Red Hat JBoss AMQ 7.0

Using the AMQ JavaScript Client

For Use with AMQ Clients 1.2

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Legal Notice

Abstract

This guide describes how to install and configure the client, run hands-on examples, and use your client with other AMQ components.

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CHAPTER 1. OVERVIEW

AMQ JavaScript is a JavaScript library for writing messaging applications. It allows you to write client and server applications that send and receive AMQP messages.

AMQ JavaScript is part of AMQ Clients, a suite of messaging libraries supporting multiple languages and platforms. See Introducing Red Hat JBoss AMQ 7 for an overview of the clients and other AMQ components. See AMQ Clients 1.2 Release Notes for information about this release.

AMQ JavaScript is based on the Rhea messaging library.

1.1. KEY FEATURES

AMQ JavaScript is a flexible and capable messaging API. It enables any application to speak AMQP 1.0.

- An event-driven API that simplifies integration with existing applications
- Access to all the features and capabilities of AMQP 1.0
- SSL/TLS and SASL for secure communication
- Seamless conversion between AMQP and language-native data types
- Heartbeating and automatic reconnect for reliable network connections

1.2. SUPPORTED STANDARDS AND PROTOCOLS

AMQ JavaScript supports the following industry-recognized standards and network protocols.

- Version 1.0 of the Advanced Message Queueing Protocol (AMQP)
- Versions 1.0, 1.1, and 1.2 of the Transport Layer Security (TLS) protocol, the successor to SSL
- Modern TCP with IPv6

1.3. SUPPORTED CONFIGURATIONS

AMQ JavaScript supports the following OS and language versions. See Red Hat JBoss AMQ 7 Supported Configurations for more information.

- Red Hat Enterprise Linux 6 with Node.js 0.10 from Software Collections
- Red Hat Enterprise Linux 7 with the following JavaScript runtimes
  - Node.js 0.10 from Software Collections
  - Node.js 4 from Software Collections
- Microsoft Windows Server 2012 R2 with Node.js 4 from the Node.js project

1.4. TERMS AND CONCEPTS

This section introduces the core API entities and describes how they operate together.

Table 1.1. API Terms

Entity	Description
Container	A top-level container of connections
Connection	A channel for communication between two peers on a network
Session	A serialized context for producing and consuming messages
Sender	A channel for sending messages to a target
Receiver	A channel for receiving messages from a source
Source	A named point of origin for messages
Target	A named destination for messages
Message	A mutable holder of application content
Delivery	A message transfer

AMQ JavaScript sends and receives *messages*. Messages are transferred between connected peers over *senders* and *receivers*. Senders and receivers are established over *sessions*. Sessions are established over *connections*. Connections are established between two uniquely identified *containers*. Though a connection can have multiple sessions, often this is not needed. The API allows you to ignore sessions unless you require them.

A sending peer creates a sender to send messages. The sender has a *target* that identifies a queue or topic at the remote peer. A receiving peer creates a receiver to receive messages. The receiver has a *source* that identifies a queue or topic at the remote peer.

The sending of a message is called a *delivery*. The message is the content sent, including all metadata such as headers and annotations. The delivery is the protocol exchange associated with the transfer of that content.

To indicate that a delivery is complete, either the sender or the receiver settles it. When the other side learns that it has been settled, it will no longer communicate about that delivery. The receiver can also indicate whether it accepts or rejects the message.

1.5. DOCUMENT CONVENTIONS

In this document, **sudo** is used for any command that requires root privileges. You should always exercise caution when using **sudo**, as any changes can affect the entire system.

For more information about using **sudo**, see The **sudo** Command.

CHAPTER 2. INSTALLATION

This chapter guides you through the steps required to install AMQ JavaScript in your environment.

2.1. PREREQUISITES

To begin installation, use your subscription to access AMQ distribution archives and package repositories.

To use AMQ JavaScript, you must also install and configure Node.js for your environment. See the Node.js website for more information.

AMQ JavaScript depends on the Node.js **debug** module. See the npm page for installation instructions.

2.2. INSTALLING ON RED HAT ENTERPRISE LINUX

AMQ JavaScript is distributed as a zip archive. Follow these steps to install it in your environment.

1. Open a browser and log in to the Red Hat Customer Portal **Product Downloads** page at access.redhat.com/downloads.
2. Locate the **Red Hat JBoss AMQ Clients** entry in the **JBOSS INTEGRATION AND AUTOMATION** category.
3. Click **Red Hat JBoss AMQ Clients**. The **Software Downloads** page opens.
4. Download the **AMQ JavaScript Client** zip file.
5. Use the **unzip** command to extract the file contents into a directory of your choosing. This will create a new subdirectory called **nodejs-rhea-*VERSION***.

```
$ unzip nodejs-rhea-VERSION.zip
Archive:  nodejs-rhea-VERSION.zip
   creating: nodejs-rhea-VERSION/
   creating: nodejs-rhea-VERSION/node_modules/
   creating: nodejs-rhea-VERSION/node_modules/rhea/
[...]
```

6. Configure your environment to use the installed library. Add the **node_modules** directory to the **NODE_PATH** environment variable.

```
$ cd nodejs-rhea-VERSION
$ export NODE_PATH=$PWD/node_modules:$NODE_PATH
```

   To make this configuration take effect for all new console sessions, set **NODE_PATH** in your **$HOME/.bashrc** file.

7. Test your installation. The following command will return zero if it can successfully import the installed library.

```
$ node -e 'require("rhea")'; echo $?
0
```

2.3. INSTALLING ON MICROSOFT WINDOWS

1. Open a browser and log in to the Red Hat Customer Portal **Product Downloads** page at access.redhat.com/downloads.
2. Locate the **Red Hat JBoss AMQ Clients** entry in the **JBOSS INTEGRATION AND AUTOMATION** category.
3. Click **Red Hat JBoss AMQ Clients**. The **Software Downloads** page opens.
4. Download the **AMQ JavaScript Client** zip file.
5. Extract the file contents into a directory of your choosing by right-clicking on the zip file and selecting **Extract All**. This will create a new subdirectory called **`nodejs-rhea-VERSION`**.
6. Configure your environment to use the installed library. Add the **`node_modules`** directory to the **`NODE_PATH`** environment variable.

```
$ cd nodejs-rhea-VERSION
$ set NODE_PATH=%cd%\node_modules;%NODE_PATH%
```

2.4. PREPARING THE LIBRARY FOR USE IN BROWSERS

AMQ JavaScript can run inside a web browser. To create a browser-compatible version of the library, use the **`npm run browserify`** command.

```
$ cd nodejs-rhea-VERSION/node_modules/rhea
$ npm install
$ npm run browserify
```

This will produce a file called **`rhea.js`** that can be used in browser-based applications.

CHAPTER 3. GETTING STARTED

This chapter guides you through a simple exercise to help you get started using AMQ JavaScript. Before starting, make sure you have completed the steps in the Chapter 2, *Installation* chapter for your environment.

3.1. PREPARING THE BROKER

The example programs require a running broker with a queue named **`examples`**. Follow these steps to define the queue and start the broker.

1. Install the broker.
2. Create a broker instance. Enable anonymous access.
3. Start the broker instance and check the console for any critical errors logged during startup.

```
$ BROKER_INSTANCE_DIR/bin/artemis run
[...]
14:43:20,158 INFO
[org.apache.activemq.artemis.integration.bootstrap] AMQ101000:
Starting ActiveMQ Artemis Server
[...]
15:01:39,686 INFO  [org.apache.activemq.artemis.core.server]
AMQ221020: Started Acceptor at 0.0.0.0:5672 for protocols [AMQP]
[...]
15:01:39,691 INFO  [org.apache.activemq.artemis.core.server]
AMQ221007: Server is now live
```

4. Use the **`artemis queue`** command to create a queue called **`examples`**.

```
$ BROKER_INSTANCE_DIR/bin/artemis queue create --name examples --
auto-create-address --anycast
```

You are prompted to answer a series of questions. For yes|no questions, type **`N`**; otherwise, press Enter to accept the default value.

3.2. RUNNING HELLO WORLD

The Hello World example sends a message to the **`examples`** queue on the broker and then fetches it back. On success it prints **`Hello World!`** to the console.

Using your configured installation environment, run the **`helloworld.js`** example.

```
$ cd nodejs-rhea-VERSION/node_modules/rhea/examples
$ node helloworld.js
Hello World!
```

CHAPTER 4. EXAMPLES

This chapter demonstrates the use of AMQ JavaScript through example programs. To run them, make sure you have completed the steps in the Chapter 2, *Installation* chapter for your environment and you have a running and configured broker.

See the Rhea examples for more sample programs. Note that some of the sample programs there require the minimist package in order to parse command-line options.

4.1. SENDING MESSAGES

This client program connects to a server using ***CONNECTION_URL***, creates a sender for target ***ADDRESS***, sends a message containing ***MESSAGE_BODY***, closes the connection, and exits.

Example: Sending Messages

```
"use strict";

var rhea = require("rhea");
var url = require("url");

if (process.argv.length !== 5) {
    console.error("Usage: send.js CONNECTION-URL ADDRESS MESSAGE-BODY");
    process.exit(1);
}

var conn_url = url.parse(process.argv[2]);
var address = process.argv[3];
var message_body = process.argv[4];

var container = rhea.create_container();

container.on("sender_open", function (event) {
    console.log("SEND: Opened sender for target address '" +
                event.sender.target.address + "'");
});

container.on("sendable", function (event) {
    var message = {
        "body": message_body
    };

    event.sender.send(message);

    console.log("SEND: Sent message '" + message.body + "'");

    event.sender.close();
    event.connection.close();
});

var opts = {
    host: conn_url.hostname,
    port: conn_url.port || 5672
};
```

```
var conn = container.connect(opts);
conn.open_sender(address);
```

Running the Example

To run the example program, copy it to a local file and invoke it using the **node** command.

```
$ node send.js amqp://localhost queue1 hello
```

4.2. RECEIVING MESSAGES

This client program connects to a server using ***CONNECTION_URL***, creates a receiver for source ***ADDRESS***, and receives messages until it is terminated or it reaches ***COUNT*** messages.

Example: Receiving Messages

```
"use strict";

var rhea = require("rhea");
var url = require("url");

if (process.argv.length !== 4 && process.argv.length !== 5) {
    console.error("Usage: receive.js CONNECTION-URL ADDRESS [MESSAGE-
COUNT]");
    process.exit(1);
}

var conn_url = url.parse(process.argv[2]);
var address = process.argv[3];
var desired = 0;
var received = 0;

if (process.argv.length === 5) {
    desired = parseInt(process.argv[4]);
}

var container = rhea.create_container();

container.on("receiver_open", function (event) {
    console.log("RECEIVE: Opened receiver for source address '" +
                event.receiver.source.address + "'");
});

container.on("message", function (event) {
    var message = event.message;

    console.log("RECEIVE: Received message '" + message.body + "'");

    received++;

    if (received == desired) {
        event.receiver.close();
        event.connection.close();
    }
```

```
});

var opts = {
    host: conn_url.hostname,
    port: conn_url.port || 5672
};

var conn = container.connect(opts);
conn.open_receiver(address);
```

Running the Example

To run the example program, copy it to a local file and invoke it using the **python** command.

```
$ node receive.js amqp://localhost queue1
```

CHAPTER 5. USING THE API

This chapter explains how to use the AMQ JavaScript API to perform common messaging tasks.

5.1. BASIC OPERATION

5.1.1. Handling Messaging Events

AMQ JavaScript is an asynchronous event-driven API. To define how the application handles events, the user registers event-handling functions on the **`container`** object. These functions are then called as network activity or timers trigger new events.

Example: Handling Messaging Events

```
var rhea = require("rhea");
var container = rhea.create_container();

container.on("sendable", function (event) {
    console.log("A message can be sent");
});

container.on("message", function (event) {
    console.log("A message is received");
});
```

These are only a few common-case events. The full set is documented in the API reference.

5.1.2. Creating a Container

The container is the top-level API object. It is the entry point for creating connections, and it is responsible for running the main event loop. It is often constructed with a global event handler.

Example: Creating a Container

```
var rhea = require("rhea");
var container = rhea.create_container();
```

Setting the Container Identity
Each container instance has a unique identity called the container ID. When AMQ JavaScript makes a network connection, it sends the container ID to the remote peer. To set the container ID, pass the **`id`** option to the **`create_container`** method.

Example: Setting the Container Identity

```
var container = rhea.create_container({"id": "job-processor-3"});
```

If the user does not set the ID, the library will generate a UUID when the container is constucted.

5.2. NETWORK CONNECTIONS

5.2.1. Creating Outgoing Connections

To connect to a remote server, pass connection options containing the host and port to the **`container.connect()`** method.

Example: Creating Outgoing Connections

```
container.on("connection_open", function (event) {
    console.log("Connection " + event.connection + " is open");
});

var opts = {
    "host": "example.com",
    "port": 5672
};

container.connect(opts);
```

The default host is **`localhost`**. The default port is 5672.

See the Section 5.3, “Security” section for information about creating secure connections.

5.2.2. Configuring Reconnect

Reconnect allows a client to recover from lost connections. It is used to ensure that the components in a distributed system reestablish communication after temporary network or component failures.

AMQ JavaScript enables reconnect by default. If a connection attempt fails, the client will try again after a brief delay. The delay increases exponentially for each new attempt, up to a default maximum of 60 seconds.

To disable reconnect, set the **`reconnect`** connection option to **`false`**.

Example: Disabling Reconnect

```
var opts = {
    "host": "example.com",
    "reconnect": false
};

container.connect(opts);
```

To control the delays between connection attempts, set the **`initial_reconnect_delay`** and **`max_reconnect_delay`** connection options. Delay options are specified in milliseconds.

To limit the number of reconnect attempts, set the **`reconnect_limit`** option.

Example: Configuring Reconnect

```
var opts = {
    "host": "example.com",
    "initial_reconnect_delay": 100,
    "max_reconnect_delay": 60 * 1000,
    "reconnect_limit": 10
```

```
};

container.connect(opts);
```

5.2.3. Configuring Failover

AMQ JavaScript allows you to configure alternate connection endpoints programatically.

To specify multiple connection endpoints, define a function that returns new connection options and pass the function in the **`connection_details`** option. The function is called once for each connection attempt.

Example: Configuring Failover

```
var hosts = ["alpha.example.com", "beta.example.com"];
var index = -1;

function failover_fn() {
    index += 1;

    if (index == hosts.length) index = 0;

    return {"host": hosts[index].hostname};
};

var opts = {
    "host": "example.com",
    "connection_details": failover_fn
}

container.connect(opts);
```

This example implements repeating round-robin failover for a list of hosts. You can use this interface to implement your own failover behavior.

5.3. SECURITY

5.3.1. Securing Connections with SSL/TLS

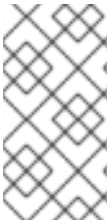
AMQ JavaScript uses SSL/TLS to encrypt communication between clients and servers.

To connect to a remote server with SSL/TLS, set the **`transport`** connection option to **`tls`**.

Example: Enabling SSL/TLS

```
var opts = {
    "host": "example.com",
    "port": 5671,
    "transport": "tls"
};

container.connect(opts);
```



NOTE

By default, the client will reject connections to servers with untrusted certificates. This is sometimes the case in test environments. To bypass certificate authorization, set the **`rejectUnauthorized`** connection option to **`false`**. Be aware that this compromises the security of your connection.

5.3.2. Connecting with a User and Password

AMQ JavaScript can authenticate connections with a user and password.

To specify the credentials used for authentication, set the **`username`** and **`password`** connection options.

Example: Connecting with a User and Password

```
var opts = {
    "host": "example.com",
    "username": "alice",
    "password": "secret"
};

container.connect(opts);
```

5.3.3. Configuring SASL Authentication

AMQ JavaScript uses the SASL protocol to perform authentication. SASL can use a number of different authentication *mechanisms*. When two network peers connect, they exchange their allowed mechanisms, and the strongest mechanism allowed by both is selected.

AMQ JavaScript enables SASL mechanisms based on the presence of user and password information. If the user and password are both specified, **`PLAIN`** is used. If only a user is specified, **`ANONYMOUS`** is used. If neither is specified, SASL is disabled.

5.4. MORE INFORMATION

For more information, see the API reference.

CHAPTER 6. INTEROPERABILITY

This chapter discusses how to use AMQ JavaScript in combination with other AMQ components. For an overview of the compatibility of AMQ components, see the product introduction.

6.1. INTEROPERATING WITH OTHER AMQP CLIENTS

AMQP messages are composed using the AMQP type system. This common format is one of the reasons AMQP clients in different languages are able to interoperate with each other.

When sending messages, AMQ JavaScript automatically converts language-native types to AMQP-encoded data. When receiving messages, the reverse conversion takes place.

NOTE

More information about AMQP types is available at the interactive type reference maintained by the Apache Qpid project.

JavaScript has fewer native types than AMQP can encode. To send messages containing specific AMQP types, use the **`wrap_`** functions from the **`rhea/types.js`** module.

Table 6.1. AMQ JavaScript and AMQP Types

AMQ JavaScript Type	AMQP Type	Description
`null`	null	An empty value
`boolean`	boolean	A true or false value
`string`	string	A sequence of Unicode characters
`wrap_binary(string)`	binary	A sequence of bytes
`wrap_byte(number)`	byte	A signed 8-bit integer
`wrap_short(number)`	short	A signed 16-bit integer
`wrap_int(number)`	int	A signed 32-bit integer
`wrap_long(number)`	long	A signed 64-bit integer
`wrap_ubyte(number)`	ubyte	An unsigned 8-bit integer
`wrap_ushort(number)`	ushort	An unsigned 16-bit integer
`wrap_uint(number)`	uint	An unsigned 32-bit integer
`wrap_ulong(number)`	ulong	An unsigned 64-bit integer

AMQ JavaScript Type	AMQP Type	Description
`wrap_float(number)`	float	A 32-bit floating point number
`wrap_double(number)`	double	A 64-bit floating point number
`wrap_array(Array, code)`	array	A sequence of values of a single type
`wrap_list(Array)`	list	A sequence of values of variable type
`wrap_map(object)`	map	A mapping from distinct keys to values
`wrap_symbol(string)`	symbol	A 7-bit ASCII string from a constrained domain
`wrap_timestamp(number)`	timestamp	An absolute point in time

Table 6.2. AMQ JavaScript and Other AMQ Client Types

AMQ JavaScript	AMQ C++	AMQ Python	AMQ .NET
`null`	`nullptr`	`None`	`null`
`boolean`	`bool`	`bool`	`System.Boolean`
`string`	`std::string`	`unicode`	`System.String`
`wrap_binary(string)`	`proton::binary`	`bytes`	`System.Byte[]`
`wrap_byte(number)`	`int8_t`	`proton.byte`	`System.SByte`
`wrap_short(number)`	`int16_t`	`proton.short`	`System.Int16`
`wrap_int(number)`	`int32_t`	`proton.int32`	`System.Int32`
`wrap_long(number)`	`int64_t`	`long`	`System.Int64`
`wrap_ubyte(number)`	`uint8_t`	`proton.ubyte`	`System.Byte`
`wrap_ushort(number)`	`uint16_t`	`proton.ushort`	`System.UInt16`

AMQ JavaScript	AMQ C++	AMQ Python	AMQ .NET
`wrap_uint(number)`	`uint32_t`	`proton.uint`	`System.UInt32`
`wrap_ulong(number)`	`uint64_t`	`proton.ulong`	`System.UInt64`
`wrap_float(number)`	`float`	`proton.float32`	`System.Single`
`wrap_double(number)`	`double`	`float`	`System.Double`
`wrap_array(Array, code)`	-	`proton.Array`	-
`wrap_list(Array)`	`std::vector`	`list`	`Amqp.List`
`wrap_map(object)`	`std::map`	`dict`	`Amqp.Map`
`wrap_symbol(string)`	`proton::symbol`	`proton.symbol`	`Amqp.Symbol`
`wrap_timestamp(number)`	`proton::timestamp`	`proton.timestamp`	`System.DateTime`

6.2. INTEROPERATING WITH AMQ JMS

AMQP defines a standard mapping to the JMS messaging model. This section discusses the various aspects of that mapping. For more information, see the AMQ JMS Interoperability chapter.

JMS Message Types

AMQ JavaScript provides a single message type whose body type can vary. By contrast, the JMS API uses different message types to represent different kinds of data. The table below indicates how particular body types map to JMS message types.

For more explicit control of the resulting JMS message type, you can set the `x-opt-jms-msg-type` message annotation. See the AMQ JMS Interoperability chapter for more information.

Table 6.3. AMQ JavaScript and JMS Message Types

AMQ JavaScript Body Type	JMS Message Type
`string`	`TextMessage`
`null`	`TextMessage`
`wrap_binary(string)`	`BytesMessage`

AMQ JavaScript Body Type	JMS Message Type
Any other type	`ObjectMessage`

6.3. CONNECTING TO AMQ BROKER

AMQ Broker is designed to interoperate with AMQP 1.0 clients. Check the following to ensure the broker is configured for AMQP messaging.

- Port 5672 in the network firewall is open.
- The AMQ Broker AMQP acceptor is enabled. See Configuring Network Access.
- The necessary addresses are configured on the broker. See Addresses, Queues, and Topics.
- The broker is configured to permit access from your client, and the client is configured to send the required credentials. See Broker Security.

6.4. CONNECTING TO AMQ INTERCONNECT

AMQ Interconnect works with any AMQP 1.0 client. Check the following to ensure the components are configured correctly.

- Port 5672 in the network firewall is open.
- The router is configured to permit access from your client, and the client is configured to send the required credentials. See Interconnect Security.

APPENDIX A. USING YOUR SUBSCRIPTION

AMQ is provided through a software subscription. To manage your subscriptions, access your account at the Red Hat Customer Portal.

Accessing Your Account

1. Go to access.redhat.com.
2. If you do not already have an account, create one.
3. Log in to your account.

Activating a Subscription

1. Go to access.redhat.com.
2. Navigate to **My Subscriptions**.
3. Navigate to **Activate a subscription** and enter your 16-digit activation number.

Downloading Zip and Tar Files

To access zip or tar files, use the customer portal to find the relevant files for download. If you are using RPM packages, this step is not required.

1. Go to access.redhat.com.
2. Navigate to **DOWNLOADS**.
3. Locate the **Red Hat JBoss AMQ** entry in the **JBOSS INTEGRATION AND AUTOMATION** category.
4. Select the desired component type from the drop-down menu on the right side of the entry.
5. Select the **Download** link for your component.

Registering Your System for Packages

To install RPM packages on Red Hat Enterprise Linux, your system must be registered. If you are using zip or tar files, this step is not required.

1. Go to access.redhat.com.
2. Navigate to **Registration Assistant**.
3. Select your OS version and continue to the next page.
4. Use the listed command in your system terminal to complete the registration.

To learn more see How to Register and Subscribe a System to the Red Hat Customer Portal.

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