IronJacamar 1.2 Developer's Guide

Connecting your Enterprise Information Systems
IronJacamar 1.2 Developer's Guide: Connecting your Enterprise Information Systems
To all Java EE Connector Architecture users, and especially the IronJacamar community
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Preface

1. About IronJacamar

The goal of the IronJacamar project is to provide an implementation of the Java Connector Architecture 1.7 specification.

The specification can be found here: http://www.jcp.org/en/jsr/detail?id=322.

The IronJacamar project is licensed under the GNU LESSER GENERAL PUBLIC LICENSE 2.1 (LGPL 2.1) license.

2. Why IronJacamar?

The Java EE Connector Architecture container can be viewed as a foundation inside an application server as it provides connectivity to the other containers such that they can communicate with EISes. Iron is often used as foundation in building houses too.

The Jacamar bird family which lives in Central and South America are glossy elegant birds with long bills and tails. Why we picked the Jacamar family is left as an exercise for the reader :)

3. Versions

This section contains the highlights of the IronJacamar releases. A full description of each release can be found through our issue tracking system at http://issues.jboss.org/browse/JBJCA.

3.1. IronJacamar 1.2

Highlights as compared to IronJacamar 1.1:

- Support for graceful shutdown of ConnectionManager and WorkManager
- Support for connectable XAResources
- Support tracking of connection handles across transaction boundaries
- Additional statistics for pools
- Event tracer for easier debugging

3.2. IronJacamar 1.1

Highlights as compared to IronJacamar 1.0:

- Java EE Connector Architecture 1.7 certified (standalone / Java EE7)
Preface

• Lazy connection manager (JCA chapter 7.16)
• Distributed work manager (JCA chapter 10.3.11)
• Advanced pool capacity policies and flush strategies
• Enhanced Arquillian integration
• Eclipse development plugin
• Enterprise Information System testing server
• Resource adapter information tool
• Migration tools

3.3. IronJacamar 1.0

Highlights as compared to previous Java EE Connector Architecture containers inside JBoss Application Server:

• Java EE Connector Architecture 1.6 certified (standalone / Java EE6)
• POJO container environment
• New configuration schemas which focuses on usability
• Fast XML and annotation parsing for quick deployment
• Reauthentication support
• Prefill support for security backed domains
• Support for pool flushing strategies
• Embedded environment for ease of development with Arquillian and ShrinkWrap integration
• New management and statistics integration for components
• Code generator for resource adapters
• Validator tool for resource adapters

4. The team

Jesper Pedersen acts as the lead for the IronJacamar project. He can be reached at jesper (dot) pedersen (at) ironjacamar (dot) org.

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5. Thanks to


6. License

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Introduction

The Java Connector Architecture (JCA) defines a standard architecture for connecting the Java EE platform to heterogeneous Enterprise Information Systems (EIS). Examples of EISs include Enterprise Resource Planning (ERP), mainframe transaction processing (TP), databases and messaging systems.

The connector architecture defines a set of scalable, secure, and transactional mechanisms that enable the integration of EISs with application servers and enterprise applications.

The connector architecture also defines a Common Client Interface (CCI) for EIS access. The CCI defines a client API for interacting with heterogeneous EISs.

The connector architecture enables an EIS vendor to provide a standard resource adapter for its EIS. A resource adapter is a system-level software driver that is used by a Java application to connect to an EIS. The resource adapter plugs into an application server and provides connectivity between the EIS, the application server, and the enterprise application. The resource adapter serves as a protocol adapter that allows any arbitrary EIS communication protocol to be used for connectivity. An application server vendor extends its system once to support the connector architecture and is then assured of seamless connectivity to multiple EISs. Likewise, an EIS vendor provides one standard resource adapter which has the capability to plug in to any application server that supports the connector architecture.

1.1. What’s New

1.1.1. Java Connector Architecture 1.7

The Java Connector Architecture 1.7 specification adds the following areas:

- Adds an activation name for message endpoints to uniquely identify them
- Deployment annotations for connection factories and administration objects

Note

The deployment annotations are only meant for developer usage, and should not be used in test or production environments.
1.1.2. Java Connector Architecture 1.6

The Java Connector Architecture 1.6 specification adds the following major areas:

- Ease of Development: The use of annotations reduces or completely eliminates the need to deal with a deployment descriptor in many cases. The use of annotations also reduces the need to keep the deployment descriptor synchronized with changes to source code.
- Generic work context contract: A generic contract that enables a resource adapter to control the execution context of a Work instance that it has submitted to the application server for execution.
- Security work context: A standard contract that enables a resource adapter to establish security information while submitting a Work instance for execution to a WorkManager and while delivering messages to message endpoints residing in the application server.
- Standalone Container Environment: A defined set of services that makes up a standalone execution environment for resource adapters.

1.2. Overview

The Java EE Connector Architecture features three different types of resource adapters:

- Outbound: The resource adapter allows the application to communicate to the Enterprise Information System (EIS).
- Inbound: The resource adapter allows messages to flow from the Enterprise Information System (EIS) to the application.
- Bi-directional: The resource adapter features both an outbound and an inbound part.

For more information about Java EE Connector Architecture see the specification.

1.2.1. Outbound resource adapter

The Java Connector Architecture specification consists of a number of outbound components:
The application uses the

- ConnectionFactory: The connection factory is looked up in Java Naming and Directory Interface (JNDI) and is used to create a connection.

- Connection: The connection contains the Enterprise Information System (EIS) specific operations.

The resource adapter contains

- ManagedConnectionFactory: The managed connection factory creates managed connections.

- ManagedConnection: The managed connection represents a physical connection to the target Enterprise Information System (EIS). The managed connection notifies the application server of events such as connection closed and connection error.

IronJacamar - the application server - contains

- ConnectionManager: The connection manager handles all managed connections in regards to pooling, transaction and security.

- ConnectionEventListener: The connection event listener allows the connection manager to know the status of each managed connection.
1.2.2. Inbound resource adapter

The Java Connector Architecture specification consists of a number of inbound components:

- **ActivationSpec**: The activation specification specifies the different properties that the application is looking for from the resource adapter and hence the Enterprise Information System (EIS). This specification can be hidden from the user by a facade provided by the application server.

The resource adapter contains

- **ResourceAdapter**: The resource adapter provides the activation point for inbound communication.

- **Resource adapter specific**: The resource adapter specific code handles communication with the Enterprise Information System (EIS) and deliver messages through the MessageEndpointFactory.

IronJacamar - the application server - contains

- **MessageEndpointFactory**: The MessageEndpointFactory is registered with the ResourceAdapter instance and creates the MessageEndpoint instances.
• MessageEndpoint: The MessageEndpoint contains the actual message from the Enterprise Information System (EIS) which the application uses. This could for example be a message driven Enterprise JavaBean (EJB/MDB).
2.1. Prerequisites

2.1.1. Java Development Kit (JDK)

You must have the following JDK installed in order to build the project:

- Sun JDK 1.7.x
- OpenJDK 1.7.x
- Sun JDK 1.8.x
- OpenJDK 1.8.x

Remember to ensure that "javac" and "java" are in your path (or symlinked).

JAVA_HOME=/location/to/javahome
export JAVA_HOME

PATH=$JAVA_HOME/bin:$PATH
export PATH

2.1.2. Apache Ant

You must have Apache Ant 1.9.4+ installed on your system.

Remember to ensure that "ant" are in your path (or symlinked).

ANT_HOME=/location/to/anthome
export ANT_HOME

PATH=$ANT_HOME/bin:$PATH
export PATH
Chapter 2. Building

You may need to set the memory settings for the Apache Ant process like

ANT_OPTS="$ANT_OPTS -Xms128m -Xmx512m -XX:MaxPermSize=256m"
export ANT_OPTS

2.1.3. Apache Ivy

The IronJacamar project uses Apache Ivy for dependency management.

Apache Ivy is automatically downloaded and included in the development environment, so no additional setup is required.

2.1.4. Git

You must have Git installed on your system.

Remember to ensure that "git" are in your path (or symlinked).

2.2. Obtaining the source code

2.2.1. Forking the repository

The IronJacamar repository is located at:

https://github.com/ironjacamar/ironjacamar

Press the "Fork" button in order to fork the repository to your own GitHub account.

Clone your repository to your machine using

```bash
git clone git@github.com:<your_account>/ironjacamar.git
```

Next add the upstream repository as a remote location:

```bash
cd ironjacamar
git remote add upstream git@github.com:ironjacamar/ironjacamar.git
```
2.2.2. Git branches

We have the following branches for the project:

• master
  The head of development targeting the next upcoming release.
• 1.0
  The development targeting the IronJacamar 1.0 releases.
• 1.1
  The development targeting the IronJacamar 1.1 releases.
• 1.2
  The development targeting the IronJacamar 1.2 releases.

2.3. Compiling the source code

In order to build the IronJacamar project you execute:

ant <target>

where target is one of

• jars
  Builds the JAR archives in the distribution.
• test
  Builds the JAR archives in the distribution and runs all the test cases.
• module-test
  Builds the JAR archives in the distribution and runs all the test cases for the specified module
  (--module=<modulename>).
• one-test
  Builds the JAR archives in the distribution and runs the specified test case
  (--module=<modulename> --test=<classname>).
• docs
Chapter 2. Building

Builds the API documentation for the project.

- aggregated-javadocs
  Builds the Aggregated API documentation for the project.

- aggregated-javadocs-api-spi
  Builds the Aggregated API documentation for API/SPI of the project.

- sjc
  Builds the standalone environment using IronJacamar/SJC.

- release
  Builds a release of the project.

- clean
  Cleans the project of temporary files.

- clean-cache
  Cleans the Apache Ivy repository.

See the full list of targets in the main build.xml file.

An example to get the IronJacamar/SJC built and running:

```
ant clean sjc
cd target/sjc/bin
./run.sh
```

2.4. Creating a patch

Our user guide explains in the "I would like to implement a feature" section how to get started on a writing a new feature or submitting a patch to the project.

You should develop your feature on a Git branch using

```
git checkout -b <feature_name>
```

Once you are done you will need to rebase your work with the latest master
Creating a patch

```
git fetch upstream
git rebase -i upstream/master
```

You will need to resolve any conflicts of course. Note, that all pull requests must be rebased against upstream master in order to get merged.

Then push the feature to your repository

```
git push origin <feature_name>
```

Go to your account on GitHub.com and submit a pull request via the "Pull request" button

https://www.github.com/<your_account>/ironjacamar

Remember to select the correct branch, fill in the subject with a short description of the feature, and fill in the description with the full description of the feature.

If your feature / bug-fix applies to multiple branches you will need to submit multiple pull requests - one pull request per branch.
Chapter 3.

3

Releases

The chapter describes the various releases and their exit criteria.

3.1. Overview

Each release is labelled with a version number and an identifier.

ironjacamar-<major>.<minor>.<patch>[.<identifier>]

where

- Major: The major version number. Signifies major changes in the implementation.
- Minor: The minor version number. Signifies functional changes to a major version.
- Patch: The patch version number. Signifies a binary compatible change to a minor version.
- Identifier: The identifier. Identifies the level of the quality of the release.
  - None / Final: Stable release
  - CR: Candidate for Release quality. The implementation is functional complete.
  - Beta: Beta quality. The implementation is almost functional complete.
  - Alpha: Alpha quality. The implementation is a snapshot of the development.

3.2. Versioning

Each release will contain a version number which relates to the feature branch where it was created.

3.2.1. Major

A Major version identifier signifies major changes in the implementation such as a change in the architecture.

The features between major versions can be a lot different, and therefore feature regressions may appear.

A Major version will most likely also mean updates to the configuration and required metadata files for deployments.
3.2.2. Minor

A Minor version identifier signifies functional changes to a Major release.

This means that new features have been added to the Major release, and hence may have new configuration options and integration points.

The release is binary compatible to the previous releases - for example 1.0 vs. 1.1.

3.2.3. Patch

A Patch version identifier signifies a binary compatible update to one or more components in a Minor release.

This means that one or more bug fixes to existing components have been integrated in the branch in question.

The release is binary compatible to the previous releases - for example 1.0.0 vs. 1.0.1.

3.3. Identifiers

Each release will contain an identifier which relates to the release quality.

3.3.1. Alpha releases

An Alpha release is a snapshot of the main development branch which likely will contain new features.

**Warning**

Alpha releases are NOT production quality

An Alpha release are made each month (time-boxed) unless the branch is using an identifier as Beta or higher.

The exit criteria for an Alpha release is that the main test suite is passing.

3.3.2. Beta releases

A Beta release contains major features that are considered almost functional complete. This doesn't mean however that all aspects of each feature is complete and therefore not all options will be active.

**Warning**

Beta releases are NOT production quality
A Beta release will be made once one or more features are almost functional complete and therefore Beta releases aren't time-boxed, but feature-boxed instead.

The exit criteria for a Beta release is that all test suites are passing.

### 3.3.3. Candidate for Release releases

A Candidate for Release is considered functional complete and candidate for being promoted to a Final release.

**Warning**

Candidate for Release releases are NOT production quality

A Candidate for Release focuses on functionality, but they are time-boxed to a maximum of two weeks between each release.

The exit criteria for a Candidate for Release release is that all test suites are passing.

### 3.3.4. Final releases

A Final release is considered feature complete and stable.

Typically only one Final release will be released from each branch, unless critical or blocker issues are found in the release. Patch releases will be available from our source control system as tags.

The exit criteria for a Final release is that all test suites are passing.

### 3.4. Nexus

The IronJacamar artifacts are uploaded to the JBoss.org Nexus repository located at:

```text
https://repository.jboss.org/nexus/content/groups/public/
```

The IronJacamar artifacts are deployed under the `groupId` of:

```text
org.jboss.ironjacamar
```

See the User Guide for a complete list of artifacts.

### 3.4.1. Deploying a release

A release of IronJacamar is deployed using:
Chapter 3. Releases

```
ant nexus
cd target
./deploy.sh
```

After the artifacts have been uploaded the release must be promoted in Nexus by logging in and choosing "Promote" and "Close". The path for the staging repository can be used for testing the release.

Note, that this requires Maven 3.0.5+.

### 3.4.2. Deploying a snapshot

A snapshot of IronJacamar is deployed using:

```
ant -Dsnapshot=true nexus
cd target
./deploy.sh
```

Note, that this requires Maven 3.0.5+.

### 3.4.3. Deploying a snapshot (locally)

A snapshot of IronJacamar is deployed to the local Maven repository $HOME/.m2/repository using:

```
ant -Dsnapshot=true nexus
cd target
./install.sh
```

Note, that this requires Maven 3.0.5+.
Chapter 4.

4 Issue tracking

4.1. Location

The JIRA issue tracking for the project is located at http://issues.jboss.org/browse/JBJCA.

4.2. Components

The project is divided into the following components:

Table 4.1. Project components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arquillian</td>
<td>The Arquillian integration for the project.</td>
</tr>
<tr>
<td>AS</td>
<td>The tools that focuses on integration with WildFly.</td>
</tr>
<tr>
<td>Build</td>
<td>The build environment for the project.</td>
</tr>
<tr>
<td>Code Generator</td>
<td>The resource adapter code generator.</td>
</tr>
<tr>
<td>Common</td>
<td>Common interfaces and classes that are shared between multiple components.</td>
</tr>
<tr>
<td>Core</td>
<td>The core implementation of the project.</td>
</tr>
<tr>
<td>Documentation</td>
<td>The documentation (Users Guide / Developers Guide) for the project.</td>
</tr>
<tr>
<td>Deployer</td>
<td>The deployers for the project.</td>
</tr>
<tr>
<td>Eclipse</td>
<td>The Eclipse plugin for IronJacamar.</td>
</tr>
<tr>
<td>EIS</td>
<td>The EIS test server.</td>
</tr>
<tr>
<td>Embedded</td>
<td>The embedded IronJacamar container.</td>
</tr>
<tr>
<td>JDBC</td>
<td>A JDBC resource adapter.</td>
</tr>
<tr>
<td>Performance</td>
<td>Performance related work.</td>
</tr>
<tr>
<td>Standalone</td>
<td>The standalone IronJacamar distribution.</td>
</tr>
<tr>
<td>Test Suite</td>
<td>The IronJacamar test suite.</td>
</tr>
<tr>
<td>Validator</td>
<td>The resource adapter validator.</td>
</tr>
</tbody>
</table>
Chapter 4. Issue tracking

4.3. Categories

The system contains the following categories:

Table 4.2. JIRA categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature Request</td>
<td>Request for a feature made by the community.</td>
</tr>
<tr>
<td>Bug</td>
<td>Software defect in the project.</td>
</tr>
<tr>
<td>Task</td>
<td>Development task created by a member of the team.</td>
</tr>
<tr>
<td>Release</td>
<td>Issue which holds informations about a release.</td>
</tr>
<tr>
<td>Component Update</td>
<td>Identifies a thirdparty library dependency.</td>
</tr>
</tbody>
</table>

The other categories in the JIRA installation are not used by this project.

4.4. Life cycle

All issues follows the following life cycle:

Table 4.3. JIRA Lifecycle

<table>
<thead>
<tr>
<th>Lifecycle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>An issue currently not implemented.</td>
</tr>
<tr>
<td>Coding in Progress</td>
<td>An issue currently being worked on.</td>
</tr>
<tr>
<td>Resolved</td>
<td>An issue which has been implemented.</td>
</tr>
<tr>
<td>Closed</td>
<td>An issue that has been resolved and is included in a release.</td>
</tr>
</tbody>
</table>

Note: ‘Component Update’ issues can't be resolved nor closed during a development cycle. These are resolved and closed as part of the release procedure of the project. The reason for this is that the library in question can receive further updates during the active development cycle.

4.5. Priorities

All issues are assigned one of the following priorities:

Table 4.4. JIRA Priorities

<table>
<thead>
<tr>
<th>Priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocker</td>
<td>An issue that needs to be fixed before the release.</td>
</tr>
<tr>
<td>Critical</td>
<td>An issue that is critical for the release.</td>
</tr>
<tr>
<td>Major</td>
<td>The default priority for an issue.</td>
</tr>
<tr>
<td>Priority</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Minor</td>
<td>An issue that is optional for a release.</td>
</tr>
<tr>
<td>Trivial</td>
<td>An issue that is optional for a release and have a lower priority than Minor.</td>
</tr>
</tbody>
</table>
5.1. Overall goals

The overall goals of our test environment is to execute tests that ensures that we have full coverage
of the JCA specification as well as our implementation.

The full test suite is executed using

ant test

A single test case can be executed using

ant -Dmodule=embedded -Dtest=org.jboss.jca.embedded.unit.ShrinkWrapTestCase one-test

where -Dmodule specifies which module to execute the test case in. This parameter defaults to
core. The -Dtest parameter specifies the test case itself.

You can also execute all test cases of a single module using

ant -Dmodule=embedded module-test

where -Dmodule specifies which module to execute the test cases in. This parameter defaults to
core.

The build script does not fail in case of test errors or failure.

You can control the behavior by using the junit.haltonerror and junit.haltonfailure
properties in the main build.xml file. Default value for both is no.
Chapter 5. Testing

You can of course change them statically in the build.xml file or temporary using -Djunit.haltonerror=yes. There are other jnuit.* properties defined in the main build.xml that can be controlled in the same way.

5.1.1. Specification

The purpose of the specification tests is to test our implementation against the actual specification text.

Each test can only depend on:

• The official Java Connector Architecture API (javax.resource)
• Interfaces and classes in the test suite that extends/implements the official API

The test cases should be created in such a way such that they are easily identified by chapter, section and paragraph. For example:

```
org.jboss.jca.core.spec.chaper10.section3
```

5.1.2. IronJacamar specific interfaces

The purpose of the IronJacamar specific interfaces tests is to test our specific interfaces.

Each test can depend on:

• The official Java Connector Architecture API (javax.resource)
• The IronJacamar specific APIs (org.jboss.jca.xxx.api)
• Interfaces and classes in the test suite that extends/implements these APIs

The test cases lives in a package that have a meaningful name of the component it tests. For example:

```
org.jboss.jca.core.workmanager
```

These test cases can use both the embedded JCA environment or be implemented as standard POJO based JUnit test cases.

5.1.3. IronJacamar specific implementation

The purpose of the IronJacamar specific implementation tests is to test our specific implementation. These tests should cover all methods are not exposed through the interface.
Each test can depend on:

- The official Java Connector Architecture API (javax.resource)
- The IronJacamar specific APIs (org.jboss.jca.xxx.api)
- The IronJacamar specific implementation (org.jboss.jca.xxx.yyy)
- Interfaces and classes in the test suite

The test cases lives in a package that have a meaningful name of the component it tests. For example:

```
org.jboss.jca.core.workmanager
```

These test cases can use both the embedded JCA environment or be implemented as standard POJO based JUnit test cases.

### 5.2. Testing principle and style

Our tests follows the Behavior Driven Development (BDD) technique. In BDD you focus on specifying the behaviors of a class and write code (tests) that verify that behavior.

You may be thinking that BDD sounds awfully similar to Test Driven Development (TDD). In some ways they are similar: they both encourage writing the tests first and to provide full coverage of the code. However, TDD doesn’t really provide a guide on which kind of tests you should be writing.

BDD provides you with guidance on how to do testing by focusing on what the behavior of a class is supposed to be. We introduce BDD to our testing environment by extending the standard JUnit 4.x test framework with BDD capabilities using assertion and mocking frameworks.

The BDD tests should

- Clearly define **given-when-then** conditions
- The method name defines what is expected: f.ex. `shouldReturnFalseIfMethodXIsCalledWithNullString()`
- Easy to read the assertions by using Hamcrest Matchers [http://code.google.com/p/hamcrest/]
- Use **given** facts whenever possible to make the test case more readable. It could be the name of the deployed resource adapter, or using the BDD Mockito class [http://mockito.googlecode.com/svn/branches/1.8.0/javadoc/org/mockito/BDDMockito.html] to mock the fact.

We are using two different kind of tests:

- **Integration Tests**: The goal of these test cases is to validate the whole process of deployment, and interacting with a sub-system by simulating a critical condition.
- **Unit Tests**: The goal of these test cases is to stress test some internal behaviour by mocking classes to perfectly reproduce conditions to test.
5.2.1. Integration Tests

The integration tests simulate a real condition using a particular deployment artifacts packaged as resource adapters.

The resource adapters are created using either the main build environment or by using ShrinkWrap [http://community.jboss.org/wiki/ShrinkWrap]. Using resource adapters within the test cases will allow you to debug both the resource adapters themself or the JCA container.

The resource adapters represent the [given] facts of our BDD tests, the deployment of the resource adapters represent the [when] phase, while the [then] phase is verified by assertion.

Note that some tests consider an exception a normal output condition using the JUnit 4.x @Exception(expected = "SomeClass.class") annotation to identify and verify this situation.

5.2.2. Unit Tests

We are mocking our input/output conditions in our unit tests using the Mockito [http://mockito.googlecode.com] framework to verify class and method behaviors.

An example:

```java
@Test
public void printFailuresLogShouldReturnNotEmptyStringForWarning() throws Throwable {
    //given
    RADeployer deployer = new RADeployer();
    File mockedDirectory = mock(File.class);
    given(mockedDirectory.exists()).willReturn(false);

    Failure failure = mock(Failure.class);
    given(failure.getSeverity()).willReturn(Severity.WARNING);

    List failures = Arrays.asList(failure);
    FailureHelper fh = mock(FailureHelper.class);
    given(fh.asText((ResourceBundle) anyObject())).willReturn("myText");

    deployer.setArchiveValidationFailOnWarn(true);

    //when
    String returnValue = deployer.printFailuresLog(null, mock(Validator.class), failures, mockedDirectory, fh);

    //then
    assertThat(returnValue, is("myText"));
}
```

As you can see the BDD style respects the test method name and using the given-when-then sequence in order.
5.3. Quality Assurance

In addition to the test suite the IronJacamar project deploys various tools to increase the stability of the project.

The following sections will describe each of these tools.

5.3.1. Checkstyle

Checkstyle is a tool that verifies that the formatting of the source code in the project is consistent. This allows for easier readability and a consistent feel of the project.

The goal is to have zero errors in the report. The checkstyle report is generated using

```
ant checkstyle
```

The report is generated into

```
reports/checkstyle
```

The home of checkstyle is located here: http://checkstyle.sourceforge.net/.

5.3.2. Findbugs

Findbugs is a tool that scans your project for bugs and provides reports based on its findings. This tool helps lower of the number of bugs found in the IronJacamar project.

The goal is to have zero errors in the report and as few exclusions in the filter as possible. The findbugs report is generated using

```
ant findbugs
```

The report is generated into

```
reports/findbugs
```
Chapter 5. Testing

The home of findbugs is located here: http://findbugs.sourceforge.net/.

5.3.3. JaCoCo

JaCoCo generates a test suite matrix for your project which helps you identify where you need additional test coverage.

The reports that the tool provides makes sure that the IronJacamar project has the correct test coverage.

The goal is to have as high code coverage as possible in all areas. The JaCoco report is generated using

```
ant jacoco
```

The report is generated into

```
reports/jacoco
```

The home of JaCoCo is located here: http://www.eclemma.org/jacoco/.

5.3.4. Tattletale

Tattletale generates reports about different quality matrix of the dependencies within the project.

The reports that the tool provides makes sure that the IronJacamar project doesn't for example have cyclic dependencies within the project.

The goal is to have as no issues flagged by the tool. The Tattletale reports are generated using

```
ant tattletale
```

The reports are generated into

```
reports/tattletale
```

The home of Tattletale is located here: http://www.jboss.org/tattletale.
5.4. Performance testing

Performance testing can identify areas that needs to be improved or completely replaced.

5.4.1. JProfiler

Insert the following line in run.sh or run.bat:

```
-agentpath:<path>/jprofiler6/bin/linux-x64/libjprofilerti.so=port=8849
```

where the Java command is executed.


5.4.2. OProfile

OProfile can give a detailed overview of applications running on the machine, including Java program running with OpenJDK.

The home of OProfile is located here: http://oprofile.sourceforge.net.

5.4.2.1. Installation

Enable the Fedora debug repo:

```
/etc/yum.repos.d/fedora.repo

[fedora-debuginfo]
name=Fedora $releasever - $basearch - Debug
failovermethod=priority
mirrorlist=https://mirrors.fedoraproject.org/metalink?repo=fedora-debug-$releasever&arch=$basearch
enabled=1
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-fedora-$basearch
```

Install:

```
yum install -y oprofile oprofile-jit
yum install -y yum-plugin-auto-update-debug-info
yum install -y java-1.6.0-openjdk-debuginfo
```
5.4.2.2. Running

Insert the following line in run.sh or run.bat:

```
-agentpath:/usr/lib64/oprofile/libjvmti_oprofile.so
```

for 64bit JVMs or

```
-agentpath:/usr/lib/oprofile/libjvmti_oprofile.so
```

for 32 bit JVMs where the Java command is executed.

Now execute:

```
opcontrol --no-vmlinux
opcontrol --start-daemon
```

and use the following commands:

```
opcontrol --start  # Starts profiling
opcontrol --dump   # Dumps the profiling data out to the default file
opcontrol --stop   # Stops profiling
```

Once you are done execute:

```
opcontrol --shutdown  # Shuts the daemon down
```

A report can be generated by:
Remember that this is system wide profiling, so make sure that only the services that you want included are running.


5.4.3. Performance test suite

IronJacamar features a basic performance test suite that tests interaction with a transaction manager.

The test suite is executed by

```shell
ant perf-test
```

which will run the tests, and output its data into the generated JUnit output.

The setup of the performance test suite is controlled in the `org.jboss.jca.core.tx.perf.Performance` class, where the following settings can be altered

- **CLIENTS**: The number of clients in each run
- **POOL_SIZES**: The pool size in each run
- **DO_RAMP_UP**: Should ramp up be performed
- **RAMP_UP_ITERATIONS**: The number of iterations that the ramp-up should perform
- **TRANSACTIONS_PER_CLIENT**: The number of transactions each client should perform
- **STATISTICS**: Should statistics be enabled
- **RECORD_ENLISTMENT_TRACES**: Should enlistment be recorded
- **USE_TRANSACTION_FOR_NOTRANSACTION**: Use a transaction for NoTransaction scenario
- **USE_CCM**: Register connections with the cached connection manager
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- **TX_BEGIN_DURATION**: The number of milliseconds spent in the resource during tx.begin()
- **TX_COMMIT_DURATION**: The number of milliseconds spent in the resource during tx.commit()
- **MCP_IMPL**: The implementation class of ManagedConnectionPool

A report can be generated using

```java
org.jboss.jca.core.tx.perf.PerfReport
```

which takes 3 arguments; output from NoopTS run, output from Narayana/MEM run and Narayana/FILE run.

The data is presented on the console, and a GNU plot script is generated.

The GNU plot can be generated using

```bash
gnuplot perf.plot
```

which will generate a `perf.png` file with the graphs.

Performance reports can be averaged using

```java
org.jboss.jca.core.tx.perf.AvgReport
```

which takes the `.dat` files from the PerfReport applications and generates a `perf-avg.dat` and a `perf-avg.plot` file.

There is integration with JProfiler through the

```bash
ant jprofiler
```

task. It is required to define the installation directory and the session id before the task is executed.

The Bash scripts `perf-jprofiler.sh` and `perf-flightrecorder.sh`, both located in `core/src/test/resource` can be used as a template for command line based runs.
6.1. Core metadata

The metadata for the IronJacamar project is split up into the following areas:

- Java Connector Architecture metadata
- IronJacamar metadata
- Resource adapter deployment metadata
- DataSource deployment metadata

All metadata parsing is done using the StAX model (`javax.xml.stream`) for optimal performance.

The implementation of these areas is done within the common module of the project.

### 6.1.1. Java Connector Architecture metadata

The Java Connector Architecture (JCA) metadata implement the metadata defined in the JCA specifications. We have metadata representing the following standards:

- Java Connector Architecture 1.0
- Java Connector Architecture 1.5
- Java Connector Architecture 1.6
- Java Connector Architecture 1.7

An instance of the metadata is bundle with the resource adapter archive as

```
META-INF/ra.xml
```

The implementation is split into two package hierarchies - the API in

```
org.jboss.jca.common.api.metadata.spec
```
and the implementation in

```java
org.jboss.jca.common.metadata.spec
```

The parser will transform the metadata into a Java Connector Architecture 1.7 based model which is used internally in IronJacamar.

### 6.1.2. IronJacamar metadata

The IronJacamar metadata can provide overrides for the values specified in the standard Java Connector Architecture metadata. It is also possible to specify deployment metadata, which will active an instance of the resource adapter without any other deployment plans.

Supported versions of the metadata:

- IronJacamar 1.0
- IronJacamar 1.1
- IronJacamar 1.2

An instance of the metadata is bundle with the resource adapter archive as

```xml
META-INF/ironjacamar.xml
```

The implementation is split into two package hierarchies - the API in

```java
org.jboss.jca.common.api.metadata.resourceadapter
```

and the implementation in

```java
org.jboss.jca.common.metadata.ironjacamar

org.jboss.jca.common.metadata.resourceadapter
```
The parser will produce one Activation instance, which defines the activation model of the resource adapter.

### 6.1.3. Resource adapter deployment metadata

The resource adapter deployment metadata provides a deployment plan for the specified resource adapter archive. It is possible to override metadata specified as part of the Java Connector Architecture metadata or the IronJacamar metadata.

Supported versions of the metadata:

- Resource adapter deployment 1.0
- Resource adapter deployment 1.1
- Resource adapter deployment 1.2

The implementation is split into two package hierarchies - the API in

```java
org.jboss.jca.common.api.metadata.resourceadapter
```

and the implementation in

```java
org.jboss.jca.common.metadata.resourceadapter
```

The parser will produce a list of Activation instances, which defines the activation model of the resource adapter.

### 6.1.4. Datasource deployment metadata

The datasource deployment metadata provides a deployment plan for datasources. The metadata allows the developer to setup connection parameters, pooling settings and security.

Supported versions of the metadata:

- Datasource deployment 1.0
- Datasource deployment 1.1
- Datasource deployment 1.2
- Datasource deployment 1.3

The implementation is split into two package hierarchies - the API in
org.jboss.jca.common.api.metadata.ds

and the implementation in

org.jboss.jca.common.metadata.ds


6.1.4.1. Datasource mapping

The table below specifies how each attribute/element map to the resource adapter or the container.

Table 6.1. Datasource mapping

<table>
<thead>
<tr>
<th>Tag</th>
<th>Resource Adapter</th>
<th>Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>min-pool-size</td>
<td>Pool</td>
<td></td>
</tr>
<tr>
<td>max-pool-size</td>
<td>Pool</td>
<td></td>
</tr>
<tr>
<td>prefill</td>
<td>Pool</td>
<td></td>
</tr>
<tr>
<td>user-name</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>password</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>connection-url</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>driver-class</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>transaction-isolation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>connection-property</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>url-delimiter</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>url-selector-strategy-class-name</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>new-connection-sql</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>xa-datasource-property</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>xa-datasource-class</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>is-same-rm-override</td>
<td>TxConnectionManager</td>
<td></td>
</tr>
<tr>
<td>interleaving</td>
<td>TxConnectionManager</td>
<td></td>
</tr>
<tr>
<td>prepared-statement-cache-size</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>share-prepared-statements</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tag</td>
<td>Resource Adapter</td>
<td>Container</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>pad-xid</td>
<td></td>
<td>TxConnectionManager</td>
</tr>
<tr>
<td>wrap-xa-resource</td>
<td></td>
<td>TxConnectionManager</td>
</tr>
<tr>
<td>no-tx-separate-pools</td>
<td></td>
<td>Pool</td>
</tr>
<tr>
<td>jndi-name</td>
<td></td>
<td>ConnectionManager</td>
</tr>
<tr>
<td>pool-name</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>enabled</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>use-java-context</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>valid-connection-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>checker-class-name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>check-valid-connection-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>sql</td>
<td></td>
<td></td>
</tr>
<tr>
<td>validate-on-match</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>background-validation</td>
<td></td>
<td>Pool</td>
</tr>
<tr>
<td>background-validation-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>use-fast-fail</td>
<td></td>
<td>Pool</td>
</tr>
<tr>
<td>stale-connection-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>checker-class-name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>exception-sorter-class-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blocking-timeout-millis</td>
<td></td>
<td>Pool</td>
</tr>
<tr>
<td>idle-timeout-minutes</td>
<td></td>
<td>Pool</td>
</tr>
<tr>
<td>set-tx-query-timeout</td>
<td></td>
<td></td>
</tr>
<tr>
<td>query-timeout</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>use-try-lock</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>allocation-retry</td>
<td></td>
<td>ConnectionManager</td>
</tr>
<tr>
<td>allocation-retry-wait-</td>
<td></td>
<td>ConnectionManager</td>
</tr>
<tr>
<td>millis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xa-resource-timeout</td>
<td></td>
<td>TxConnectionManager</td>
</tr>
<tr>
<td>track-statements</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>prepared-statement-cache-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>share-prepared-statements</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
6.2. Metadata Repository

The metadata repository serves as a central point for all the metadata in the systems.

6.2.1. Interface

The interface of the metadata repository is located in:

```java
org.jboss.jca.core.spi.MetaDataRepository
```

providing methods to query and update the repository.

6.2.2. Bean

The implementation of the metadata repository can be defined as:

```xml
<bean name="MetaDataRepository"

    interface="org.jboss.jca.core.spi.MetaDataRepository"

    class="org.jboss.jca.core.mdr.SimpleMetaDataRepository">

</bean>
```

which is a simple implementation of the metadata repository service provider interface (SPI).
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7

Deployers

The deployer chains for the project is located in the `deployers` module.

7.1. RAR Deployer

The responsibility of the RAR deployer is to deploy a resource adapter archive (.RAR) file.

7.1.1. Fungal

The Fungal kernel features a simple deployment framework, so only three classes are needed for the deployer chain.

The classes are located in the `deployers/src/main/java/org/jboss/jca/deployers/fungal` directory.

7.1.1.1. RADeployer

This class represent a resource adapter deployer and implements the

```java
com.github.fungal.spi.deployers.Deployer
com.github.fungal.spi.deployers.MultiStageDeployer
com.github.fungal.spi.deployers.DeployerOrder
```

interfaces.

The responsible of the class is to

- Create a classloader for the deployment
- Retrieve metadata and annotations such that they can be merged
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- Perform archive validation using the JCA validator
- Perform bean validation
- Register the metadata in the metadata repository
- Register the resource adapter in the metadata repository
- Identify and activate the resource adapter objects - if JNDI information is available
- Bind connection factories and admin objects into JNDI - if JNDI information is available

If the resource adapter isn't activated in this step based on an `ironjacamar.xml` file, the deployment will advance to the next step in the deployer chain.

7.1.1.2. RADeployment

This class represents a resource adapter deployment and implements the

```java
com.github.fungal.spi.deployers.Deployment
```

interface.

The responsible of the class is to

- Unregister the resource adapter from the metadata repository
- Unregister the JNDI bindings in the metadata repository - if the deployment was activated
- Unbind connection factories and admin objects in JNDI - if the deployment was activated
- Close the classloader
- Clean up any temporary files

7.1.1.3. RaXmlDeployer

This class represents a resource adapter deployer and implements the

```java
com.github.fungal.spi.deployers.Deployer
com.github.fungal.spi.deployers.MultiStageDeployer
com.github.fungal.spi.deployers.DeployerOrder
com.github.fungal.spi.deployers.DeployerPhases
```

interface.
The class deploys resource adapter archives based on a `-ra.xml` which provides the necessary deployment information.

The responsible of the class is to

- Create a class loader for the deployment
- Retrieve metadata from the metadata repository
- Merge metadata from the deployment descriptor
- Perform archive validation using the JCA validator
- Perform bean validation
- Register the metadata in the metadata repository
- Identify and activate the resource adapter objects
- Bind connection factories and admin objects into JNDI

Since multiple resource adapter archives can be activated within a single `-ra.xml` file the class uses the `DeployerPhases` callbacks to unregister these from the container. If there is only a single resource adapter activation the deployer acts as part of the normal deployer chain.

### 7.1.1.4. RaXmlDeployment

This class represents a resource adapter deployment from the `RaXmlDeployer` and implements the

```java
com.github.fungal.spi.deployers.Deployment
```

The responsible of the class is to

- Unregister the JNDI bindings in the metadata repository
- Unbind connection factories and admin objects in JNDI
- Close the class loader

### 7.1.1.5. RAActivator

This class will activate all resource adapters which haven't been deployed by a previous step. The class implements the
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interface. This interface allows the class to hook into the deployer lifecycle of the kernel and receive callback notifications.

The responsible of the class is to

- Find any resource adapters which hasn't been deployed through the metadata repository
- Perform a deployment like RA Deployer
- Register each deployment with the kernel through the main deployer

7.1.1.6. RAActivatorDeployment

This class represent a resource adapter deployment activated by the RAActivator and implements the

com.github.fungal.spi.deployers.Deployment

interface.

The responsible of the class is to

- Unregister the JNDI bindings in the metadata repository
- Unbind connection factories and admin objects in JNDI
- Close the classloader

7.2. DataSource Deployer

The responsibility of the datasource deployer is to deploy a datasource deployment (-ds.xml) file.

7.2.1. Fungal

The Fungal datasource deployer chain consists of two classes.

The classes are located in the

deployers/src/main/java/org/jboss/jca/deployers/fungal
directory.

**7.2.1.1. DsXmlDeployer**

This class represents a datasource deployer and implements the

```
com.github.fungal.spi.deployers.Deployer
```

interface.

The responsible of the class is to

- Locate metadata about JDBC in the metadata repository
- **Activate each** `DataSource` **using** `jdbc-local.rar` **as a template**
- **Activate each** `XaDataSource` **using** `jdbc-xa.rar` **as a template**

**7.2.1.2. DsXmlDeployment**

This class represents a datasource deployment and implements the

```
com.github.fungal.spi.deployers.Deployment
```

interface.

The responsible of the class is to

- Unbind the datasource in JNDI
- Close the classloader
Chapter 8.

8. Connection manager

8.1. Overview

The connection manager defines the interface for resource adapters to allocate connections, which are associated with the physical connections to the target Enterprise Information System, such as a database.

It is up to the connection manager to use the pool, and enlist the connection listeners in the transactions, if supported.

The connection manager architecture

![Connection Manager Architecture Diagram]

**Note**

Each of the components in the connection manager architecture can be accessed by multiple threads at the same time, hence each component needs to make sure that thread safely is maintained.

8.2. Public API

The public API defines the API that programs external to the IronJacamar project can use to configure, and use the connection manager.

The `ConnectionManager` interface allows to associate and dissociate a managed connection with a connection.

The package for the public API is org.jboss.jca.core.api.connectionmanager.

8.3. Private API

The private API defines the API that can be used internally IronJacamar to control the connection manager. The API extends the public API where it makes sense in order to provide a more uniform interface to the implementation.

The ConnectionManagerFactory class can create a ConnectionManager instance.

The ConnectionManager interface defines the internal API of the connection manager used by IronJacamar.

The NoTxConnectionManager interface defines the internal API of a non-transactional connection manager.

The TxConnectionManager interface defines the internal API of a transactional connection manager.

The ConnectionListener interface defines the internal API of a connection listener, which is associated with a managed connection.

The package for the private API is org.jboss.jca.core.connectionmanager.

8.4. Implementation

The implementation of the connection manager is split in two classes, with a shared base class for common functionality.

8.4.1. AbstractConnectionManager

AbstractConnectionManager provides the methods that are shared across both implementations, NoTxConnectionManagerImpl and TxConnectionManagerImpl.

getManagedConnection(Transaction, Subject, ConnectionRequestInfo) obtains a ConnectionListener instance from the pool. If an error occurs a retry is performed, if configured.

returnManagedConnection(ConnectionListener, boolean) returns a ConnectionListener instance to the pool. If an error occurs a retry is performed, if configured.

allocateConnection(ManagedConnectionFactory, ConnectionRequestInfo) allocates a connection for the managed connection attached to the ConnectionListener instance.

associateManagedConnection(Object, ManagedConnectionFactory, ConnectionRequestInfo) associates a ManagedConnection with the passed in connection. This is a LazyAssociatableConnectionManager extension of IronJacamar.
dissociateManagedConnection(Object, ManagedConnection, ManagedConnectionFactory) **dissociates a connection with its ManagedConnection instance.** This is a LazyAssociatableConnectionManager extension of IronJacamar.

shutdown shuts down the connection manager, and its related pool instance. This is done using synchronization such that any components having a reference will be notified through an error.

### 8.4.2. NoTxConnectionManagerImpl

NoTxConnectionManagerImpl provides the implementation for a connection manager configured with NoTransaction.

createConnectionListener(ManagedConnection, ManagedConnectionPool) **creates a NoTxConnectionListener and associates it with the ManagedConnection instance.**

### 8.4.3. TxConnectionManagerImpl

TxConnectionManagerImpl provides the implementation for a connection manager configured with LocalTransaction or XATransaction.

createConnectionListener(ManagedConnection, ManagedConnectionPool) **creates a TxConnectionListener and associates it with the ManagedConnection instance.** In case of LocalTransaction a XAResource is created to wrap the local transaction methods of the resource adapter. In case of XATransaction the underlying XAResource instance is wrapped with product information, if configured.

cleanupManagedConnection(Subject, ConnectionRequestInfo) verifies that a valid transaction exists before creating a ManagedConnection, since there is no point in spending resources on work that is going to be rolled back. ironjacamar.allow_marked_for_rollback overrides this behavior.

managedConnectionReconnected(ConnectionListener) **enlist the ConnectionListener in the transaction.**

managedConnectionDisconnected(ConnectionListener) **delist the ConnectionListener from the transaction.**

lazyEnlist(ManagedConnection) **handles lazy enlistment scenarios as defined by LazyEnlistableConnectionManager.**

### 8.4.4. AbstractConnectionListener

AbstractConnectionListener provides the methods that are shared across both implementations, NoTxConnectionListener and TxConnectionListener. This base class keeps track off the connection handles used for the associated ManagedConnection.

connectionErrorOccurred(ConnectionEvent) **logs the application error, and flushes either the Pool or ManagedConnectionPool depending on the strategy configured.**
Chapter 8. Connection manager

controls(ManagedConnection, Object) checks if the ManagedConnection and optional connection is controlled by this connection listener.

compareTo(Object) is used to sort the connection listeners based on their last used time.

8.4.5. NoTxConnectionListener

NoTxConnectionListener is the listener for NoTransaction scenarios.

connectionClosed(ConnectionEvent) dissociates the connection handles, and if there are no handles associated anymore the ManagedConnection is returned to the pool.

8.4.6. TxConnectionListener

TxConnectionListener is the listener for LocalTransaction and XATransaction scenarios.

used() updates the last used time, and resets the timeout value for the underlying XAResource if in XATransaction mode.

enlist() enlists the XAResource instances in the transaction through TransactionSynchronization including resources picked up by the CachedConnectionManager.

delist() delists the XAResource from the transaction in interleaved scenarios.

dissociate() dissociates the ConnectionListener with the transaction.

connectionClosed(ConnectionEvent) dissociates a connection handle through wasFreed(Object) and returns the ManagedConnection in interleaved scenarios.

connectionErrorOccurred(ConnectionEvent) clears any TransactionSynchronization object such that the ManagedConnection can be returned for destruction.

tidyup() will rollback any left over LocalTransaction instance.

isManagedConnectionFree() checks if there is exists a TransactionSynchronization object in track by transaction scenarios, since the ManagedConnection can't be returned in that case.

wasFreed(Object) dissociates a connection handle from the ConnectionListener, or resets the track by transaction flag if null such that the ManagedConnection can be returned.

The TransactionSynchronization class takes care of enlisting the XAResource in the transaction, in track by transaction scenarios. This is done in its enlist() and its result can be verified in checkEnlisted(). The beforeCompletion() method delists the XAResource from the transaction. The afterCompletion(int) method returns the ManagedConnection to the pool.
Chapter 9.

9. Pool

9.1. Overview

The pool controls the physical connection to the target Enterprise Information System, such as a database.

It is up to the pool to create, hand out and destroy connections in the defined lifecycle based on the configuration parameters supplied by the user.

The pool architecture

![Pool Architecture Diagram]

**Note**

Each of the components in the pool architecture can be accessed by multiple threads at the same time, hence each component needs to make sure that thread safety is maintained.

9.2. Public API

The public API defines the API that programs external to the IronJacamar project can use to configure, and use the pool.

The `Pool` interface allows access to the name of the pool, flushing connections, verifying if a connection can be obtained from the pool and dump any queued threads.

The `PoolConfiguration` class holds the configuration parameters for the pool.
The FlushMode enum defines the different flush modes supported.

The PoolStatistics interface defines the statistics available for a pool.

The package for the public API is org.jboss.jca.core.api.connectionmanager.pool.

### 9.3. Private API

The private API defines the API that can be used internally IronJacamar to control the pool. The API extends the public API where it makes sense in order to provide a more uniform interface to the implementation.

The PoolFactory class will create a Pool based upon the passed in configuration.

The PoolStrategy enum defines how the pool is split based on credential equality.

The Pool interface extends the public API with methods that should only be available from with IronJacamar such as getting a connection listener, returning a connection listener, and shutting down the pool.

The PrefillPool interface defines the contract for pool implementations that supports prefilling of connections upon startup, such as OnePool and PoolBySubject.

The Capacity interface provides a handle to the policies used for increasing and decreasing the pool.

The CapacityIncremernter interface defines if a physical connection should be created given the input parameters.

The CapacityDecrementer interface defines if a physical connection should be destroyed given the input parameters.

The package for the private API is org.jboss.jca.core.connectionmanager.pool.api.

### 9.4. Implementation

The pool implementation provides a concrete implementation of the contracts defined by the public and private APIs.

The package for the pool implementation is org.jboss.jca.core.connectionmanager.pool.

### 9.4.1. AbstractPool

AbstractPool provides the methods that are shared across all pool implementations.

getKey(Subject, ConnectionRequestInfo, boolean) defines the key used to lookup the ManagedConnectionPool instance. The implementation of this method is different for each pool type.
getManagedConnectionPool(Object, Subject, ConnectionRequestInfo) retrieves the correct ManagedConnectionPool instance. If the ManagedConnectionPool doesn't yet exist then one is created, and initialized.

emptyManagedConnectionPool(ManagedConnectionPool) removes a ManagedConnectionPool instance, if unused.

flush flushes the ManagedConnectionPool instances, based on the FlushMode.

getConnection(Transaction, Subject, ConnectionRequestInfo) returns a ConnectionListener instance, which has the physical connection to the Enterprise Information System attached. The method uses 3 sub methods to return the correct listener instance.

getSimpleConnection returns a ConnectionListener if there is no transaction associated.

getTransactionOldConnection returns the ConnectionListener already associated with the transaction, if any. getTransactionNewConnection creates a new ConnectionListener, and associates it with the transaction.

findConnectionListener finds a specific ConnectionListener instance.

returnConnectionListener returns a ConnectionListener instance to the correct ManagedConnectionPool.

shutdown shuts down the pool. This is done using synchronization such that any components having a reference will be notified through an error.

internalTestConnection(ConnectionRequestInfo, Subject) tries to obtain a ConnectionListener based on the input given.

getLock() returns the lock that guards the maximum number of active ConnectionListener's in the pool. This method is used by the ManagedConnectionPool instances when modifying their data structure that holds the ConnectionListener's.

dumpQueuedThreads() returns a stack trace of each of the queued threads waiting to obtain a ConnectionListener instance.

9.4.2. AbstractPrefillPool

The AbstractPrefillPool enables the pool to prefill connections during startup, and through its lifecycle.

prefill(Subject, ConnectionRequestInfo, boolean) handles the prefilling process.

9.4.3. Pool types

IronJacamar features 5 different pool types. Each pool type has its own getKey method implementation that defines how a ManagedConnectionPool instance is located.

OnePool uses one ManagedConnectionPool instance to hold all ConnectionListener's.
PoolByCri splits the ManagedConnectionPool instances based on the ConnectionRequestInfo instance.

PoolBySubject splits the ManagedConnectionPool instances based on the Subject instance.

PoolBySubjectAndCri splits the ManagedConnectionPool instances based on both the ConnectionRequestInfo instance and the Subject instance.

ReauthPool allows the ConnectionListener instances to reauthenticate, so the ManagedConnectionPool instances can change over time based on the ConnectionRequestInfo and Subject instances.

The package for the pool types is org.jboss.jca.core.connectionmanager.pool.strategy.

9.5. ManagedConnectionPool

The ManagedConnectionPool controls the ConnectionListener instances, which each has a physical connection (ManagedConnection) associated.

The package is org.jboss.jca.core.connectionmanager.pool.mcp

9.5.1. Private API

ManagedConnectionPool instances should only be accessed from within IronJacamar, so they only have a private API.

The ManagedConnectionPoolFactory class creates a ManagedConnectionPool instance.

The ManagedConnectionPool interface defines the methods exposed to the pool, connection validator, and idle remover. These methods includes getting a connection listener, finding a connection listener, and returning a connection listener.

The ManagedConnectionPoolStatistics interface defines the statistics for the ManagedConnectionPool instance.

The ManagedConnectionPoolUtility class defines utility methods for the ManagedConnectionPool instance.

9.5.2. Implementation

There are three different implementations of the ManagedConnectionPool interface. SemaphoreArrayListManagedConnectionPool which uses an ArrayList to hold the ConnectionListenerS. SemaphoreConcurrentLinkedQueueManagedConnectionPool which uses a ConcurrentLinkedQueue to hold the ConnectionListenerS. SemaphoreConcurrentLinkedQueueManagedConnectionPool also uses a ConcurrentHashMap to keep track of the internal status of each of the ConnectionListenerS. Last, a LeakDumperManagedConnectionPool which extends SemaphoreArrayListManagedConnectionPool, but reports any leaks upon shutdown.
getConnection(Subject, ConnectionRequestInfo) provides a ConnectionListener. The method requires a lock in order to obtain a listener, using the specified timeout value. If a listener is available in the pool then it is matched against the ManagedConnectionFactory to verify it is valid, and returned - otherwise it is destroyed. If no listener is available then a new listener is created and returned. In the latter case both prefill and a capacity increase is scheduled in order to prefill to the minimum size, and increase the pool by the specified capacity policy.

returnConnection(ConnectionListener, boolean, boolean) returns a ConnectionListener into the pool.

flush(FlushMode) flushes the ConnectionListeners according to the mode. Any listeners marked as bad will be destroyed. Prefill is scheduled at the end in order to maintain the minimum pool size.

removeIdleConnections is invoked from the idle remover in order to decrement the pool to the desired size based on the CapacityDecrementer policy. If any listeners are destroyed the pool is either scheduled for prefill, or for removal through emptyManagedConnectionPool if empty.

shutdown shuts the instance down. All listeners are removed. This is done using synchronization such that any components having a reference will be notified through an error.

fillTo(int) fills the pool to the specified size. The pool filler component uses this method.

increaseCapacity(Subject, ConnectionRequestInfo) increases the pool based on the CapacityIncrementer policy. The capacity filler component uses this method.

validateConnections validates that the listeners are valid according to ValidatingManagedConnectionFactory. Any invalid listeners are destroyed and prefill scheduled. The connection validator component uses this method.

detachConnectionListener disassociates the connections attached to the ManagedConnection such that it can be reused in another request through DissociatableManagedConnection.

**Important**
The ConnectionListener implements java.lang.Comparable, so ConnectionListener.used() must be called before returning it to the data structure controlling the free connections. There may be a time interval between the call and the actual return.
10.1. Overview

The standalone IronJacamar container implements Chapter 3 Section 5 of the JCA 1.6 specification which defines a standalone JCA environment.

The standalone container has the following layout:

- $IRON_JACAMAR_HOME/bin/
  contains the run scripts and the SJC kernel.

- $IRON_JACAMAR_HOME/config/
  contains the configuration of the container.

- $IRON_JACAMAR_HOME/deploy/
  contains the user deployments.

- $IRON_JACAMAR_HOME/doc/
  contains the documentation.

- $IRON_JACAMAR_HOME/lib/
  contains all the libraries used by the container.

- $IRON_JACAMAR_HOME/log/
  contains the log files.

- $IRON_JACAMAR_HOME/system/
  contains system deployments files.

- $IRON_JACAMAR_HOME/tmp/
  contains temporary files.

To start the container execute the following
cd $IRON_JACAMAR_HOME/bin
./run.sh

10.2. IronJacamar/SJC

Warning
This standalone configuration is for development purposes only.

The IronJacamar/SJC uses the Fungal kernel for its run-time environment.

The homepage for the Fungal is http://jesperpedersen.github.com/fungal

SJC is short for "Simple JCA Container".
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Version 2.1, February 1999

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