

JBoss Communications JAIN SLEE Diameter Rx Resource Adaptor User Guide

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Preface

1. Document Conventions

This manual uses several conventions to highlight certain words and phrases and draw attention to specific pieces of information.

In PDF and paper editions, this manual uses typefaces drawn from the [Liberation Fonts](https://fedorahosted.org/liberation-fonts/) [https://fedorahosted.org/liberation-fonts/] set. The Liberation Fonts set is also used in HTML editions if the set is installed on your system. If not, alternative but equivalent typefaces are displayed. Note: Red Hat Enterprise Linux 5 and later includes the Liberation Fonts set by default.

1.1. Typographic Conventions

Four typographic conventions are used to call attention to specific words and phrases. These conventions, and the circumstances they apply to, are as follows.

Mono-spaced Bold

Used to highlight system input, including shell commands, file names and paths. Also used to highlight key caps and key-combinations. For example:

To see the contents of the file `my_next_bestselling_novel` in your current working directory, enter the `cat my_next_bestselling_novel` command at the shell prompt and press **Enter** to execute the command.

The above includes a file name, a shell command and a key cap, all presented in Mono-spaced Bold and all distinguishable thanks to context.

Key-combinations can be distinguished from key caps by the hyphen connecting each part of a key-combination. For example:

Press **Enter** to execute the command.

Press **Ctrl+Alt+F1** to switch to the first virtual terminal. Press **Ctrl+Alt+F7** to return to your X-Windows session.

The first sentence highlights the particular key cap to press. The second highlights two sets of three key caps, each set pressed simultaneously.

If source code is discussed, class names, methods, functions, variable names and returned values mentioned within a paragraph will be presented as above, in **Mono-spaced Bold**. For example:

File-related classes include `filesystem` for file systems, `file` for files, and `dir` for directories. Each class has its own associated set of permissions.

Proportional Bold

This denotes words or phrases encountered on a system, including application names; dialogue box text; labelled buttons; check-box and radio button labels; menu titles and sub-menu titles. For example:

Choose **System > Preferences > Mouse** from the main menu bar to launch **Mouse Preferences**. In the **Buttons** tab, click the **Left-handed mouse** check box and click **Close** to switch the primary mouse button from the left to the right (making the mouse suitable for use in the left hand).

To insert a special character into a **gedit** file, choose **Applications > Accessories > Character Map** from the main menu bar. Next, choose **Search > Find** from the **Character Map** menu bar, type the name of the character in the **Search** field and click **Next**. The character you sought will be highlighted in the **Character Table**. Double-click this highlighted character to place it in the **Text to copy** field and then click the **Copy** button. Now switch back to your document and choose **Edit > Paste** from the **gedit** menu bar.

The above text includes application names; system-wide menu names and items; application-specific menu names; and buttons and text found within a GUI interface, all presented in Proportional Bold and all distinguishable by context.

Note the **>** shorthand used to indicate traversal through a menu and its sub-menus. This is to avoid the difficult-to-follow 'Select **Mouse** from the **Preferences** sub-menu in the **System** menu of the main menu bar' approach.

Mono-spaced Bold Italic Of Proportional Bold Italic

Whether Mono-spaced Bold or Proportional Bold, the addition of Italics indicates replaceable or variable text. Italics denotes text you do not input literally or displayed text that changes depending on circumstance. For example:

To connect to a remote machine using ssh, type `ssh username@domain.name` at a shell prompt. If the remote machine is `example.com` and your username on that machine is john, type `ssh john@example.com`.

The `mount -o remount file-system` command remounts the named file system. For example, to remount the `/home` file system, the command is `mount -o remount /home`.

To see the version of a currently installed package, use the `rpm -q package` command. It will return a result as follows: `package-version-release`.

Note the words in bold italics above `username`, `domain.name`, `file-system`, `package`, `version` and `release`. Each word is a placeholder, either for text you enter when issuing a command or for text displayed by the system.

Aside from standard usage for presenting the title of a work, italics denotes the first use of a new and important term. For example:

When the Apache HTTP Server accepts requests, it dispatches child processes or threads to handle them. This group of child processes or threads is known as

a *server-pool*. Under Apache HTTP Server 2.0, the responsibility for creating and maintaining these server-pools has been abstracted to a group of modules called *Multi-Processing Modules (MPMs)*. Unlike other modules, only one module from the MPM group can be loaded by the Apache HTTP Server.

1.2. Pull-quote Conventions

Two, commonly multi-line, data types are set off visually from the surrounding text.

Output sent to a terminal is set in `Mono-spaced Roman` and presented thus:

```
books      Desktop  documentation  drafts  mss    photos  stuff  svn
books_tests Desktop1  downloads      images  notes  scripts svgs
```

Source-code listings are also set in `Mono-spaced Roman` but are presented and highlighted as follows:

```
package org.jboss.book.jca.ex1;

import javax.naming.InitialContext;

public class ExClient
{
    public static void main(String args[])
        throws Exception
    {
        InitialContext iniCtx = new InitialContext();
        Object      ref  = iniCtx.lookup("EchoBean");
        EchoHome    home = (EchoHome) ref;
        Echo        echo = home.create();

        System.out.println("Created Echo");

        System.out.println("Echo.echo('Hello') = " + echo.echo("Hello"));
    }
}
```

1.3. Notes and Warnings

Finally, we use three visual styles to draw attention to information that might otherwise be overlooked.



Note

A note is a tip or shortcut or alternative approach to the task at hand. Ignoring a note should have no negative consequences, but you might miss out on a trick that makes your life easier.



Important

Important boxes detail things that are easily missed: configuration changes that only apply to the current session, or services that need restarting before an update will apply. Ignoring Important boxes won't cause data loss but may cause irritation and frustration.



Warning

A Warning should not be ignored. Ignoring warnings will most likely cause data loss.

2. Provide feedback to the authors!

If you find a typographical error in this manual, or if you have thought of a way to make this manual better, we would love to hear from you! Please submit a report in the the [Issue Tracker](http://bugzilla.redhat.com/bugzilla/) [http://bugzilla.redhat.com/bugzilla/], against the product **JBoss Communications JAIN SLEE Diameter Rx Resource Adaptor**, or contact the authors.

When submitting a bug report, be sure to mention the manual's identifier: JAIN_SLEE_DIAMETER_RX_RA_User_Guide

If you have a suggestion for improving the documentation, try to be as specific as possible when describing it. If you have found an error, please include the section number and some of the surrounding text so we can find it easily.

Introduction to JBoss

Communications JAIN SLEE

Diameter Rx Resource Adaptor

This resource adaptor provides a Diameter API for JAIN SLEE applications, according to Rx interface based on Diameter protocol.

The Rx reference point is used to exchange application level session information between the Policy and Charging Rules Function (PCRF) and the Application Function (AF). This information is part of the input used by the PCRF for the Policy and Charging Control (PCC) decisions. The PCRF exchanges the PCC rules with the Policy and Charging Enforcement Function (PCEF) and QoS rules with the Bearer Binding and Event Reporting Function (BBERF).

Events represent Diameter Rx messages received by the Diameter stack. Different events types are specified for each Diameter request or answer. Events are fired either on client or server activities.

The Activities are defined by RA Type to ease use of RA. Activities represent Diameter session between two peers. SLEE applications use activities to create, send and receive messages.

Resource Adaptor Type

Diameter Rx Resource Adaptor Type is defined by Mobicents team as part of effort to standardize RA Types.

2.1. Activities

Diameter Rx Type 1.0.0.BETA2 defines the following Activities:

`net.java.slee.resource.diameter.rx.RxClientSessionActivity`

This type of activity represents client side of Rx session. Abort-Session-Request (ASR) and Re-Auth-Request (RAR) messages are received in this Activity and respective Answers are sent from it. AA-Request (AAR) and Session-Termination-Request (STR) messages can be created and sent in this Activity, receiving the respective Answer (or timeout) later on this Activity.

This activity type can be created with call to the proper `createRxClientSessionActivity` method of `net.java.slee.resource.diameter.rx.RxProvider`. It ends once underlying Rx session ends.

State machine for client Authorization sessions can be found at [Section 8.1](http://tools.ietf.org/html/rfc3588#section-8.1) [<http://tools.ietf.org/html/rfc3588#section-8.1>] of Diameter Base Protocol RFC.

`net.java.slee.resource.diameter.rx.RxServerSessionActivity`

This type of activity represents server side of Rx session. AA-Request (AAR) and Session-Termination-Request (STR) messages are received in this Activity and respective Answers are sent from it. Abort-Session-Request (ASR) and Re-Auth-Request (RAR) messages can be created and sent in this Activity, receiving the respective Answer (or timeout) later on this Activity.

This activity type is implicitly created by the Resource Adaptor upon reception of the AA-Request message. It ends once underlying Rx session ends.

State machine for server Authorization sessions can be found at [Section 8.1](http://tools.ietf.org/html/rfc3588#section-8.1) [<http://tools.ietf.org/html/rfc3588#section-8.1>] of Diameter Base Protocol RFC.

All activities define methods required to properly function and expose necessary information to JAIN SLEE services. Rx Server Activity is defined as follows:

```
public AAAnswer createAAAnswer();

public void sendAAAnswer(AAAnswer aaa) throws IOException;
```

```
public SessionTerminationAnswer createSessionTermAnswer();  
  
public void sendSessionTermAnswer(SessionTerminationAnswer sta) throws IOException;  
  
public void sendReAuthRequest(ReAuthRequest rar) throws IOException;  
  
public void sendAbortSessionRequest(AbortSessionRequest asr) throws IOException;
```

```
public AAAAnswer createAAAAnswer();
```

This method creates a Rx-specific AA-Answer message pre-populated with the AVPs appropriate for this session taken from previously received session AA-Request.

```
public void sendAAAAnswer(AAAnswer aaa) throws IOException;
```

This method sends a AA-Answer message to the peer.

```
public SessionTerminationAnswer createSessionTermAnswer();
```

This method creates a Rx-specific Session-Termination-Answer message pre-populated with the AVPs appropriate for this session taken from previously received session Session-Termination-Request.

```
public void sendSessionTermAnswer(SessionTerminationAnswer sta) throws IOException;
```

This method sends a Session-Termination-Answer message to the peer.

```
public void sendReAuthRequest(ReAuthRequest rar) throws IOException;
```

This method sends a Rx-specific Re-Auth-Request message to the peer.

```
public void sendAbortSessionRequest(AbortSessionRequest asr) throws IOException;
```

This method sends a Rx-specific Abort-Session-Request message to the peer.

Rx Client Activity is defined as follows:

```
public AAResponse createRxAAResponse();  
  
public void sendRxAAResponse(AAResponse aar) throws IOException;  
  
public SessionTerminationRequest createSessionTermRequest();  
  
public void sendSessionTermRequest(SessionTerminationRequest str) throws IOException;  
  
public void sendReAuthAnswer(ReAuthAnswer raa) throws IOException;
```

```
public void sendAbortSessionAnswer(AbortSessionAnswer asa) throws IOException;
```

```
public AAResponse createRxAAResponse();
```

Create a Rx-specific AA-Response message pre-populated with the AVPs appropriate for this session.

```
public void sendRxAAResponse(AAResponse aar) throws IOException;
```

Sends an AA-Response message to the peer.

```
public void sendReAuthAnswer(ReAuthAnswer raa) throws IOException;
```

Sends a Re-Auth-Answer message to the peer.

```
public void sendSessionTerminationRequest(SessionTerminationRequest str) throws IOException;
```

Sends a Rx-specific Session-Termination-Request message to the peer.

```
public void sendAbortSessionAnswer(AbortSessionAnswer asa) throws IOException;
```

Sends a Abort-Session-Answer message to the peer.



Note

It is safe to type cast all the mentioned Diameter Activities to its super interface `net.java.slee.resource.diameter.base.DiameterActivity` defined in Diameter Base Activities section.

2.2. Events

Diameter Rx Resource Adaptor Type declares the Diameter Rx Interface specific events.

The following tables shows which events are fired on each activity.

Table 2.1. Events received on Rx Server Activity

Name	Vendor	Version	Class
net.java.slee.resource.diameter.rx.events.AAResponse	java.net	0.8	net.java.slee.resource.diameter.rx.events.AAResponse
net.java.slee.resource.diameter.rx.events.AbortSessionAnswer	java.net	0.8	net.java.slee.resource.diameter.rx.events.AbortSessionAnswer
net.java.slee.resource.diameter.rx.events.ReAuthAnswer	java.net	0.8	net.java.slee.resource.diameter.rx.events.ReAuthAnswer

Name	Vendor	Version	Class
net.java.slee.resource. diameter.rx.events. SessionTerminationRequest	java.net	0.8	net.java.slee.resource. diameter.rx.events. SessionTerminationRequest

Table 2.2. Events received on Rx Client Activity

Name	Vendor	Version	Class
net.java.slee.resource. diameter.rx.events. AAAnswer	java.net	0.8	net.java.slee.resource. diameter.rx.events. AAAnswer
net.java.slee.resource. diameter.rx.events. AbortSessionRequest	java.net	0.8	net.java.slee.resource. diameter.rx.events. AbortSessionRequest
net.java.slee.resource. diameter.rx.events. ReAuthRequest	java.net	0.8	net.java.slee.resource. diameter.rx.events. ReAuthRequest
net.java.slee.resource. diameter.rx.events. SessionTerminationAnswer	java.net	0.8	net.java.slee.resource. diameter.rx.events. SessionTerminationAnswer



Important

Spaces were introduced in `Name` and `Event Class` column values, to correctly render the table. Please remove them when using copy/paste.

2.3. Activity Context Interface Factory

The JBoss Communications Diameter Rx Activity Context Interface Factory is defined as follows:

```
package net.java.slee.resource.diameter.rx;

import javax.slee.ActivityContextInterface;
import javax.slee.UnrecognizedActivityException;

public interface RxActivityContextInterfaceFactory {

    public ActivityContextInterface getActivityContextInterface(RxClientSessionActivity cSession)
        throws UnrecognizedActivityException;

    public ActivityContextInterface getActivityContextInterface(RxServerSessionActivity sSession)
        throws UnrecognizedActivityException;
}
```

```
}
```

2.4. Resource Adaptor Interface

The JBoss Communications Diameter Rx Resource Adaptor SBB Interface provides SBBs with access to the Diameter objects required for creating and sending messages. It is defined as follows:

```
package net.java.slee.resource.diameter.rx;

import java.io.IOException;

import net.java.slee.resource.diameter.Validator;
import net.java.slee.resource.diameter.base.CreateActivityException;
import net.java.slee.resource.diameter.base.events.avp.DiameterIdentity;
import net.java.slee.resource.diameter.rx.events.AAAnswer;
import net.java.slee.resource.diameter.rx.events.AARequest;
import net.java.slee.resource.diameter.rx.events.AbortSessionAnswer;
import net.java.slee.resource.diameter.rx.events.AbortSessionRequest;
import net.java.slee.resource.diameter.rx.events.ReAuthAnswer;
import net.java.slee.resource.diameter.rx.events.ReAuthRequest;

public interface RxProvider {

    public RxMessageFactory getRxMessageFactory();

    public RxAvpFactory getRxAvpFactory();

    public RxClientSessionActivity getActivityBySessionID(String sessionID);

    public RxClientSessionActivity createRxClientSessionActivity()
        throws CreateActivityException;

    public RxClientSessionActivity createRxClientSessionActivity(
        DiameterIdentity destinationHost,
        DiameterIdentity destinationRealm) throws CreateActivityException;

    public AAAnswer sendAARequest(AARequest aar) throws IOException;

    public AbortSessionAnswer sendAbortSessionRequest(
```

```
AbortSessionRequest asr)
    throws IOException;

    public ReAuthAnswer sendReAuthRequest(
        ReAuthRequest rar) throws IOException;

    DiameterIdentity[] getConnectedPeers();

    int getPeerCount();

    Validator getValidator();
}
```

public RxMessageFactory getRxMessageFactory();

This method returns a message factory to be used to create concrete implementations of Rx messages.

public RxAvpFactory getRxAvpFactory();

This method returns an avp factory to be used to create concrete implementations of Rx AVPs.

public RxClientSessionActivity getActivityBySessionID(String sessionID);

This method returns an existing Rx activity by its Session-Id attribute and null if it doesn't exist.

public RxClientSessionActivity createRxClientSessionActivity() throws CreateActivityException;

This method creates a new activity to send and receive Diameter Rx messages.

public RxClientSessionActivity createRxClientSessionActivity(DiameterIdentity destinationHost, DiameterIdentity destinationRealm) throws CreateActivityException;

This method creates a new activity to send and receive Diameter Rx messages for the given host and/or realm.

public AAAnswer sendAARequest(AARequest aar) throws IOException;

This method sends an AA-Request message to the appropriate peers, and block until the response is received then return it.

public AbortSessionAnswer sendAbortSessionRequest(AbortSessionRequest asr) throws IOException;

This method sends an Abort-Session-Request message to the appropriate peers, and block until the response is received then return it.

public ReAuthAnswer sendReAuthRequest(ReAuthRequest rar) throws IOException;

This method sends an Re-Auth-Request message to the appropriate peers, and block until the response is received then return it.

public DiameterIdentity[] getConnectedPeers();

This method returns the identities of peers this Diameter resource adaptor is connected to.


```
public int getPeerCount();
```

This method returns the number of peers this Diameter resource adaptor is connected to.

```
public Validator getValidator();
```

This method returns the Diameter Message and AVP validator instance.

2.5. Restrictions

Current Resource Adaptor Type has no defined restrictions.

2.6. Sbb Code Examples

TODO

```
// TODO: Create Rx Authorization Client/Server Examples.
```


Resource Adaptor Implementation

This RA uses the JBoss Communications Diameter Stack, an improvement over [jDiameter Stack](http://jdiameter.dev.java.net) [http://jdiameter.dev.java.net]. The stack is the result of the work done by JBoss Communications Diameter and jDiameter development teams, and source code is provided in all releases.

3.1. Configuration

The Resource Adaptor supports configuration only at Resource Adaptor Entity creation time, the following table enumerates the configuration properties:

Table 3.1. Resource Adaptor's Configuration Properties

Property Name	Description	Property Type	Default Value
authApplicationIds	List of supported Authorization Application Ids in form of {vendor}: {application-id}, separated by comma ','	java.lang.String	10415:16777236



Important

JAIN SLEE 1.1 Specification requires values set for properties without a default value, which means the configuration for those properties are mandatory, otherwise the Resource Adaptor Entity creation will fail!

3.2. Default Resource Adaptor Entities

There is a single Resource Adaptor Entity created when deploying the Resource Adaptor, named `DiameterRx`. The `DiameterRx` entity uses the default Resource Adaptor configuration, specified in [Section 3.1, "Configuration"](#).

The `DiameterRx` entity is also bound to Resource Adaptor Link Name `DiameterRx`, to use it in an Sbb add the following XML to its descriptor:

```
<resource-adaptor-type-binding>
  <resource-adaptor-type-ref>
    <resource-adaptor-type-name>Diameter Rx</resource-adaptor-type-name>
    <resource-adaptor-type-vendor>java.net</resource-adaptor-type-vendor>
```

```
<resource-adaptor-type-version>0.8.1</resource-adaptor-type-version>
</resource-adaptor-type-ref>

<activity-context-interface-factory-name>
  slee/resources/JDiameterRxResourceAdaptor/java.net/0.8.1/acif
</activity-context-interface-factory-name>

<resource-adaptor-entity-binding>
  <resource-adaptor-object-name>
    slee/resources/diameter-rx-ra-interface
  </resource-adaptor-object-name>
  <resource-adaptor-entity-link>DiameterRx</resource-adaptor-entity-link>
</resource-adaptor-entity-binding>
</resource-adaptor-type-binding>
```

3.3. Traces and Alarms

3.3.1. Tracers

Each Resource Adaptor Entity uses a single JAIN SLEE 1.1 Tracer, named `DiameterRxResourceAdaptor`. The related Log4j Logger category, which can be used to change the Tracer level from Log4j configuration, is `javax.slee.RAEntityNotification[entity=DiameterRx]`.

3.3.2. Alarms

No alarms are set by this Resource Adaptor.

Setup

4.1. Pre-Install Requirements and Prerequisites

Ensure that the following requirements have been met before continuing with the install.

4.1.1. Hardware Requirements

The Resource Adaptor hardware's main concern is RAM memory and Java Heap size, the more the better. For instance, while the underlying JBoss Communications JAIN SLEE may run with 1GB of RAM, 8GB is needed to achieve performance higher than 800 new requests per second.

Of course, memory is only needed to store the Resource Adaptor state, the faster the CPU more requests per second are supported, yet no particular CPU is a real requirement to use the RA.

4.1.2. Software Prerequisites

The RA requires JBoss Communications JAIN SLEE properly set and Mobicents Diameter Multiplexer (MUX), which includes the stack, JBoss Communications Diameter Base RA and JBoss Communications Diameter CCA RA to be properly installed too.

4.2. JBoss Communications JAIN SLEE Diameter Rx Resource Adaptor Source Code

4.2.1. Release Source Code Building

1. Downloading the source code



Important

Subversion is used to manage its source code. Instructions for using Subversion, including install, can be found at <http://svnbook.red-bean.com>

Use SVN to checkout a specific release source, the base URL is ?, then add the specific release version, lets consider 1.0.0.BETA2.

```
[usr]$ svn co ?/1.0.0.BETA2 slee-ra-diameter-rx-1.0.0.BETA2
```

2. Building the source code



Important

Maven 2.0.9 (or higher) is used to build the release. Instructions for using Maven2, including install, can be found at <http://maven.apache.org>

Use Maven to build the deployable unit binary.

```
[usr]$ cd slee-ra-diameter-rx-1.0.0.BETA2
[usr]$ mvn install
```

Once the process finishes you should have the `deployable-unit` jar file in the `target` directory, if JBoss Communications JAIN SLEE is installed and environment variable `JBOSS_HOME` is pointing to its underlying JBoss Enterprise Application Platform directory, then the deployable unit jar will also be deployed in the container.

4.2.2. Development Trunk Source Building

Similar process as for [Section 4.2.1, "Release Source Code Building"](#), the only change is the SVN source code URL, which is NOT AVAILABLE.

4.3. Installing JBoss Communications JAIN SLEE Diameter Rx Resource Adaptor

To install the Resource Adaptor simply execute provided ant script `build.xml` default target:

```
[usr]$ ant
```

The script will copy the RA deployable unit jar to the `default` JBoss Communications JAIN SLEE server profile deploy directory, to deploy to another server profile use the argument `-Dnode=`.

4.4. Uninstalling JBoss Communications JAIN SLEE Diameter Rx Resource Adaptor

To uninstall the Resource Adaptor simply execute provided ant script `build.xml` `undeploy` target:

```
[usr]$ ant undeploy
```

The script will delete the RA deployable unit jar from the `default` JBoss Communications JAIN SLEE server profile deploy directory, to undeploy from another server profile use the argument `-Dnode=.`

Clustering

5.1. Failover

The Diameter stack used by the JBoss Communications JAIN SLEE Diameter Rx Resource Adaptor supports application session failover, with specific session state being replicated, thus only available for Application sessions. Failover of application activities is transparent to SLEE applications. This means that SLEE applications must be in charge of properly adapting its state machine to recover generic session on node failure.

5.2. Load Balancing

Currently, the only available balancing mechanism is provided by Diameter stack. It depends on [RFC 3588](http://tools.ietf.org/html/rfc3588) [http://tools.ietf.org/html/rfc3588] algorithm to select one peer from realm serving the desired application.

Appendix A. Revision History

Revision History

Revision 1.0

Mon Sep 07 2011

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Creation of the JBoss Communications JAIN SLEE Diameter Rx RA User Guide.

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