JSR066 Remote Method Invocation - Optional Package

Contents

Chapter 1. Remote Method Invocation - Optional Package (JSR066)

RMI Optional Package - Overview

The **Remote Method Invocation** (RMI) **Optional Package** augments the **Foundation/Personal Profile J9 Runtime** by allowing remote method invocation across virtual machines.

The **RMI Optional Package** consists of:
- An **rmip.jar** which contains the class files
- An **rmip-src.jar** which contains the source files
- No native methods. This optional package is pure Java only.

Supported platform:
- Java™ 2 Micro Edition (J2ME) configurations/profiles which include **Connected Device Configuration** and **Foundation Profile**.

Dependencies:
- The **RMI Optional Package** is dependent on a configuration/profile which supports CDC 1.0.

The Remote Method Invocation defines the Java API for distributed applications. It provides a set of classes, interfaces, tools, and protocols that enable the user to write distributed applications without worrying about serialization, network protocols, garbage collection, and all the low-level details that consume a large amount of time when developing distributed applications using java.net.

The RMI system basically enables a Java program to send messages to objects in another VM. Instead of developing clients and servers, the developer can design a distributed application the same way that any other object-oriented program is designed. Instead of having the objects restricted to the VM where they were created, remote objects can be created and will answer messages from other Java VMs regardless of whether or not they are running in the same host.

Restrictions

A remote method invocation involves more than just sending a message to a normal object. Objects are serialized, network connections must be established, data is sent through these connections, etc. These details can be the cause of exceptions that will have to be handled in the user code.

In light of these details, plus the fact that Java is a strongly-typed language, some restrictions must be considered.
- **Interfaces:** A remote object must implement at least one sub-interface of **java.rmi.Remote**, and only the messages defined in remote interfaces can be invoked from another VM.
- **Exceptions:** All the remote methods may throw remote exceptions in case, for example, of a network problem, and those exceptions have to be caught.
- **Objects**: Remote objects are passed as reference, but normal objects are serialized; the receiver will have a copy of the parameter instead of the real object.

RMI compiler

To free the developer from low-level details such as serialization of objects, RMI needs proxy classes to provide the API implemented by a remote object to the sender in the other VM. These classes are automatically generated by the RMI compiler (the rmic tool).

In JDK 1.1, RMI needed a proxy class on the remote object side (called a Skeleton) and another proxy class on the sender side (called a Stub). In Java 2, Skeleton is no longer needed. To maintain compatibility, the stub generator provides the options to create proxies in Java 1.1, Java 2, or other compatible format.

Refer to J9 utilities, RMI compiler for more information.

RMI registry

The registry is a bootstrap mechanism offered by the RMI system. It enables remote objects to be registered with a name and to be retrieved by using this same name.

After the remote object is passed to another VM using the registry, messages can be sent to this object, and other remote objects can be passed as parameters of methods constituting an RMI-distributed application.

You can start the RMI registry in two ways:
- Run the RMI registry utility (rmiregistry executable). This will create the RMI registry in a different VM.
- Use the `java.rmi.registry.LocateRegistry.createRegistry()` API. The RMI registry will be created in the same VM where remote objects are created.

After you start the RMI registry,

`java.rmi.registry.LocateRegistry.getRegistry()`

API then can be used to bind, lookup, list, or unbind remote objects.

An alternative way to access RMI Registry is to use the `java.rmi.Naming` API. RMI applications can lookup and list remote objects in an RMI Registry on local or remote host using the Naming API, but can only bind or unbind to an RMI registry on local host.

Refer to J9 utilities, RMI registry for more information.

J9 Utilities

The following J9 VM utilities are included with WebSphere Everyplace Micro Environment for use with RMI Optional Package:

RMI compiler

The RMI Compiler (rmic executable) is available for select platforms. It generates stubs and skeletons from RMI classes, and automatically compiles them using j9c, unless the `-nocompile` option is used. The generated Java files for the stubs and skeletons will only be kept if the `-keep` option is used.

Syntax and options:

The syntax for the RMI compiler is as follows:

`rmic <rmioptions> classnames`

The class name is not optional; this is the class for which the proxies are being generated. The following rmic options are available:

Option	Description
-ver:version	Generate proxies for JDK 1.1, JDK 1.2 or compatible. version can be any one of the following: • 1.1 • 1.2 • Compat version 1.2 is the default version.
-cp: path	Set the classpath to path.
-d:destinationDirectory	Destination for the stub and skeleton.
-keep	Keep the generated JAVA files.
-nocompile	Do not compile the JAVA files.
-g	Generate all debug information. The default is lines only.
-verbose	Print accessed and/or processed compilation units.
-nowarn	Do not report compiler warnings.

RMI registry

The RMI registry (rmiregistry executable) is available for select platforms. It creates an instance of the RMI registry in a new VM, and starts the RMI registry on the local host on the specified port.

Syntax and options:

```
rmiregistry <port>
```

<port> is the port number where the RMI registry will be started. The RMI registry will be started on port 1099 if you do not specify a port.

Using WebSphere Everyplace Technology Libraries

WSDD includes WebSphere Everyplace Technology Libraries that can be used with your Java class libraries. This section describes how the libraries are integrated with the tools.

Follow these steps to create a new project and add a new J2ME project with the WebSphere Technology Library **RMI-OP**.

1. Click **File | New | Project** to open the **New Project Wizard** in workbench toolbar.
2. In the left pane, select **J2ME**. In the right pane, select, **J2ME Project**. Then click **Next**.
3. Enter the following name for the new project: `My WTL Project`
4. Click **Next**.
5. Select the primary feature library configuration, for example **JCL Foundation 1.0**, then click **Next**.
6. Select the **Libraries** tab.
7. Click **Add Library** (on the right), then WebSphere Everyplace Technology Library, then **Next**.
8. Select the WTL library that you would like to incorporate in your project, for example **WTL RMI-OP**, then click **Finish**.

   Note: RMI-OP also requires WTL PDAP-FC
9. Click **Finish**, to create the J2ME project with the additional WTL library.
10. In the workbench, expand the + sign to the left of **My WTL Project**. Notice that the additional **WTL RMI-OP** library has been added.

Chapter 2. Additional Information

Further Information

If you need more information or have questions about our implementation of this JSR:

In the United States and Canada, call 1-800-IBM-CALL (1-800-426-2255)

In all other countries, you can submit your questions on the web at:
http://www.ibm.com/software/pervasive/support/questions.shtml

You may also find the following website helpful: JSR-066 JCP Site -
http://www.jcp.org/en/jsr/detail?id=66

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