CAROL Library User Manual

CAROL (Common Architecture for RMI ObjectWeb Layer), a RMI manager

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CAROL Library User Manual: CAROL (Common Architecture for RMI ObjectWeb Layer), a RMI manager

by Guillaume Riviere

CAROL is a library allowing to use different RMI implementations. Thanks to CAROL, a Java server application can be independent of RMI implementations and accessible simultaneously by RMI clients using different RMI implementations. CAROL allows to design, implement, compile, package, deploy, and execute distributed applications compliant with the RMI model.

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Chapter 1. Introduction

1.1. About this manual

This manual was meant as a tutorial that can give you an introduction on how to use the CAROL RMI IIOP library.

> **Note:** Please note that this manual is designed to be used along with, not instead of, the RMI IIOP Tutorial (http://java.sun.com/j2se/1.4/docs/guide/rmi-iiop/tutorial.html) and the JNDI tutorial (http://java.sun.com/products/jndi/tutorial). There are a number of cases where it is much easier to refer to the rather RMI IIOP and JNDI tutorials than trying to rehash what it already covers.

This manual will teach you the general way to use the CAROL abstraction in order to manipulate remote object on multi-RMI architecture. You will learn in particulars:

- the CAROL configuration rules for each RMI architecture,
- the RMI IIOP general mechanism and programming rules,
- the JNDI general mechanism and programming rules.

1.2. What is CAROL?

CAROL is a library allowing to use different RMI implementations. Thanks to CAROL, a Java server application can be independent of RMI implementations and accessible simultaneously by RMI clients using different RMI implementations. CAROL allows to design, implement, compile, package, deploy, and execute distributed applications compliant with the RMI model. CAROL provide tools for accessing to a Java server, in the same time, through the ObjectWeb JEREMIE RMI like RPC, through the JAVA standard RMI RPC and through a CORBA RPC (via a RMI IIOP). Therefore, a Java server using CAROL manipulates remote object only through RMI IIOP API classes and interfaces and never through CAROL classes or interface. So, CAROL allows a Java server to be independent, by configuration, of the RMI architecture and provider.

The CAROL library basically provides support (CAROL basic SPIs) for the following RMI implementations:

- ObjectWeb JEREMIE (JRMP 1.1 and 1.2)
- Sun RMI JRMP (JRMP 1.1 and 1.2)
- Sun JDK 1.4 RMI IIOP

The CAROL library provides also non standard tools for RMI architecture:

- a set of mechanisms for implicit context propagation in RMI JRMP,
- a set of mechanisms for Referenceable object binding via a CosNaming.

Please see the Non standard CAROL tools and mechanisms chapter for more information.

1.3. Why CAROL?

CAROL is basically design to be a solution for implementing J2EE specifications on interoperability and implicit context propagation. This library allows a J2EE server to be accessible, at the same time, by IIOP and JRMP clients.

Chapter 2. CAROL overview

2.1. Presentation of the CAROL library

This section describes the general CAROL architecture and development rules. CAROL is based on an API/SPI mechanism for export and registering RMI objects. This section describes which API are used by CAROL and how to develop a server using this API. This section is supposed to be used with the RMI IIOP tutorial (http://java.sun.com/j2se/1.4/docs/guide/rmi-iiop/tutorial.html) and the JNDI tutorial (http://java.sun.com/products/jndi/tutorial).

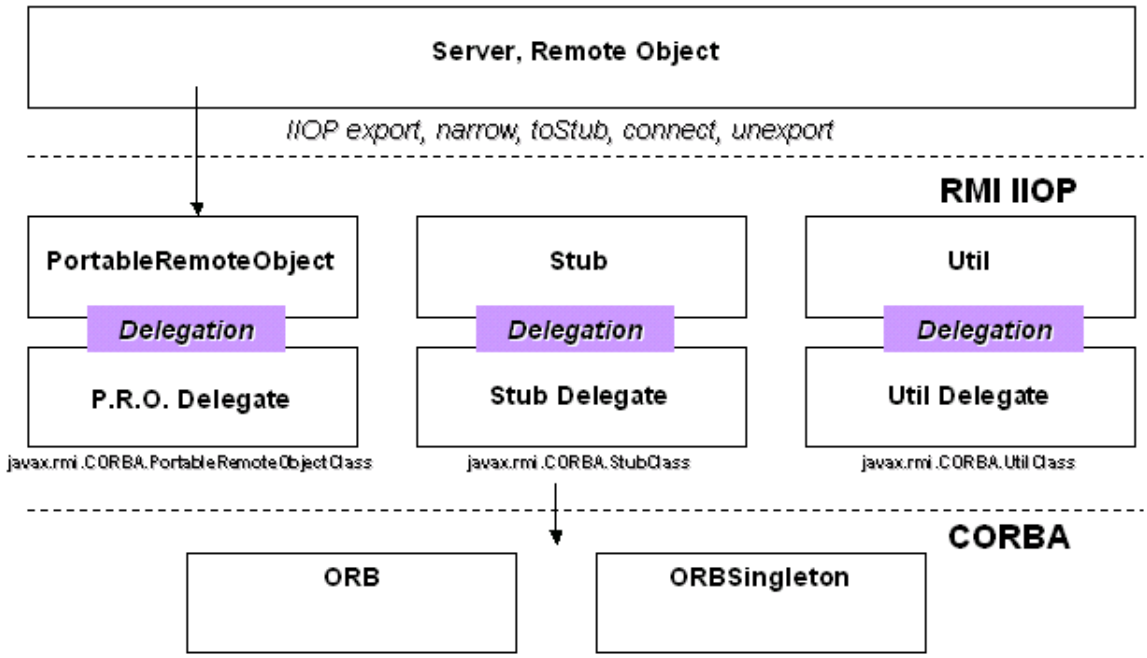
2.2. CAROL standard architecture

2.2.1. CAROL architecture

CAROL is behind the standard RMI IIOP and JNDI API. A Java server using CAROL have to be a standard RMI IIOP server and use only the JNDI interfaces for name service connections (see the section RMI IIOP Development rules and the JNDI Development rules section). A standard RMI IIOP server is required to migrate to the CAROL library without any code modification. Using CAROL library, in this case, is only a configuration manipulation. CAROL simulates a standard RMI IIOP PortableRemoteObjectDelegate and a standard JNDI context factory for interceptions and manipulations of the RPC and naming mechanism. CAROL allows any RMI IIOP remote object to be manipulate by a server on different RMI architectures and different naming services, in the same time, without code modification on the server or on the client side.

CAROL uses the standard RMI IIOP PortableRemoteObject to abstract the export mechanism. The figure 2.1 shows that the server only manipulate remote object via the RMI IIOP PortableRemoteObject and this PortableRemoteObject is a delegation to a "configured by system properties" PortableRemoteObjectDelegate class.

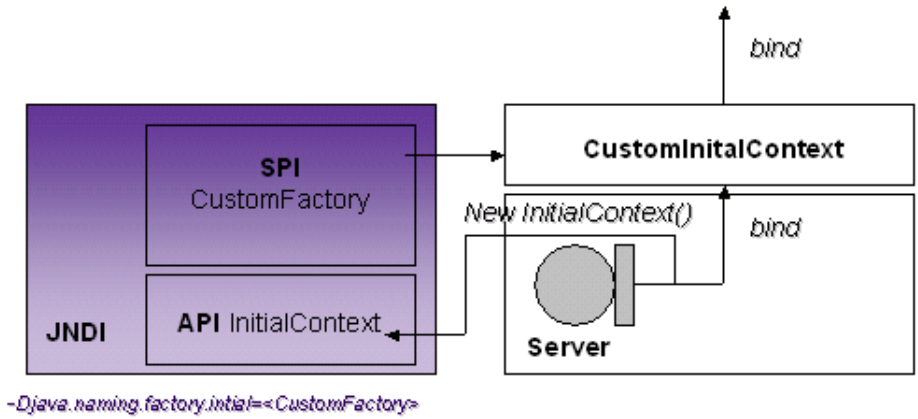
Figure 2-1. RMI IIOP mechanism



In fact, the CAROL remote object API is the standard RMI IIOP API. A Java server using CAROL is supposed to use only the java.rmi.* and the javax.rmi.* classes and never to call directly the CAROL library classes.

The same mechanism is used for objects registering through JNDI: a CAROL server is supposed to use only the JNDI interface to manipulate and contact the remote object name service. So, with JNDI, a CAROL server use the InitialContext mechanism, for (un)registering object, and this InitialContext delegate the registering to a context object build by a factory "configured by system properties". In the figure 2.2 we can see that the server only manipulates remote object registered via the JNDI InitialContext API.

Figure 2-2. JNDI mechanism



2.2.2. RMI IIOP development rules

This section describes the basic rules of RMI IIOP development. For more information, see the Sun entry for *RMI IIOP Documentation* (http://java.sun.com/j2se/1.4/docs/guide/rmi-iiop/index.html). This RMI IIOP quick start guide is design for a 3 step development:

- Development of the RMI IIOP remote objects and development of the RMI server part
- Java and CAROL RMI IIOP objects compilation
- Deployment step in a distributed environment

The Java classes used in this section are:

- `java.rmi.Remote` (http://java.sun.com/j2se/1.4/docs/api/java/rmi/Remote.html)
- `javax.rmi.PortableRemoteObject` (http://java.sun.com/j2se/1.4/docs/api/javax/rmi/PortableRemoteObject.html)

2.2.2.1. RMI IIOP remote objects development step

A RMI IIOP remote object needs only to expose its remote methods in a Java interface extending `Remote`. This is exactly the same development rules than in classical RMI JRMP. In the example 2-1, the

remote object `Foo` exposes its remote method `myMethod()` in the remote interface `FooRemoteInterface`.

Example 2-1. RMI basic example

```
//The foo object is a remote object
import java.rmi.RemoteException;

//The class foo implements only
//the FooRemoteInterface interface
public class Foo implement FooRemoteInterface {

    //This method is remote
    public Integer myMethod() throws RemoteException{
return new Integer(0);
    }
}


//The foo remote interface
//extends only the Remote interface
//and exposes the remote methods
import java.rmi.Remote;
import java.rmi.RemoteException;

public interface FooRemoteInterface extends Remote {

    //This method is remote
    public Integer myMethod() throws RemoteException;

}
```

> **Note:** The method `myMethod()` throws a RemoteException if an exceptions occurs in the remote method call.

2.2.2.2. RMI IIOP server development step

The RMI IIOP server has to manage remote objects. This section only describes the (un)export management of a RMI IIOP remote object. Please see the JNDI development rules section for the remote object (un)registering managment. One of the most important step in a remote object life cycle is the export step (and the opposite unexport step). To Exporte a remote object means to prepare this object to receive remote call. RMI IIOP abstracts the intricate CORBA implementation mechanism of this export

with the API class `PortableRemoteObject`. To Export a remote object is mandatory for remote call. There is two way for this export:

- The implicit method: if the remote object class implements the `PortableRemoteObject` class, this remote object is automatically export in is creation time. In the example 2-2 the remote object is implicitly exported by inheritance. In this case, the server only needs to construct the remote object to exported it.

  Example 2-2. RMI implicit export

```
//The foo object is a remote object
import java.rmi.RemoteException;
import javax.rmi.PortableRemoteObject;

//The class foo extends PortableRemoteObject
//and implements the FooRemoteInterface interface
public class Foo extends PortableRemoteObject
 implements FooRemoteInterface {

    //The constructor
    public Foo() throws RemoteException {
super();
    }

    //This method is remote
    public Integer myMethod() throws RemoteException {
return new Integer(0);
    }
}

//The foo remote object server
import java.rmi.RemoteException;

public class Server {

    //The main method of this server
    public static void main(String [] args)  {
try {
    FooRemoteInterface myFoo = new Foo();
    // the object is automatically
    // exported on RMI IIOP
} catch (RemoteException e) {
    //Foo construction problem
}

    }
}
```

- The explicit method: if the remote object class do not implement the `PortableRemoteObject` class, this remote object has to be explicitly exported by the server. The `public static void`

`exportObject(java.rmi.Remote)` method in `PortableRemoteObject` class allow to do that. In the example 2-3 the remote object is explicitly exported by the server.

Example 2-3. RMI explicit export

```
//The foo object is a remote object
import java.rmi.RemoteException;

//The class foo implements
//only the FooRemoteInterface interface
public class Foo implement FooRemoteInterface {

    //The constructor
    public Foo() throws RemoteException {
super();
    }

    //This method is remote
    public Integer myMethod() throws RemoteException {
return new Integer(0);
    }
}

//The foo remote object server
import java.rmi.RemoteException;
import javax.rmi.PortableRemoteObject;

public class Server {

    //The main method of this server
    public static void main(String [] args)  {
try {
    FooRemoteInterface myFoo = new Foo();
    //The object is explicitly exported on RMI IIOP:
    PortableRemoteObject.exportObject(myFoo);
} catch (RemoteException e) {
    //Foo construction problem
}

    }
}
```

2.2.2.3. CAROL RMI IIOP compilation step

The compilation step is designed by Java and RMI. There is no particular compilation step in order to use CAROL. Therefore, you need to compile Java classes and to compile stubs and skeletons with each RMI provider compiler for each RMI architecture (IIOP, JRMP, JEREMIE ...).

2.2.2.4. CAROL RMI IIOP server deployment step

The 3 points below are mandatory for CAROL server deploying on multi-RMI architecture:

- The system property javax.rmi.CORBA.PortableRemoteObjectClass need to be instantiated to `org.objectweb.carol.rmi.multi.MultiPRODelegate` in the server JVM.
- The `carol.properties` file need to be configured (see the CAROL Configuration chapter) and visible in the JVM classpath.
- For each RMI architecture all remote objects stub and skeleton have to be visible in the classpath.

> **Note:** For the moment, in CAROL library, there is 3 architectures available (CAROL SPI implementation): IIOP, JRMP and JEREMIE. There is no, in those 3 architectures, stub/skeleton class conflicts. For example, if my remote object is Foo with FooItf remote interface:
>
> - The stub/skel name for IIOP are: `_FooItf_Stub/_Foo_Tie`
> - The stub/skel name for JRMP are: `FooItf_Stub/FooItf_Skel`
> - The stub/skel name for JEREMIE are: `FooItf_OWStub/FooItf_OWSkel`
>
> And so there is no class name conflict, those 3 RMI architectures can be available in the same JVM. The Java classes used in this section are:
>
> - `javax.naming.InitialContext` (http://java.sun.com/j2se/1.4/docs/api/javax/naming/InitialContext.html)
> - `org.objectweb.carol.rmi.jrmp.interceptor.JServerRequestInterceptor`
> - `org.objectweb.carol.rmi.jrmp.interceptor.JServerRequestInfo`
> - `org.objectweb.carol.rmi.jrmp.interceptor.JServiceContext`
> - `org.objectweb.carol.rmi.jrmp.interceptor.JClientRequestInterceptor`
> - `org.objectweb.carol.rmi.jrmp.interceptor.JClientRequestInfo`
> - `org.objectweb.carol.rmi.jrmp.interceptor.JInitializer`
> - `org.objectweb.carol.rmi.jrmp.interceptor.JInitInfo`
> - `org.objectweb.carol.rmi.jrmp.interceptor.ProtocolInterceptorInitializer`
> - `org.objectweb.carol.jndi.iiop.IIOPContextWrapperFactory`
> - `org.objectweb.carol.jndi.iiop.IIOPContextWrapper`

Warning

But, be careful, there is stubs and/or skeletons class name conflicts for different provider of the same RMI architecture. For example, this is not possible, with CAROL, to deploy a remote object on two RMI provider with the same architecture (for example RMI JRMP 1.1 and RMI JRMP 1.2 or DAVID RMI IIOP and SUN JDK 1.4 RMI IIOP) because there are a stubs and/or skeletons class name conflicts in the server JVM.

2.2.3. JNDI development rules

This section describes the basic JNDI development rules. For more information, see the Sun entry for *JNDI Documentation* (http://java.sun.com/products/jndi/1.2/javadoc/). This JNDI start guide is designed for a 2 steps development:

- Development of the JNDI server part
- JNDI deployment step on a distributed environment

2.2.3.1. Development of the JNDI server part

For remote object access with CAROL, the first part is to develop and deploy RMI IIOP remote objects (see the RMI IIOP Development rules chapter) on a Java server. The second part is to register those objects in one/many name service through the standard JNDI Interface. For this, the server needs to build a `InitialContext` object and to register all remote objects in this context like in the Example 2-4:

Example 2-4. JNDI basic example

```
//The foo remote object server
import java.rmi.RemoteException;
import javax.naming.InitialContext;
import javax.naming.NamingException;

public class Server {

    //The main method of this server
    public static void main(String [] args)  {
try {
    // the object is automatically
    // exported on RMI IIOP
    FooRemoteInterface myFoo = new Foo();

    // now the server bind this object trough JNDI
```

```
    // with the name myobjectname
    InitialContext ic = new InitialContext();
    ic.rebind("myobjectname", myFoo)

} catch (RemoteException e) {
    //Foo construction problem
}catch (NamingException ne) {
    //Foo binding problem
}

    }
}
```

Note: In this example, the server use a default `IntialContext` without configuration. You may want to configure your server JNDI for each name service (registry, cosnaming ...). Please use only the CAROL configuration to setup your multi JNDI name service. For this feature, a Java server, needs the CAROL JNDI context factory (see the CAROL Configuration chapter).

2.2.3.2. JNDI deployment step on a distributed environment

The 3 points below are mandatory for CAROL server deploying on multi name service architecture:

- The system property java.naming.factory.initial need to be instantiated to `org.objectweb.carol.jndi.spi.MultiOrbInitialContextFactory` in the server JVM.
- The `carol.properties` and the `jndi.properties` files need to be configured (see the CAROL Configuration chapter) and visible in the server JVM classpath.
- Each name service (registry, cosnaming, ...) need to be launched in the distribute environment.

Warning

Be careful, the InitialContext need to be configured for CAROL with the system property java.naming.factory.initial instantiated to `org.objectweb.carol.jndi.spi.MultiOrbInitialContextFactory`. Every other properties configured directly in the server InitialContext will be lost. The important point is to understand that the `IntialContext` is an indirection to an other context, the CAROL one, which manage all the contexts for each name service.

2.3. Non standards CAROL tools and mechanisms

2.3.1. Implicit context propagation with RMI JRMP

One of the non standard features (API) provided by CAROL is the possibility to instantiate, for a Java server, an implicit context propagation. This API is very useful for security and transaction behavior. This API is a simplification of CORBA portable interceptor concept. Therefore, this tool use a server and client interceptor with an initializer registering mechanism. This mechanism is pure Java without any CORBA classes connection (only the `rt.jar` classes are needed for this features). This mechanism works with the version 1.1 and 1.2 of RMI. This section explain the way to build, register and use server and client interceptor through RMI JRMP.

2.3.1.1. CAROL RMI JRMP interceptors API

Implementing JRMP interceptors is very easy. A server interceptor only need to implements the `JServerRequestInterceptor` interface and use the `JServerRequestInfo` interface to propagate a `JServiceContext`. On the client side this is the same concept with `JClientRequestInterceptor` interface and `JClientRequestInfo` interface. For propagation, a CAROL propagation context need only to be a Serializable object and to extends the class `JServiceContext`.

2.3.1.2. CAROL RMI JRMP interceptor registering

To register interceptor in CAROL is very easy. A server/client initializer implements the `JInitializer` and use the pre_init and post_init methods for registering server and client interceptors through `JInitInfo` interface. For JVM CAROL JRMP initialization, use the org.objectweb.PortableInterceptor.JRMPInitializerClass.XXX property where XXX is the JInitializer full classname (for example pass -Dorg.objectweb.PortableInterceptor.JRMPInitializerClass .org.objectweb.carol.rmi.jrmp.interceptor.ProtocolInterceptorInitializer register into CAROL the `ProtocolInterceptorInitializer` class). Register more than one JInitializer is possible with CAROL (The `ProtocolInterceptorInitializer` is mandatory for CAROL multi protocol management).

2.3.2. Refereanceable binding through a RMI IIOP CosNaming

The second non standard CAROL features is a way to register Referenceable and Serializable objects in a CosNaming through JNDI. The IIOP InitialContext delivered for IIOP wrap the Referenceable or Serializable object into a standard remote object. This remote object is exported into the JNDI context bind(or rebind) method and unexported into the JNDI context unbind method. CAROL use automatically, on the server side, this mechanism with a standard CAROL IIOP configuration (you need to call the IIOP protocol 'iiop' in the `carol.properties` file see the CAROL configuration chapter).

For a JNDI java RMI IIOP client you can use the `IIOPContextWrapperFactory` by setting the -Djava.naming.factory.initial jvm properties (with the full name of the factory). This factory builds a JNDI Context based on you `jndi.properties` uses the wrapping mechanism. For other client (Non JNDI), you can re-build manually the Referenceable or Serializable object for the CosNaming wrapper remote object (see inside the `IIOPContextWrapper` class for a detailed mechanism. A CAROL server can be also an IIOP CAROL client without any extra configuration than in a classical IIOP CAROL server.

2.4. Getting started conclusion

CAROL is only configured by system properties and files. There is no intrusion of CAROL classes in a standard RMI IIOP server. The server is RMI architecture independent but work simultaneously on different RMI architectures. The next chapter explains the general rules for this configuration.

Chapter 3. CAROL Configuration

3.1. Presentation of the CAROL library configuration

This section describes the configuration rules for different RMI and name services managed by CAROL. Currently, CAROL is distributed with tools and classes that allow to use:

- ObjectWeb/Jonathan JEREMIE (http://objectweb.org/jonathan) RMI JRMP like
- Sun RMI JRMP (http://java.sun.com/j2se/1.4/docs/guide/rmi/index.html) (version 1.1 and 1.2)
- Sun jdk 1.4 RMI IIOP (http://java.sun.com/j2se/1.4/docs/guide/idl/index.html)

CAROL allows to configure a remote Java server to accessible by one,two or three of those RMI architecture, in the same time, by configuration.

3.2. CAROL configuration

3.2.1. General configuration files

CAROL configuration is based on two properties files. The `carol.properties` file and the `jndi.properties` file. Only the carol.properties file is mandatory to configure CAROL. If there is no JNDI configuration in the `carol.properties` file, CAROL will automatically search for those configuration informations in the `jndi.properties` file. In this case, if there is no `jndi.properties` file, an Exception will be raised.

> **Note:** CAROL use, for JNDI conformance, the standard `jndi.properties` file (for only one RMI architecture activate). For multi RMI architectures with multi name services (registry and CosNaming for example) CAROL need a JNDI configuration inside the `carol.properties`. In this case, if, for one (and only one) of those activated RMI, the JNDI configuration missing, the `jndi.properties` file is used by CAROL.

All the configuration below use only the `carol.properties` file. You can put one of the JNDI configuration in a `jndi.properties` file, this will work with CAROL.

3.2.2. General configuration rules for all RMI and JNDI architectures

The `carol.properties` file is a standard Java properties file. All properties, in this file, follow the rules below (we suppose that XXX is the rmi name like ’jrmp’, ’iiop’ or ’jeremie’. For RMI IIOP configuration, please use only the name ’iiop’).

Table 3-1. Carol general properties

Property name	Property value	Description	Required
carol.rmi.activated	'XXX protocol-name', 'YYY potocol-name'	All rmi activated architecture name. The first (XXX) is the default rmi protocol for CAROL. This default protocol is used by the server when there is no entrant protocol.	Yes
carol.jvm.'property-name'	'property-value'	All extra JVM property for all RMI (directly pass to the JVM with 'name' name and 'value' value without any verifications). This is equivalent to put -D'property-name'='property-value' in the Java JVM option.	no

Table 3-2. Carol RMI XXX specifics properties

Property name	Property value	Description	Required
carol.rmi.XXX .PortableRemoteObject-Class	'XXX portable remote object class name'	The portable remote object delegate class name for this RMI (CAROL provide those classes for RMI JRMP and JEREMIE, see below).	Yes, for all activated rmi.
carol.jndi.XXX.'property-name'	'property-value'	All jndi properties needed for XXX name service configuration. This is equivalent to put 'property-name'='property-value' in the jndi.properties file	Yes, for 'java.naming.factory.initial' and 'java.naming.provider.url' jndi property (in the `carol.properties` or in the `jndi.properties` file)

3.2.3. RMI JRMP configuration

One of the SPI personality available/provided in CAROL is the standard Sun RMI JRMP. This personality can be used with all standard RMI JRMP features. CAROL also allow this RMI JRMP to propagate implicitly a context (like transactional or security context) via a RMI IIOP Interceptor like mechanism. The example below explains the general way for CAROL RMI JRMP configuration:

Example 3-1. RMI JRMP `carol.properties` file

```
# activated protocols
carol.rmi.activated=jrmp

# portable remote object delegate class
# for this protocol (class name with package)
carol.rmi.jrmp.PortableRemoteObjectClass
 =org.objectweb.carol.rmi.multi.JrmpPRODelegate

# configuration for rmi jrmp jndi
carol.jndi.jrmp.java.naming.factory.initial
 =com.sun.jndi.rmi.registry.RegistryContextFactory

carol.jndi.jrmp.java.naming.provider.url
 =rmi://localhost:19570

# Protocol Interceptors initializer class
# (this class is mandatory for multi rmi)
carol.jvm.org.objectweb.PortableInterceptor.JRMPInitializerClass
 .org.objectweb.carol.rmi.jrmp.interceptor.ProtocolInterceptorInitializer

# Interceptors initializer class
carol.jvm.org.objectweb.PortableInterceptor.JRMPInitializerClass
 .org.objectweb.carol.jtests.conform.interceptor.jrmp.Initializer
```

In the file above we see a JRMP standard configuration:

- carol.rmi.activated property is set to JRMP default and activated protocol.
- The carol.rmi.jrmp.PortableRemoteObjectClass property is set to `org.objectweb.carol.rmi.multi.JrmpPRODelegate`. This class is provide by CAROL to simulate a RMI IIOP portable remote object delegate in JRMP.
- JNDI is configured with classical property values

There is also non standard values (passed directly to the JVM). Those values are for JRMP remote call interception with a CORBA 'portable interceptor like' mechanism through CAROL interfaces. Here there is two interception instantiation classes (org.objectweb.PortableInterceptor.JRMPInitializerClass.*): `ProtocolInterceptorInitializer`

(provided by CAROL and mandatory for multi protocol management) and `Initializer` (provided by CAROL tests and not mandatory, only for this example).

3.2.4. RMI IIOP configuration

One of the SPI personality available/provided in CAROL is the Sun jdk1.4 RMI IIOP. This personality can be used with all standard RMI IIOP (CORBA 2.3) features. CAROL also allows this RMI IIOP to propagate implicitly a context (like transactional or security context) via a standard RMI IIOP Interceptor mechanism. This section explain the general way for CAROL RMI IIOP configuration:

Example 3-2. RMI IIOP `carol.properties` file

```
# activated protocols
carol.rmi.activated=iiop

# portable remote object delegate class
# for this protocol (full class name with package)
carol.rmi.iiop.PortableRemoteObjectClass
 =com.sun.corba.se.internal.javax.rmi.PortableRemoteObject

# configuration for rmi iiop jndi
carol.jndi.iiop.java.naming.factory.initial
 =com.sun.jndi.cosnaming.CNCtxFactory

carol.jndi.iiop.java.naming.provider.url
 =iiop://localhost:19571

# util delegate
carol.jvm.javax.rmi.CORBA.UtilClass
 =com.sun.corba.se.internal.POA.ShutdownUtilDelegate

# stub delegate
carol.jvm.javax.rmi.CORBA.StubClass
 =com.sun.corba.se.internal.javax.rmi.CORBA.StubDelegateImpl

# orb
carol.jvm.org.omg.CORBA.ORBClass
 =com.sun.corba.se.internal.Interceptors.PIORB

# orb singleton
carol.jvm.org.omg.CORBA.ORBSingletonClass
 =com.sun.corba.se.internal.corba.ORBSingleton

# Protocol Interceptors initializer class
# (this class is mandatory for multi rmi)
carol.jvm.org.omg.PortableInterceptor.ORBInitializerClass
 .org.objectweb.carol.rmi.iiop.interceptor.ProtocolInitializer

# Interceptors initializer class (class name with package)
```

```
carol.jvm.org.omg.PortableInterceptor.ORBInitializerClass
 .org.objectweb.carol.jtests.conform.interceptor.iiop.IIOPInitializer
```

In the file above we see a IIOP standard configuration:

- The carol.rmi.activated property is set to IIOP default and activated protocol.
- The carol.rmi.iiop.PortableRemoteObjectClass property is set to `com.sun.corba.se.internal.javax.rmi.PortableRemoteObject`. This class is the standard Sun RMI IIOP portable remote object delegate.
- JNDI is configured with classical property values

There is also non standard values (passed directly to the JVM). Those values are for standard IIOP CORBA configuration and remote call interception with a CORBA portable interceptor mechanism. Here there is two interception instantiation classes (org.objectweb.PortableInterceptor.ORBInitializerClass.*): `ProtocolInitializer` (provided by CAROL and mandatory for multi protocol) and `IIOPInitializer` (provided by CAROL tests and not mandatory, only for this example).

3.2.5. RMI JEREMIE personality configuration

One of the SPI personality available/provided in CAROL is the ObjectWeb Jonathan JEREMIE personality. This personality can be used with all standard JEREMIE features. CAROL also allow this JEREMIE to propagate implicitly a context (like transactionnal or security context) via a JEREMIE handler mechanism. This section explain the general way for CAROL JEREMIE configuration in the two file jonathan.xml and carol.properties:

Example 3-3. JEREMIE `jonathan.xml` file

```
<?xml version="1.0"?>
<!DOCTYPE Configuration SYSTEM "configuration.dtd">
  <CONFIGURATION>
    <ELEM name="DavidCarolHandler">
      <ATOM class="org.objectweb.carol.rmi.jonathan.david.DavidCarolHandler"/>
    </ELEM>
    <ELEM name="david/orbs/iiop/services_handler_context/1534">
      <ALIAS name="/DavidCarolHandler" />
    </ELEM>
    <ELEM name="JeremieCarolHandler">
      <ATOM
class="org.objectweb.carol.rmi.jonathan.jeremie.JeremieCarolHandler"/>
    </ELEM>
    <ELEM name="jeremie/service_handler_context/1535">
      <ALIAS name="/JeremieCarolHandler" />
    </ELEM>
```

```
    <ELEM name="jeremie/stub_factories/std">
      <CONFIGURATION>
<ELEM name="Stub name extension">
  <PROPERTY type="String" value="OW"/>
</ELEM>
      </CONFIGURATION>
    </ELEM>
  </CONFIGURATION>
```

In the file above, JEREMIE is configured to use the OW extension for stub/skeleton and to use the CAROL protocol handler.

Example 3-4. JEREMIE `carol.properties` file

```
# activated protocols
carol.rmi.activated=jeremie

# portable remote object delegate class
# for this protocol (class name with package)
carol.rmi.jeremie.PortableRemoteObjectClass
 =org.objectweb.carol.rmi.multi.JeremiePRODelegate

# configuration for rmi jrmp jndi
carol.jndi.jeremie.java.naming.factory.initial
 =org.objectweb.jeremie.libs.services.registry.jndi.JRMIInitialContextFactory

carol.jndi.jeremie.java.naming.provider.url
 =jrmi://localhost:19572
```

In the file above we see a JEREMIE standard configuration:

- The carol.rmi.activated property is set JEREMIE default and activated protocols
- The carol.rmi.jeremie.PortableRemoteObjectClass property is set to `org.objectweb.carol.rmi.multi.JeremiePRODelegate`. This class is provided by CAROL to simulate a RMI IIOP portable remote object delegate in JEREMIE.
- JNDI is configured with classical property values for JEREMIE

3.2.6. MULTI RMI configuration

The example below show a general RMI configuration with 3 RMI architectures configured and 2 activated (RMI IIOP and JEREMIE) and with RMI IIOP default:

Example 3-5. MULTI RMI `carol.properties` file

```
# activated and default protocol (iiop)
carol.rmi.activated=iiop,jeremie

### IIOP Configuration ###

# portable remote object delegate class
# for this protocol (full class name with package)
carol.rmi.iiop.PortableRemoteObjectClass
 =com.sun.corba.se.internal.javax.rmi.PortableRemoteObject

# configuration for rmi iiop jndi
carol.jndi.iiop.java.naming.factory.initial
 =com.sun.jndi.cosnaming.CNCtxFactory

carol.jndi.iiop.java.naming.provider.url
 =iiop://localhost:19571

# util delegate
carol.jvm.javax.rmi.CORBA.UtilClass
 =com.sun.corba.se.internal.POA.ShutdownUtilDelegate

# stub delegate
carol.jvm.javax.rmi.CORBA.StubClass
 =com.sun.corba.se.internal.javax.rmi.CORBA.StubDelegateImpl

# orb
carol.jvm.org.omg.CORBA.ORBClass
 =com.sun.corba.se.internal.Interceptors.PIORB

# orb singleton
carol.jvm.org.omg.CORBA.ORBSingletonClass
 =com.sun.corba.se.internal.corba.ORBSingleton

# Protocol Interceptors initializer class
# (this class is mandatory for multi rmi)
carol.jvm.org.omg.PortableInterceptor.ORBInitializerClass
 .org.objectweb.carol.rmi.iiop.interceptor.ProtocolInitializer

# Interceptors initializer class (class name with package)
carol.jvm.org.omg.PortableInterceptor.ORBInitializerClass
 .org.objectweb.carol.jtests.conform.interceptor.iiop.IIOPInitializer

### JRMP Configuration (desactivate) ###

# portable remote object delegate class$
# for this protocol (class name with package)
carol.rmi.jrmp.PortableRemoteObjectClass
 =org.objectweb.carol.rmi.multi.JrmpPRODelegate

# configuration for rmi jrmp jndi
carol.jndi.jrmp.java.naming.factory.initial
```

```
 =com.sun.jndi.rmi.registry.RegistryContextFactory

carol.jndi.jrmp.java.naming.provider.url
 =rmi://localhost:19570

# Protocol Interceptors initializer class
# (this class is mandatory for multi rmi)
carol.jvm.org.objectweb.PortableInterceptor.JRMPInitializerClass
 .org.objectweb.carol.rmi.jrmp.interceptor.ProtocolInterceptorInitializer

# Interceptors initializer class
carol.jvm.org.objectweb.PortableInterceptor.JRMPInitializerClass
 .org.objectweb.carol.jtests.conform.interceptor.jrmp.Initializer

### JEREMIE Configuration ###

# portable remote object delegate class
# for this protocol (class name with package)
carol.rmi.jeremie.PortableRemoteObjectClass
 =org.objectweb.carol.rmi.multi.JeremiePRODelegate

# configuration for rmi jrmp jndi
carol.jndi.jeremie.java.naming.factory.initial
 =org.objectweb.jeremie.libs.services.registry.jndi.JRMIInitialContextFactory

carol.jndi.jeremie.java.naming.provider.url
 =jrmi://localhost:19572
```

Chapter 4. CAROL requirements

This chapter describe the system requirements for CAROL.

Web sites index

General CAROL requirements

Java environment

A CAROL Java server need a JDK 1.2 or greater

A CAROL Java server need the `carol.jar` file in it's classpath

CAROL RMI JRMP requirements

Server Environement

A CAROL RMI JRMP Java server need a JDK 1.2 or greater

Client Environement

A CAROL RMI JRMP Java client need a JDK 1.2 or greater

A CAROL RMI JRMP Java client need the `carol.jar` file in it's classpath

CAROL RMI IIOP requirements

Server Environement

A CAROL RMI IIOP Java server need a JDK 1.4 or a 2.6 CORBA with RMI IIOP

Client Environement

A CAROL IIOP client need a CORBA 2.6

A CAROL RMI IIOP Java client need a JDK 1.4 or a 2.6 CORBA with RMI IIOP and the `carol.jar` file in it's classpath

CAROL JEREMIE requirements

Server Environement

A CAROL JEREMIE Java server need a JDK 1.2 and a Jonathan 3.0 alpha10 or greater

Client Environement

A CAROL JEREMIE Java client need a JDK 1.2 and a Jonathan 3.0 alpha10 or greater

Chapter 5. Links and Reference

Web site list and book reference

Web sites index

ObjectWeb web sites

ObjectWeb
- ObjectWeb main web site

CAROL
- CAROL ObjectWeb web site

JONATHAN
- JONATHAN ObjectWeb web site

SUN web sites

Java Sun
- Java Sun main web site

JDK 1.4
- Java JDK 1.4 API

RMI
- RMI documentation and tutorial web site

RMI IIOP
- RMI IIOP documentation and tutorial web site

OMG web sites

OMG
- OMG main web site

CORBA web page
- CORBA web page

PortableInterceptor
- PortableInterceptor documentation

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Glossary

RMI

(Remote Method Invocation) This is the standard specifications of the Java RPC.

RPC

(Remote Procedure Call) all remote method call protocol is a RPC.

JVM

(Java Virtual Machine) The Java virtual machine.

JDK

(Java Development Kit) A set a Java tools (compiler, jvm, library ...) for Java programs development.

API

(Application Programming Interface) Interfaces allowing to use library in programs.

SPI

(Service Provider Interface) Interface for provider library plugging in an other library.

JNDI

(Java Naming Directory Interface) Standard API/SPI for J2EE naming interface .

OMG

(Object Management Group) Industrial group for computer standard specifications.

CORBA

(Common Object Request Broker Architecture) OMG RPC specification.

IIOP

(Inter-operable Internet Object Protocol) CORBA RPC standard protocol on TCP/IP

JRMP

(Java Remote Method Protocol)Java RMI standard protocol