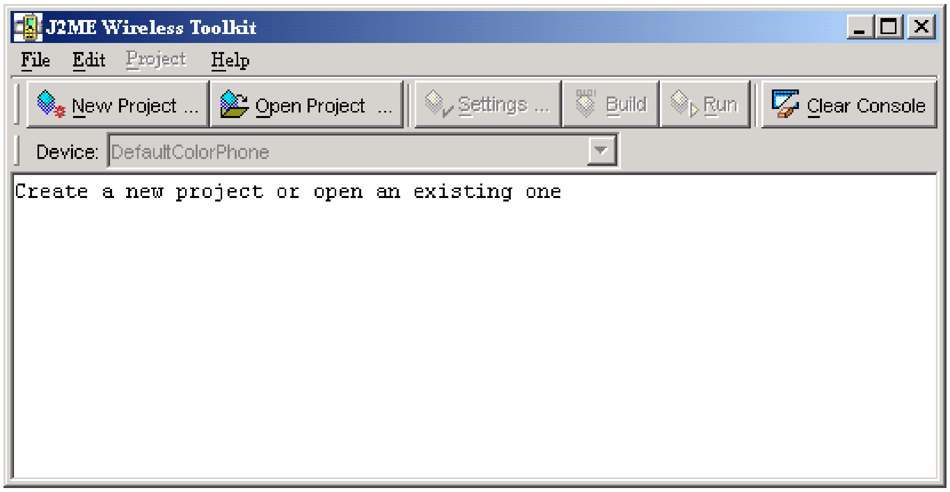
	Demonstration	APIs	Description	Special Instructions
	Photoalbum	MIDP 2.0	Demonstrates a variety of image formats	
	UIDemo	MIDP 2.0	Showcases the breadth of MIDP 2.0's user interface capabilities	
NEW	WMADemo	WMA 2.0	Shows how to send and receive SMS, and CBS, and MMS messages	Section A.9

A.2 General Instructions

It's usually very simple to run one of the demonstration applications. This section describes the general procedure. More detailed instructions for specific demonstrations are referenced in the table above.

The first step is to run KToolbar. To do this, go to the Windows Start menu and choose **Start > Programs > J2ME Wireless Toolkit 2.2 > KToolbar**. The KToolbar window pops up:

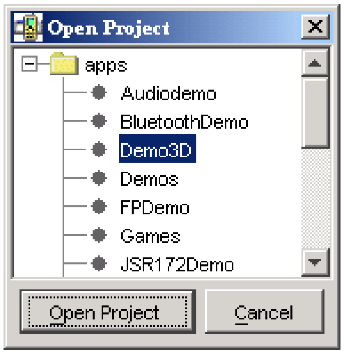
FIGURE 40 KToolbar



```
Create a new project or open an existing one
```

Click on the **Open Project...** button to open a demonstration application. You'll see a list of all the available applications.

FIGURE 41 Opening a demonstration application project



Select one and click on the **Open Project** button in the dialog.

Once the application is opened, all you need to do is press the **Run** button. The device emulator will pop up running the example application. Choose a specific demonstration to run from the menu and press the soft button for **Launch**.

Some demonstrations require other setup and instructions. Check the full list to see if there are specific instructions for a demonstration.

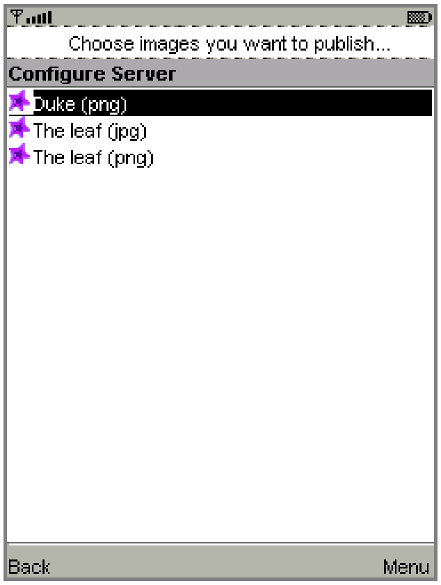
A.3 BluetoothDemo

This application contains a MIDlet that demonstrate the use of JSR 82's Bluetooth API.

`Bluetooth Demo` shows how images can be transferred between devices using Bluetooth. You will need to run two instances of the emulator to see how this demonstration works.

In the first emulator, choose `Bluetooth Demo`, then **Server**. The emulator will ask you if you want to allow a Bluetooth connection. Choose **Yes**. The server starts up and displays a list of images. At the beginning, none of the images are being made available on the Bluetooth network. To make images available, select them and choose **Publish image** from the menu. Images with a green icon are published, while those with a purple icon are not.

FIGURE 42 Running the `Bluetooth Demo` server



Choose images you want to publish...

Configure Server

Duke (png)

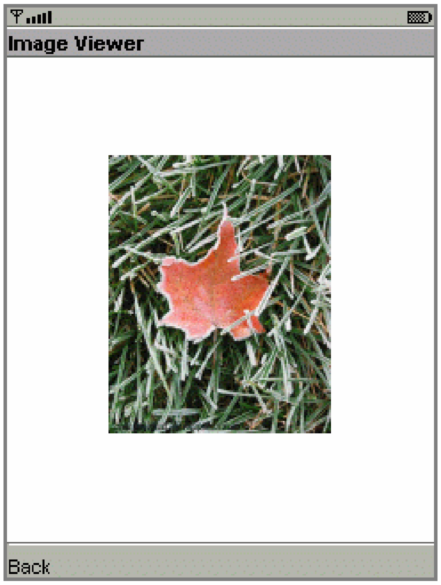
The leaf (jpg)

The leaf (png)

On the second emulator, choose `Bluetooth Demo`, then **Client**. The MIDlet tells you it's ready to search for images. Choose **Find**. The MIDlet will find the other emulator and get a list of images from it. Select one from the list and choose **Load**. The emulator asks if you want to allow the connection. Choose **Yes**.

In the first emulator, the server, a prompt appears, asking if you want to authorize the connection from the client. Choose **Yes**. The image is transferred via simulated Bluetooth and shown on the client emulator.

FIGURE 43 An image transferred via simulated Bluetooth



You can avoid the permission prompts by running the demonstration in the `trusted` protection domain.

A.4 Demo3D

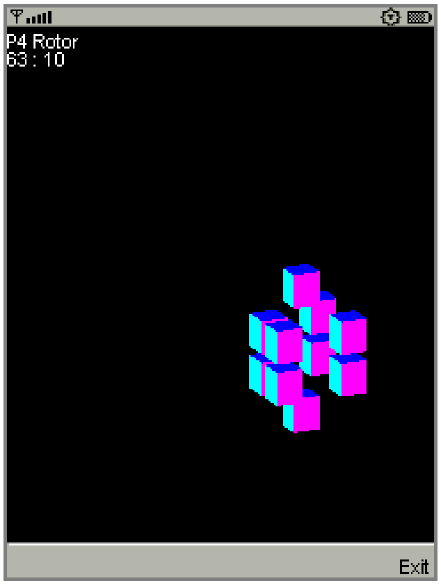
This application contains three MIDlets that show off the emulator's support of JSR 184, the Mobile 3D Graphics API.

A.4.1 Life3D

`Life3D` implements the popular Game of Life in three dimensions. Live cells are represented by cubes. Each cell has 26 possible neighbors (including diagonals). For each step of the animation, cells with fewer than 4 neighbors die of loneliness, while cells with more than 5 neighbors die of overcrowding. An empty cell with exactly 4 neighbors will become a new live cell.

The view of the playing board rotates slowly so you can view the board from all angles.

FIGURE 44 The Game of Life in three dimensions



P4 Rotor
63 : 10

The keypad buttons provide control over the game.

TABLE 9 Controls for `Life3D`

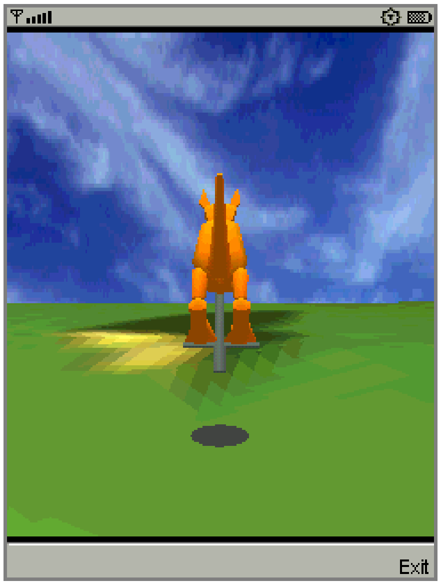
Button	Description
0	Pause the animation
1	Resume the animation at its default speed
2	Speed up the animation
3	Slow down the animation
4	Choose the previous preset configuration from a list that includes gems like P4 Glider, Skew beehive plus, and P4 Rotor.
5	Choose the next preset configuration from the list.
*	Generate a random configuration and animate until it stabilizes or dies. If it dies, generate a new random configuration.

This source code for this example is particularly well-documented. Take a look at *{toolkit}*`\apps\Demo3D\src\com\superscape\m3g\wtksamples\life3d\Life3D.java`.

A.4.2 PogoRoo

`PogoRoo` shows you the rear end of a kangaroo bouncing up and down on a pogo stick.

FIGURE 45 A bouncing kangaroo



You can get the kangaroo to bounce around the landscape by using the arrow keys. Push up to go forward, down to go backward, and left and right to change direction. You might need to hold down the keys to see an effect.

A.4.3 retainedmode

The `retainedmode` MIDlet plays back a scene file that shows a tireless skateboarder in an endless loop.

FIGURE 46 A tireless skateboarder

A.5 JSR172Demo

`JSR172Demo` shows how to access a web service from a MIDlet. The web service is already running on an Internet server. You should be able to simply build and run the example.

If you are behind a firewall, you'll need to configure the emulator's proxy server settings. Choose **Edit > Preferences...** from the KToolbar menu, then select the **Network Preferences** tab. Fill in the proxy server addresses and ports.

`JSR172Demo` contains a single MIDlet, `Server Script`. Launch it and follow the prompts. You can browse through simulated news headlines, all of which are retrieved from the web service.

To see what's going on behind the scenes, use the network monitor.

A.6 mmademo

The `mmademo` application contains four MIDlets that showcase the multimedia capabilities of the J2ME Wireless Toolkit. This section describes the MIDlets and includes additional information about using multimedia from your applications.

A.6.1 Simple Tones

The Simple Tones example demonstrates how to use interactive synthetic tones. The first menu entries play tones with different pitch and duration using `Manager.playTone()`. Choosing the third menu item will play a chord on the interactive MIDI device (locator `"device://midi"`). The `shortMidiEvent()` method of `MIDIControl` is used to trigger the notes of the chord.

A.6.2 Simple Player

The Simple Player application demonstrates the range of audio and video capabilities of the emulator. It includes example files in a variety of formats and can play files from the emulator's persistent storage or from HTTP URLs.

The player portion uses a generic `javax.microedition.media.Player` interface. The player displays duration, media time, and controls for running the media file. If metadata is available in a file, the player enables you to view the information, such as author and title. In the case of MIDI files, if karaoke text is present in the file, it displays on the screen during play. Graphical user interface controls can be viewed on the display screen if applicable. You can access these controls by selecting one of the media samples in Simple Player, then pressing the **Menu** button to view and select the desired command.

The demo includes the following media samples:

- `Bong` plays a short WAV file. You can adjust certain playback features, as described later in this document. The display shows the duration of the sound in minutes:seconds:tenths of a second, for example 00:17:5. This audio sample is a resource file in the MIDlet suite JAR file.
- `MIDI Scale` plays an example musical scale. The display shows the title of the selected music file, the duration of the song, the elapsed time during playback, and the current tempo in beats per minute (bpm). This MIDI file is stored in the MIDlet suite JAR file.
- `Simple Ring Tone` plays a short sequence of Beethoven's Fifth Symphony. The display shows the title of the selected music file, the duration of the song, the elapsed time in seconds and tenths of a second during playback, and the current tempo in beats per minute (bpm). This ringtone file (`.jts` format) is stored in the MIDlet suite JAR file.
- `WAV Music` plays a brief audio file. The display shows the title of the audio file, the duration of the audio the elapsed time during playback, and the playback rate in percent. This WAV file is retrieved from an HTTP server.
- `MIDI Scale` plays a MIDI file that is retrieved from an HTTP server.
- The `Animated GIF` example shows an animated GIF that counts from 1 to 5. The file is stored in the MIDlet suite JAR.
- `Audio Capture` from a default device lets you capture audio from the microphone or connected device. The sound is captured and played back on the speaker. To avoid feedback, use a headset.

- `Video Capture Simulation` simulates viewing input video such as might be possible on a device equipped with a camera.
- `[enter URL]` allows you to play back media files from arbitrary HTTP servers. Type a valid URL at the insertion point and click OK to play a file. If you want to open an HTTP directory from which to select media, be sure to add a slash to the end of the URL.

In addition, Simple Player parses ring tones in Ringing Tones text transfer language (RTTTL). See `http://www.convertyourtone.com/rtttl.html` for information on RTTTL.

A key feature of Simple Player is a common set of commands that control media playback. The commands are available from the Simple Player menu, and some have associated keypad buttons. The following table describes these commands.

TABLE 10 `Simple Player` commands

Command	Key	Description
Mute/ Unmute	0	Turns off sound but the file continues to play. This command toggles to Unmute.
Volume	* and #	Increases or decreases loudness.
META Data		Displays information provided by the media file such as copyright information, title, and track list.
Stop in 5 seconds		Pauses the audio play in five seconds when set during playback.
Rate	4 and 6	Alters the rate of speed of playback.
Tempo		Increases or decreases the tempo of the tone sequence or MIDI file.
Pitch	Up and down	Lowers or raises the notes in a MIDI file.
Start/Stop Recording		Records the audio playback. A file is created containing the recorded audio in the directory in which the emulator is running. If you do not specify a filename, a file called recording.wav is created. This command toggles to Stop Recording.
Step Frame	7 and 9	Jumps forward or backward one frame at a time in a video file.
Play/Stop	2 and Select	Starts or stops the media.

TABLE 10 `Simple Player` commands

Command	Key	Description
Loop Mode		Plays back the audio file immediately after completion of play. Running Loopmode once plays the audio file once. Pressing a second time plays the file three times. Pressing a third time plays the file repeatedly. Pressing a fourth time returns to single play.
Skip	1 and 3	Skips forward or backward five percent of the duration of the media file. The sound track syncs to the video.
Rewind		Returns to the start time of the audio playback.
Stop and Rewind	5	Stops plaback and rewinds to the start time.
Quick Help		Displays a list of commands and keypad buttons.

The commands may or may not be available depending on the media type that Simple Player is playing. In addition, some commands can be invoked using the keypad buttons. The following table describes the availability of commands, their keypad equivalents, and the relevant class from MMAPI.

Note that a short list of commands and the corresponding keypad buttons is available in the Simple Player application itself. Just choose the **Quick Help** command from the menu.

A.6.3 PausingAudioTest

This MIDlet exists to demonstrate how the J2ME Wireless Toolkit will warn you if a paused MIDlet has not stopped its running `Players`. After you launch the MIDlet, choose the **Play** command to start playing some audio. The screen displays a status, which is either “Well-behaved” or “Not Well-Behaved.”

Pause the MIDlet by choosing **MIDlet > Pause** from the emulator window’s menu. As expected, the MIDlet is paused and no message is displayed on the KToolbar console. Restart the MIDlet by choosing **MIDlet > Resume** from the emulator window’s menu.

Now choose the **Misbehave** command. Pause the MIDlet again. In the KToolbar console, you will receive a short lecture about how well-behaved MIDlets release resources when they are paused.

A.6.4 Video

The Video application illustrates how the emulator is capable of playing animated GIF files and capturing video. On a real device with a camera, video capture can be used to show the user what the camera sees.

Animated GIFs and video capture can be implemented using either a `Form Item` or a `Canvas`. The Video demonstration includes all the possibilities:

- `Animated GIF - Form [jar]` shows an animated GIF as a `Form Item`. The form also includes some information about the playback, including the current time. Choose the **Snapshot** command to take a snapshot of the running animation. The snapshot will be placed in the form following the animated GIF.
- `Animated GIF - Canvas [jar]` shows an animated GIF in a `Canvas`. A simple indicator shows the progress through the animation. Choose **Snapshot** to get a still image of the current appearance. The snapshot is shown briefly, then the display goes back to the animation.
- `Video Capture - Form` simulates capturing video from a camera or other source and showing it as an `Item` in a `Form`. Choose the **Snapshot** command to take a snapshot of the captured video. The snapshot will be placed in the form following the video capture.
- `Video Capture - Canvas` simulates capturing video from a camera or other source and showing it in a `Canvas`. Choose **Snapshot** to get a still image of the current appearance. The snapshot is shown briefly, then the display goes back to the video capture.

A.6.5 Attributes for mmademo

The mmademo applications have the following attributes that you can modify in the **User Defined** tab of the project settings dialog box:

TABLE 11 Descriptions of MMAPI-specific MIDlet attributes

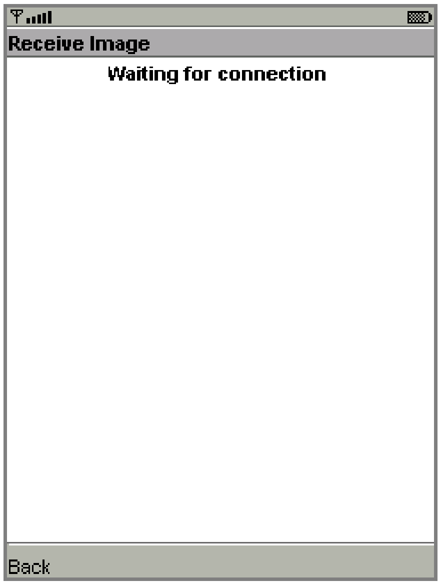
Attribute	Description
`PlayerTitle-<`*n*`>`	Name of the *n*th media title to be played back by the Simple Player MIDlet.
`PlayerURL-<`*n*`>`	Location of the *n*th media title, `PlayerTitle-<`*n*`>`, to be played back by the Simple Player MIDlet.
`VideoTest-<`*n*`>`	The name of the *n*th media title to be played back by the `Video` application.
`VideoTest-URL<`*n*`>`	Location of the *n*th media title, `VideoTest-<`*n*`>`, to be played back by the `Video` application.

A.7 ObexDemo

This application shows how to transfer image files between emulator instances using the OBEX API. This demonstration shows the use of OBEX over a simulated infrared connection.

Run two instances of the emulator. One listens for incoming connections, while the other attempts to send an image. In the first emulator, choose **Obex Demo**, then **Receive Image**. The emulator will ask for permission to listen. Choose **Yes**. The emulator will display a screen that indicates it's waiting for incoming connections.

FIGURE 47 Waiting for an OBEX connection

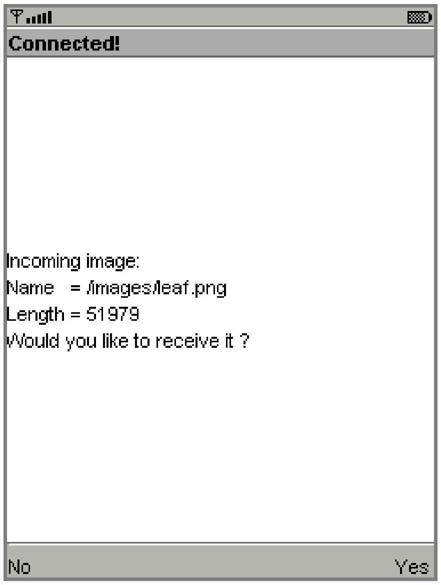

Receive Image

Waiting for connection

In the second emulator, launch **Obex Demo**, then choose **Send Image**. You'll see a list of images. Select one and choose **Send**. The emulator will ask for permission to make the outgoing connection. Choose **Yes**.

Back in the first (listening) emulator, you'll see a prompt asking whether you want to accept the incoming connection.

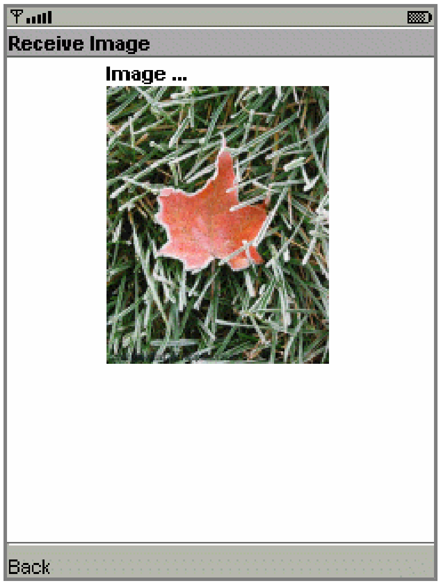
FIGURE 48 Prompting to accept a connection



Incoming image:
Name = /images/leaf.png
Length = 51979
Would you like to receive it ?

Choose **Yes**. The image you selected is transferred over the simulated infrared link and displayed on the first emulator.

FIGURE 49 A successfully transferred image



A.8 PDAPDemo

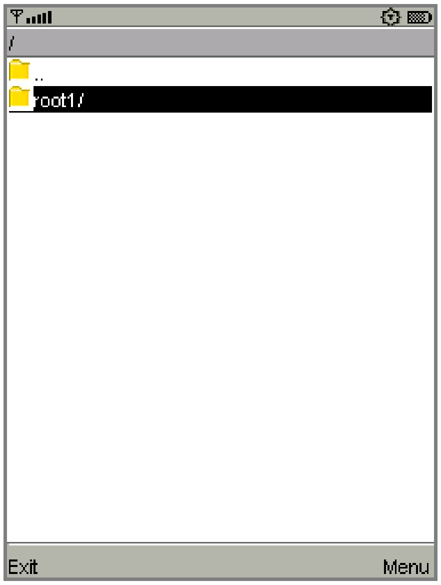
PDAPDemo shows how to use the PIM and FileConnection APIs that are part of the JSR 75 specification.

A.8.1 Browsing Files

To run the file browser, you'll need to give the MIDlet appopriate security authorization. The easiest way to do this is to choose **Edit > Preferences...** from the KToolbar menu. Click on the **Security** tab. Change the **Security domain** to **trusted** and press **OK**.

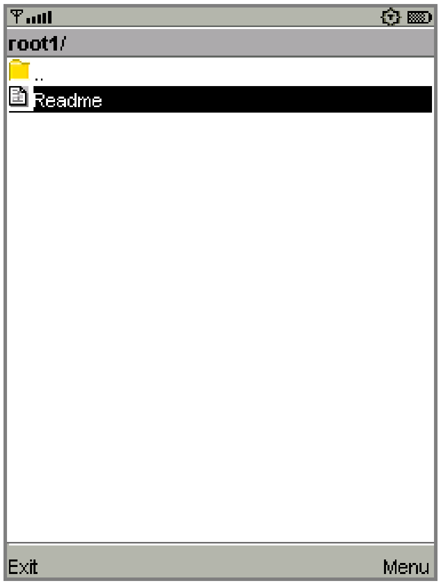
Now open and run the PDAPDemo project. Launch the FileBrowser MIDlet. You will see a directory listing. You can browse through the available directories and files. By default there is one directory, root1.

FIGURE 50 Browsing files



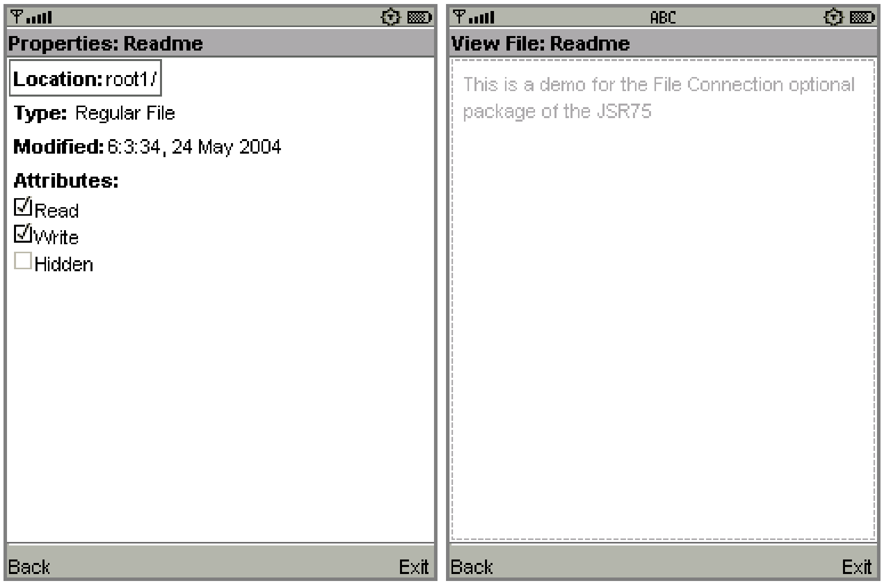
Select a directory and press the select button to enter it. The root1 directory contains a single file, Readme.

FIGURE 51 Contents of the `root1` directory



Using the commands in the demonstration, you can view the file or see its properties. Try selecting the file and choosing **Properties** or **View** from the menu.

FIGURE 52 Viewing file properties and contents


Properties: Readme

Location: root1/

Type: Regular File

Modified: 6:3:34, 24 May 2004

Attributes:

☑ Read
☑ Write
□ Hidden

View File: Readme

This is a demo for the File Connection optional package of the JSR75

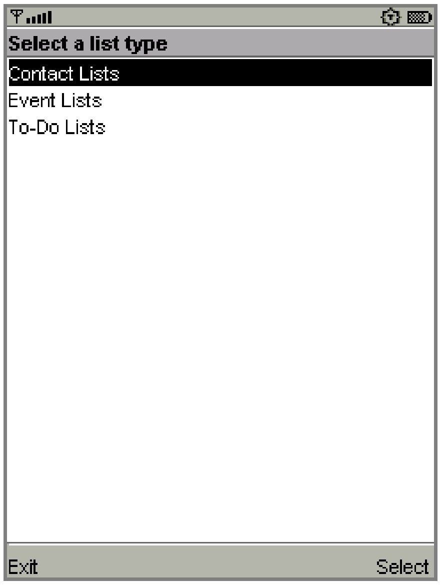
The actual files are located in *{toolkit}*`\appdb\DefaultColorPhone\filesystem`, assuming you are using the `DefaultColorPhone` emulator skin. You can add files and root directories as you wish and they will be visible to the JSR 75 File API. See Chapter 10 for more information.

A.8.2 The PIM API

The `JSR75 PIM APIs` example demonstrates how to access personal information, like contact lists, calendars, and to-do lists. After you launch the example, choose a type of list from the main menu.

In this example application, each type of list works the same way and each list type contains a single list. For example, if you choose Contact Lists, there is a single contact list called Contacts. Event Lists contains a single list called Events, and To-Do Lists conatains a single list called To do.

FIGURE 53 Choosing a list type



Select a list type

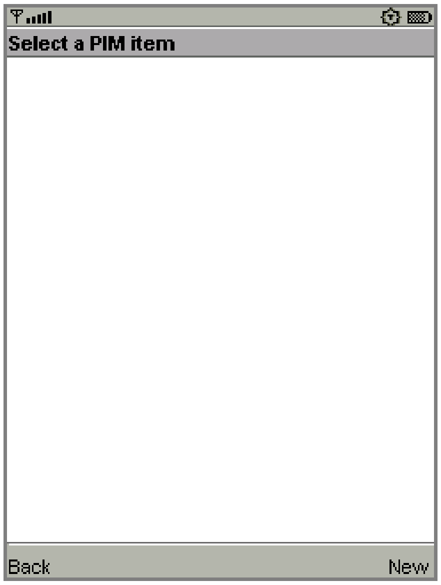
Contact Lists

Event Lists

To-Do Lists

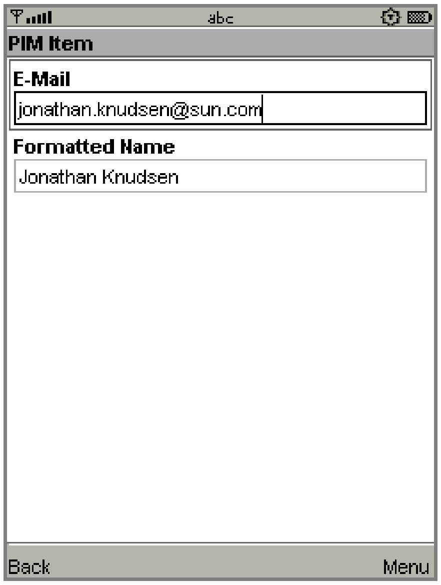
Once you've selected a list type and chosen the specific list, you'll see all the items in the list. If this is the first time you've run the example, the list is probably empty.

FIGURE 54 An empty contact list


Select a PIM item

To add an item, choose **New** from the menu. The application prompts you for a **Formatted Name** for the item. You can add more data fields to this item using **Add Field** in the menu. You'll see a list of field names. Pick one, then enter the value for the new field.

FIGURE 55 Adding contact fields


PIM Item

E-Mail

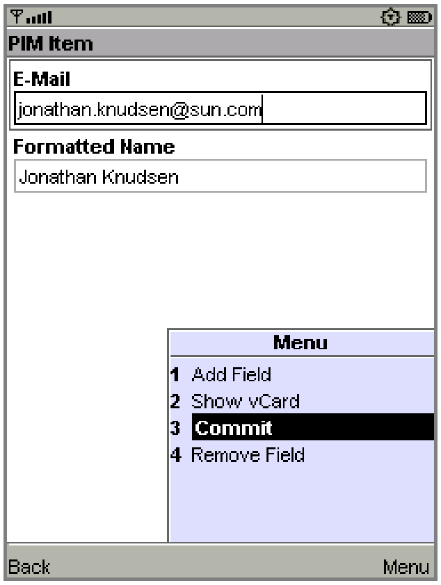
jonathan.knudsen@sun.com

Formatted Name

Jonathan Knudsen

To actually save the list item, choose **Commit** from the menu.

FIGURE 56 Saving an item



jonathan.knudsen@sun.com

Jonathan Knudsen

You can return to the list by choosing the **Back** command. You'll see the item you just created in the list.

The items that you create are stored in standard vCard or vCalendar format in the *{toolkit}*`\appdb\`*{skin}*`\pim` directory. See Chapter 10 for more information.

The PIM API allows for exporting contact, calender, and to-do items in a standard format. The exact format depends on the list type. When you are viewing an item in any list, the menu contains a command for viewing the exported item.

For example, when you are viewing a contact list item, the menu contains **Show vCard**. When you choose this command, the exported item is shown on the screen. Calendar items and to-do items both get exported as vCalendar.

A.9 WMADemo

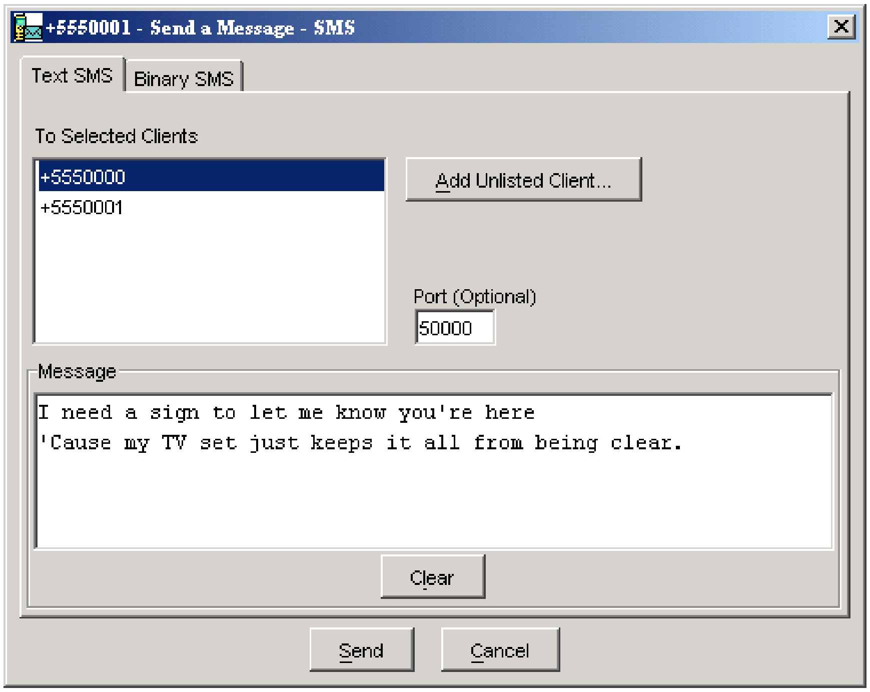
This application shows how to send and receive SMS, CBS, and MMS messages. The J2ME Wireless Toolkit offers a flexible emulation environment to support messaging. Messages can be exchanged between emulator instances and can be generated or received using the WMA console utility.

Because this example makes use of the push registry, you can't see all of its features just by using the **Run** button. You need to use the **Run via OTA** feature to install the application into the emulator in a process that mirrors how applications are installed on real devices. If you don’t know how to do this, read about it in Chapter 2, “Developing MIDlet Suites.”

To see the magic of the push registry, use the WMA console to send the emulator a message. Launch the console by choosing **File > Utilities...** from the KToolbar menu. Click on the **Open Console** button in the WMA box to launch the WMA console.

Click on the **Send SMS...** button in the WMA console window. Choose the number that corresponds to the emulator, probably +5550000. If you're not sure what number the emulator is using, look in its title bar. Choose the number in the SMS message window, then fill in a port number of 50000. Then type in your text message and click on **Send**.

FIGURE 57 Sending a text message



+5550001 - Send a Message - SMS

To Selected Clients

+5550000

+5550001

Port (Optional)

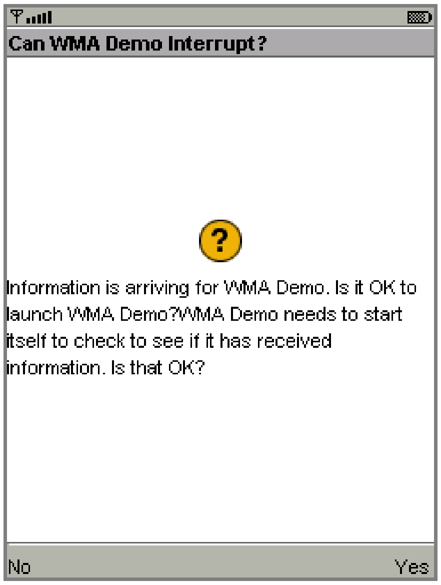
50000

Message

```
I need a sign to let me know you're here
'Cause my TV set just keeps it all from being clear.
```

The emulator will spring to life. First it politely asks if it can launch the `WMADemo` application.

FIGURE 58 The push registry springs to life

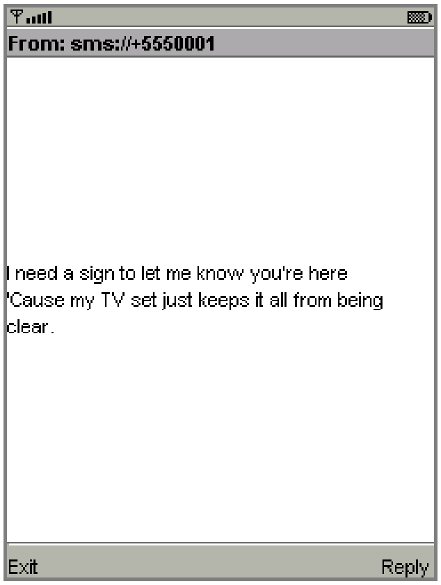


Can WMA Demo Interrupt?

Information is arriving for WMA Demo. Is it OK to launch WMA Demo?WMA Demo needs to start itself to check to see if it has received information. Is that OK?

Choose Yes. The `SMSReceive` MIDlet is launched and immediately displays the incoming SMS message.

FIGURE 59 An incoming text message



From: sms://+5550001

I need a sign to let me know you're here
'Cause my TV set just keeps it all from being clear.

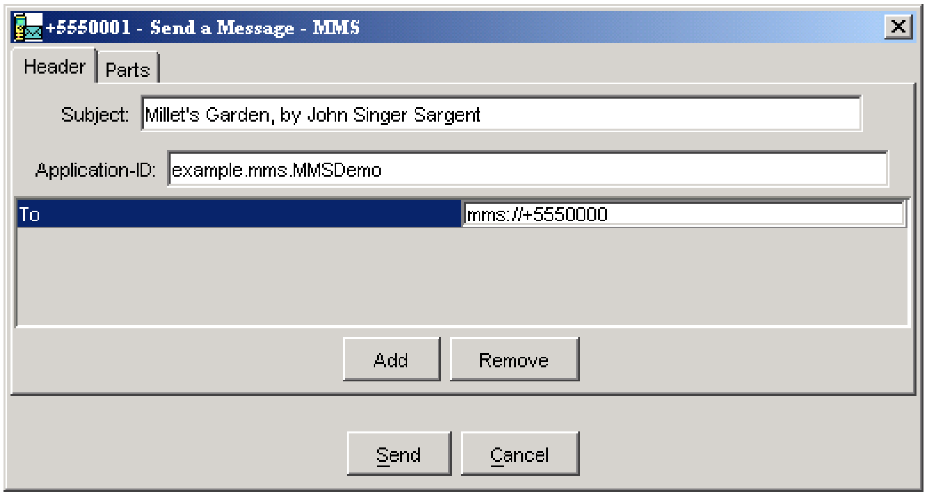
You can also use the WMA console to send and receive CBS and MMS messages. See Chapter 7, "Using the Wireless Messaging API," for more information.

If you are attempting to send text messages to `WMADemo` using the WMA console, make sure to specify the port number as 50000. Use port 50001 for CBS messages. For MMS messages, use `example.mms.MMSDemo` as the application ID.

For example, to send an MMS message from the WMA console to the emulator, make sure that `WMADemo` has been installed using **Run via OTA** as described above. Leave the emulator running.

In the WMA console, click on **Send MMS...** to pop up the MMS composition window. Fill in a message subject, the application ID `example.mms.MMSDemo`, and the telephone number of the running emulator.

FIGURE 60 Addressing an MMS message



+5550001 - Send a Message - MMS

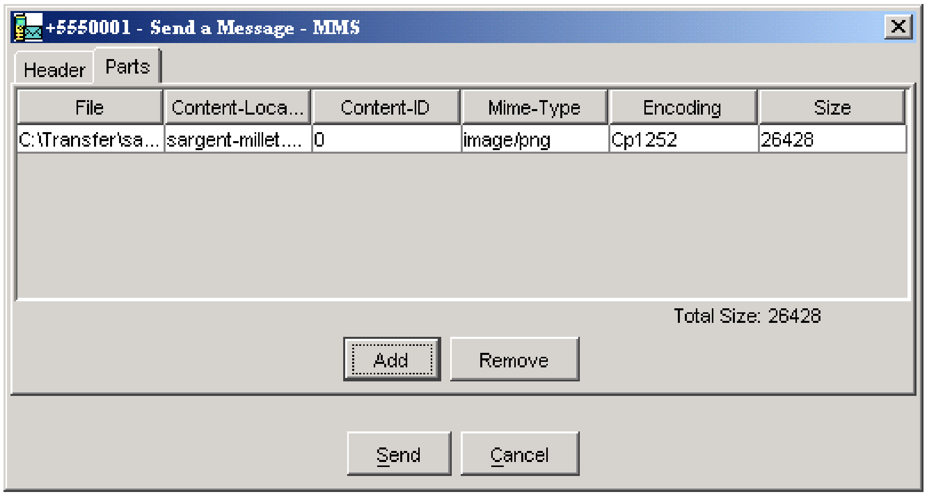
Subject: Millet's Garden, by John Singer Sargent

Application-ID: example.mms.MMSDemo

To mms://+5550000

Next, click on the **Parts** tab. The WMA console allows you to select files from your hard disk that you wish to send as parts of the MMS message. Click **Add** to add a file to the message. Use the file browser to find the file you want to send and click **OK**.

FIGURE 61 Adding parts to an MMS message



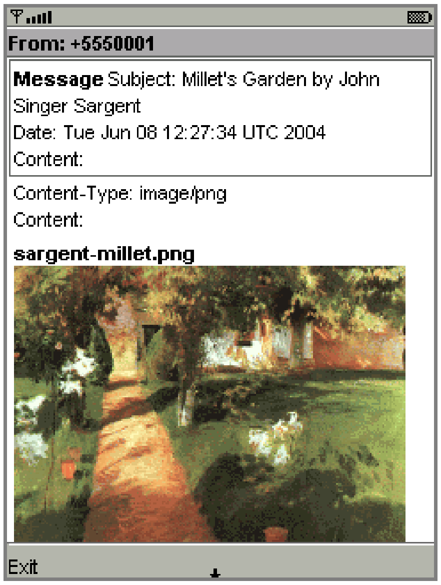
File	Content-Loca...	Content-ID	Mime-Type	Encoding	Size
C:\Transfer\sa...	sargent-millet....	0	image/png	Cp1252	26428

Total Size: 26428

Click on **Send** to send the message.

The emulator asks if it can launch `WMADemo`. Click on **Yes**. The image and its information are displayed.

FIGURE 62 `WMADemo` receives the image


From: +5550001

Message Subject: Millet's Garden by John Singer Sargent
Date: Tue Jun 08 12:27:34 UTC 2004
Content:

Content-Type: image/png
Content:

sargent-millet.png

APPENDIX **B**

Command Line Reference

This appendix describes how to operate the J2ME Wireless Toolkit from the command line and details the steps required to build and run an application. It also describes the J2ME Wireless Toolkit certificate manager utility, called MEKeyTool, and the MIDlet signing utility, called JAD Tool (Java Application Descriptor Tool).

B.1 Prerequisites

Before building and running an application from the command line, verify that you have a version no earlier than 1.4.2 of the J2SE SDK. Run the `jar.exe` command (make sure the command is in your PATH) and then run `java -version` at the command line to verify that the version of the J2SE SDK that is actually being used is 1.4.2.

For more examples, see the files `build.bat` and `run.bat` in the `bin` directories of the demonstration applications. You can find these files under the *{toolkit}*`\apps\<demo>\bin` directory where *{toolkit}* is the installation directory of the J2ME Wireless Toolkit and `<demo>` is the name of one of the demo applications.

B.2 The Development Cycle

For a full description of developing MIDP applications, see Chapter 2, "Developing MIDlet Suites." This section describes how to accomplish each of the steps in the development cycle from the command line.

B.2.1 Build

Using KToolbar, building a project is a single step. Behind the scenes, however, there are actually two steps. First, Java source files are compiled into Java class files. Next, the class files are *preverified*, which means they are prepared for the CLDC KVM.

Use the `javac` compiler from the J2SE SDK to compile Java source files. You can use the existing J2ME Wireless Toolkit project directory structure. You'll need to use the `-bootclasspath` option to tell the compiler to use the MIDP APIs, and you'll use the `-d` option to tell the compiler where to put the compiled class files.

The following example shows how you could compile a MIDP 2.0 application, taking source files from the `src` directory and placing the class files in the `tmpclasses` directory. Newlines have been added for clarity.

```
javac
  -bootclasspath ..\..\lib\cldcapi10.jar;..\..\lib\midpapi20.jar
  -d tmpclasses
  src\*.java
```

If you want to use the optional APIs that are supported by the toolkit, add their JAR files to the `-bootclasspath` option.

For more information on `javac`, consult the J2SE documentation.

The next step is to preverify the class files. In the `bin` directory of the J2ME Wireless Toolkit lives a handy utility called `preverify`. The syntax for the preverify command is as follows:

`preverify [`*options*`] <`*files* `|` *directories*`>`

Some of the options are as follows:

`-classpath` <*classpath*>

Specify the directories or JAR files (given as a semicolon-delimited list) from which classes are loaded.

`-d` <*output directory*>

Specify the directory into which the preverifier should output classes. This directory must exist before preverifying. If this option is not used, the preverifier places the classes in a directory called output.

Following the example for compiling, use the following command to verify the compiled class files. As before, newlines have been added for clarity.

```
preverify
  -classpath ..\..\lib\cldcapi10.jar;..\..\lib\midpapi20.jar
  -d classes
  tmpclasses
```

As a result of this command, preverified class files are placed in the `classes` directory. If your application uses WMA, MMAPI, or other versions of CLDC or MIDP, be sure to include the relevant `.jar` files in the classpath.

B.2.2 Package

To package a MIDlet suite, you must create a manifest file, an application JAR, and finally, a MIDlet suite descriptor.

Create a manifest file containing the appropriate attributes as specified in the MIDP specification. You can use any text editor to create the manifest file. A manifest might have the following contents, for example:

```
MIDlet-1: My MIDlet, MyMIDlet.png, MyMIDlet
MIDlet-Name: MyMIDlet
MIDlet-Vendor: My Organization
MIDlet-Version: 1.0
MicroEdition-Configuration: CLDC-1.0
MicroEdition-Profile: MIDP-2.0
```

Create a JAR file containing the manifest as well as the suite's class and resource files. To create the JAR file, use the `jar` tool that comes with the J2SE SDK. The syntax is as follows:

```
jar cfm <file> <manifest> -C <class_directory> . -C <resource_directory> .
```

The arguments are as follows:

<*file*>: The JAR file to create.

<*manifest*>: The manifest file for the MIDlets.

<*class_directory*>: The directory containing the application's classes.

<*resource_directory*>: The directory containing the application's resources.

For example, to create a JAR file named `MyApp.jar` whose classes are in the `classes` directory and resources are in the `res` directory, use the following command:

```
jar cfm MyApp.jar MANIFEST.MF -C classes . -C res .
```

Create a JAD file containing the appropriate attributes as specified in the MIDP specification. You can use any text editor to create the JAD file. This file must have the extension `.jad`.

Note – You need to set the `MIDlet-Jar-Size` entry to the size of the JAR file created in the previous step.

For example, a JAD file might have the following contents:

```
MIDlet-Name: MyMIDlet
MIDlet-Vendor: My Organization
MIDlet-Version: 1.0
MIDlet-Jar-URL: MyApp.jar
MIDlet-Jar-Size: 24601
```

B.2.3 Run

You can run the emulator from the command line. The J2ME Wireless Toolkit's `bin` directory contains the command `emulator`. The syntax for the `emulator` command is as follows:

`emulator [`*options*`]`

The general options are:

`-help`: Display a list of valid options.

`-version`: Display version information about the emulator.

`-Xquery`: Print emulator skin information on the standard output stream and exit immediately. The information includes the skin name, screen size, and other capabilities.

Options that pertain to running MIDlet suites are:

`-Xdevice:`<*skin_name*>: Run an application on the emulator using the given skin name. For a list of skin names, see Chapter 4, "Using the Emulator."

`-Xdescriptor:`<*jad_file*>: Run an application locally using the given JAD file.

`-classpath` <*classpath*>: Specify the classpath for libraries required to run the application. Use this option when running an application locally.

`-D` <*runtime_property*>: Set the HTTP and HTTPS proxy servers. Valid properties include:

`com.sun.midp.io.http.proxy=`<*proxy host*>`:`<*proxy port*>

`-Xjam:`<*command*>`=`<*application*>: Run an application remotely using the Application Management System (AMS) to run using OTA provisioning. If no application is specified with the argument, the graphical AMS is run.

`install=`<*jad_file_url*> `| force | list | storageNames|`

Install the application with the specified JAD file onto a device.

`run=[`<*storage_name*> `|` <*storage_number*>`]`

Run a previously installed application. The application is specified by its valid storage name or storage number.

`remove=[`<*storage_name*> `|` <*storage_number*> `| all]`

Remove a previously installed application. The application is specified by its valid storage name or storage number. Specifying `all`, all previously installed applications are removed.

`transient=`<*jad_file_url*>

Install, run, and remove the application with the specified JAD file. Specifying `transient` causes the application to be installed and run and then removed three times.

B.2.4 Debugging

You can use the following options with the emulator for debugging and tracing.

`-Xverbose:`<*trace_options*>

Display trace output, as specified by a list of comma-separated options:

`class` : trace class loading

`gc` : trace garbage collection

`all` : use all tracing options

`-Xdebug`

Enable runtime debugging. The `-Xrunjdwp` option must also be used.

`-Xrunjdwp:`<*debug_settings*>

Start a JDWP debug session, as specified by a list of comma-separated debug settings. The `-Xdebug` option must also be used. Valid debug settings include:

`transport=`<*transport_mechanism*>

The transport mechanism used to communicate with the debugger. The only transport mechanism supported is `dt_socket`.

`address=`<*host:port*>

The transport address for the debugger connection. You can omit providing a *host*. If *host* is omitted, *localhost* is assumed to be the host machine.

`server=`*{y|n}*

Start the debug agent as a server. The debugger must connect to the port specified. The possible values are `y` and `n`. Currently, only `y` is supported (the emulator must act as a server).

B.3 Launching Toolkit GUI Components

The components of the J2ME Wireless Toolkit can all be launched from the command line. Each component is in the toolkit's `bin` directory.

TABLE 12 Toolkit component commands

Command	Description
`DefaultDevice`	Pops up a dialog that allows you to choose the default emulator skin
`ktoolbar`	Launches KToolbar
`prefs`	Launches the toolkit preferences
`utils`	Launches the toolkit utilities window

B.4 Setting Emulator Preferences

You can change the emulator preferences from the command line by using the `-Xprefs` option for the `emulator` command. The format is as follows:

`-Xprefs:`<*filename*>

The *filename* you provide should be the full path name of a property file whose values override the values in the preferences dialog box. The property file can contain the following properties:

TABLE 13 Emulator Preferences Properties List

Property Name	Property Description and Legal Values
`http.version`	Network Configuration > HTTP Version Value: HTTP/1.1 | HTTP/1.0
`http.proxyHost`	Network Configuration > HTTP Address Value: hostname
`http.proxyPort`	Network Configuration > HTTP Port Value: integer
`https.proxyHost`	Network Configuration > HTTPS Address Value: hostname
`https.proxyPort`	Network Configuration > HTTPS Port Value: integer

TABLE 13 Emulator Preferences Properties List

Property Name	Property Description and Legal Values
`kvem.memory.monitor.enable`	Monitor > Enable memory monitor Value: true | false
`kvem.netmon.comm.enable`	Monitor > Enable Comm monitoring Value: true | false
`kvem.netmon.datagram.enable`	Monitor > Enable Datagram monitoring Value: true | false
`kvem.netmon.http.enable`	Monitor > Enable HTTP monitoring Value: true | false
`kvem.netmon.https.enable`	Monitor > Enable HTTPS monitoring Value: true | false
`kvem.netmon.socket.enable`	Monitor > Enable Socket monitoring Value: true | false
`kvem.netmon.ssl.enable`	Monitor > Enable SSL monitoring Value: true | false
`kvem.profiler.enable`	Monitor > Enable profiling Value: true | false
`netspeed.bitpersecond`	Performance > bits/sec combo box Value: integer
`netspeed.enableSpeedEmulation`	Performance > Enable network throughput emulation Value: true | false
`screen.graphicsLatency`	Performance > Graphics primitives latency Value: integer
`screen.refresh.mode`	Performance > Display refresh (radio button) Value: default | immediate | periodic
`screen.refresh.rate`	Performance > Display refresh (slider) Value: integer
`vmspeed.bytecodespermilli`	Performance > Enable VM speed emulation (check box) Value: integer
`vmspeed.enableEmulation`	Performance > Enable VM speed emulation (slider) Value: true | false
`storage.root`	Storage > Storage root directory Value: String (relative path to *appdb*)
`storage.size`	Storage > Storage size Value: integer
`mm.control.capture`	MMedia > Audio Capture Value: true | false
`mm.control.midi`	MMedia > MIDI tones Value: true | false

TABLE 13 Emulator Preferences Properties List

Property Name	Property Description and Legal Values
`mm.control.mixing`	MMedia > Audio Mixing Value: true | false
`mm.control.record`	MMedia > Audio Record Value: true | false
`mm.control.volume`	Value: true | false
`mm.format.midi`	MMedia > MIDI format Value: true | false
`mm.format.video`	MMedia > Video format Value: true | false
`mm.format.wav`	MMedia > WAV Audio format Value: true | false
`wma.client.phoneNumber`	WMA > Phone Number of Next Emulator Value: integer
`wma.server.firstAssignedPhoneNumber`	WMA > First Assigned Phone Number Value: integer
`wma.server.percentFragmentLoss`	WMA > % Random Message Fragment Loss Value: integer
`wma.server.deliveryDelayMS`	WMA > Message Fragment Delivery Delay (ms) Value: integer

B.5 Using Security Features

The full spectrum of the J2ME Wireless Toolkit's security features are also available from the command line. You can adjust the emulator's default protection domain, sign MIDlet suites, and manage certificates.

B.5.1 Changing the Emulator's Default Protection Domain

To adjust the emulator's default protection domain, use the following option with the `emulator` command:

`-Xdomain` <*domain_type*>

Assigns a security domain to the MIDlet suite. Domain types include `untrusted`, `trusted`, `minimum`, and `maximum`.

B.5.2 Signing MIDlet Suites

`JadTool` is a command-line interface for signing MIDlet suites using public key cryptography according to the MIDP 2.0 specification. Signing a MIDlet suite is the process of adding the signer certificates and the digital signature of the JAR file to a JAD file.

`JadTool` only uses certificates and keys from J2SE keystores. J2SE provides `keytool`, the command-line tool to manage J2SE keystores.

`JadTool` is packaged in a JAR file. To run it, open a command prompt, change the current directory to {*toolkit*}`\bin`, and enter the following command:

`java -jar JADTool.jar` <*command*>

The commands are as follows:

`-help`

Print the usage instructions for JADTool.

`-addcert -keystore` <*keystore*> `-alias` <*alias*> `-storepass` <*password*> `[-certnum` <*number*>`] [-chainnum` <*number*>`] -inputjad` <*input_jadfile*> `-outputjad` <*output_jadfile*>

Add the certificate of the key pair from the given keystore to the JAD file. The default keystore is {*toolkit*}`\appdb\_main.ks`.

`-addjarsig -jarfile` <*jarfile*> `-keystore` <*keystore*> `-alias` <*alias*> `-storepass` <*password*> `-keypass` <*password*> `-inputjad` <*input_jadfile*> `-outputjad` <*output_jadfile*>

Add the digital signature of the given JAR file to the specified JAD file. The default value for `-jarfile` is the `MIDlet-Jar-URL` property in the JAD file. The default ME keystore is {*toolkit*}`\appdb\_main.ks`.

`-showcert [([-certnum` <*number*>`] [-chainnum` <*number*>`]) |-all [-encoding` <*encoding*>`] -inputjad` <*filename*>

Display the list of certificates in the given JAD file.

The default value for:

`-encoding` is `UTF-8`

`-jarfile` is the `MIDlet-Jar-URL` property in the JAD

`-keystore` is `%HOMEPATH%\.keystore`

`-certnum` is 1

`-chainnum` is 1

B.5.3 Managing Certificates

`MEKeyTool` manages the public keys of certificate authorities (CAs), making it functionally similar to the `keytool` utility that comes with the J2SE SDK. The keys can be used to facilitate secure HTTP communication over SSL (HTTPS).

Before using `MEKeyTool`, you must first have access to a Java Cryptography Extension (JCE) keystore. You can create one using the J2SE `keytool` utility; see `http://java.sun.com/j2se/1.4/docs/tooldocs/win32/keytool.html` for more information.

To run `MEKeyTool`, open a command prompt, change the current directory to `{`*toolkit*`}\bin`, and enter the following command:

`mekeytool.exe <`*command*`>`

The commands are as follows:

`-help`

Print the usage instructions for MEKeyTool.

`-import -alias <`*alias*`> [-keystore <`*JCEkeystore*`>] [-storepass <`*storepass*`>] -domain <`*domain_name*`>`

Import a public key into the ME keystore from the given JCE keystore using the given JCE keystore password. The default ME keystore is {*toolkit*}`\appdb\_main.ks` and the default JCE keystore is {*user.home*}`\.keystore`.

`-list`

List the keys in the ME keystore, including the owner and validity period for each. The ME keystore is {*toolkit*}`\appdb\_main.ks`.

`-delete (-owner <owner> | -number <key number>)`

Delete a key from the given ME keystore with the given owner. The ME keystore is {*toolkit*}`\appdb\_main.ks`.

Note – The J2ME Wireless Toolkit contains an ME keystore called `_main.ks`, which is located in the `appdb` subdirectory. This keystore includes all the certificates that exist in the default J2SE keystore, which comes with the J2SE SDK installation.

B.6 Using the Stub Generator

J2ME Clients can use the Stub Generator to access web services. The wscompile tool generates stubs, ties, serializers, and WSDL files used in JAX-RPC clients and services. The tool reads a configuration file, which specifies either a WSDL file, a model file, or a compiled service endpoint interface.

The syntax for the stub generator command is as follows:

`wscompile [`*options*`]` *configuration_files*

B.6.1 Options

TABLE 14 Options for the `wscompile` Command

Option	Description
`-d` *<output directory>*	specify where to place generated output files
`-f:`*<features>*	enable the given features
`-features:`*<features>*	same as `-f:`*<features>*
`-g`	generate debugging info
`-gen`	same as `-gen:client`
`-gen:client`	generate client artifacts (stubs, etc.)
`-httpproxy:`*<host>:<port>*	specify a HTTP proxy server (port defaults to 8080)
`-import`	generate interfaces and value types only
`-model` *<file>*	write the internal model to the given file
`-O`	optimize generated code
`-s` *<directory>*	specify where to place generated source files
`-verbose`	output messages about what the compiler is doing
`-version`	print version information
`-cldc1.0`	Set the CLDC version to 1.0 (default) (float and double become String)
`-cldc1.1`	Set the CLDC version to 1.1 (float and double are ok)
`-cldc1.0info`	Show all CLDC 1.0 info/warning messages.

Note – Exactly one `-gen` option must be specified. The `-f` option requires a comma-separated list of features.

TABLE 15 lists the features (delimited by commas) that can follow the `-f` option. The wscompile tool reads a WSDL file, compiled service endpoint interface (SEI), or model file as input. The Type of File column indicates which of these files can be used with a particular feature.

TABLE 15 Command Supported Features (-f) for `wscompile`

Option	Description	Type of File
`explicitcontext`	turn on explicit service context mapping	WSDL
`nodatabinding`	turn off data binding for literal encoding	WSDL
`noencodedtypes`	turn off encoding type information	WSDL, SEI, model
`nomultirefs`	turn off support for multiple references	WSDL, SEI, model
`novalidation`	turn off full validation of imported WSDL documents	WSDL
`searchschema`	search schema aggressively for subtypes	WSDL
`serializeinterfaces`	turn on direct serialization of interface types	WSDL, SEI, model
`wsi`	enable WSI-Basic Profile features (default)	
`resolveidref`	Resolve `xsd:IDREF`	
`nounwrap`	No unwrap.	

B.6.1.1 Example

```
wscompile -gen -d generated config.xml
```

```
wscompile -gen -f:nounwrap -O -cldc1.1 -d generated config.xml
```

APPENDIX C

Internationalization

This appendix describes setting the language displayed in the J2ME Wireless Toolkit and the localization setting of the emulation environment.

C.1 Locale Setting

A locale is a geographic or political region or community that shares the same language, customs, or cultural conventions. In software, a locale is represented by a collection of files, data, and code, which contains the information necessary to adapt software to a specific location.

Some software uses a locale to tailor information for users, such as:

- Messages displayed to the user
- Fonts used or other writing-specific information

By default, all KToolbar strings, that is, the entire User Interface (UI), are displayed in the language of the supported platform's locale.

For example, Japanese characters can be displayed in KToolbar running on a Japanese Windows machine, provided that the correct localized J2ME Wireless Toolkit has been downloaded and installed.

You can set the `wtk.locale` property to have the KToolbar displayed in a specified locale's language. For example, you can have the toolkit running on a Japanese machine but still have the KToolbar display shown in English by setting the locale property to `en-US`, and making sure that the proper supplement has been downloaded and installed over the J2ME Wireless Toolkit. The `wtk.locale` property should be placed in the *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties` file, where *{platform}* is the name of the underlying platform (`Windows` or `Linux`, for example).

C.2 Emulated Locale

The `microedition.locale` property is the MIDP system property that defines the current locale of the device, which is `null` by default. For the J2ME Wireless Toolkit emulator, this value is automatically set to the default locale for the J2SE environment you are running. For example:

- If you are running in an English system in the US, the `microedition.locale` is set to `en-US`.
- If you are running in a French system, the `microedition.locale` is set to `fr-FR`.

For information on `microedition.locale`, consult the MIDP specification.

You can override the default value by adding the `microedition.locale` property to the file *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties` file and define the property as desired, as shown in the following examples:

```
microedition.locale=en-US
```

```
microedition.locale=null
```

For details on setting a default locale, see the *J2ME Wireless Toolkit Basic Customization Guide.*

C.3 Character Encodings

The CLDC system property, `microedition.encoding,` defines the default character encoding name of the MIDP environment. In the J2ME Wireless Toolkit emulator, this property is set according to the underlying window system you are using. The property's value is set to the default encoding for the J2SE environment running on the same window system. For example, in an English window system, the encoding setting is

```
microedition.encoding=ISO8859_1
```

You can override the default value by adding the `microedition.encoding` property to the *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties` file. For example, if you want to use UTF-8 as the default setting on Windows, you can set the property in the *{toolkit}*`\wtklib\Windows\ktools.properties` file as follows:

```
microedition.encoding=UTF-8
```

For more information on character encoding, see the CLDC specification.

Note – All the J2SE encoders are available in the emulated environment. See the *J2ME Wireless Toolkit Basic Customization Guide* for information on how to limit the list of available encoders for a specific device.

C.3.1 Java Compiler Encoding Setting

The `javac.encoding` property determines the encoding used by the javac compiler to compile your source files. The property's value is set to the default encoding for the J2SE environment running on the same window system.

You can override the default value by adding the `javac.encoding` property to the *{toolkit}*`\wtklib\`*{platform}*`\ktools.properties` file, where {platform} is the name of the underlying platform, like `Windows` or `Linux`. For example, if you are running in an English system but find you need to compile a Japanese resource bundle, you can specify a Japanese character set, such as:

```
javac.encoding=EUCJIS
```

C.4 Font Support in the Default Emulator

The default fonts that are used in the emulated environment are set according to the underlying window system locale. By default, the MIDP environment fonts are mapped to the default J2SE environment Java fonts. These fonts usually support all the characters that are required by the current window's locale.

You can override these fonts to support other characters that are not supported by the default fonts. See the *J2ME Wireless Toolkit Basic Customization Guide* for information on how to configure them.

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