



Red Hat AMQ 7.3

Using the AMQ JavaScript Client

For Use with AMQ Clients 2.4

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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 library for developing messaging applications. It enables you to write JavaScript applications that send and receive AMQP messages.

AMQ JavaScript is part of AMQ Clients, a suite of messaging libraries supporting multiple languages and platforms. For an overview of the clients, see [AMQ Clients Overview](#). For information about this release, see [AMQ Clients 2.4 Release Notes](#).

AMQ JavaScript is based on the [Rhea](#) messaging library.

1.1. KEY FEATURES

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

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, 1.2, and 1.3 of the [Transport Layer Security](#) (TLS) protocol, the successor to SSL
- [Simple Authentication and Security Layer](#) (SASL) mechanisms ANONYMOUS, PLAIN, and EXTERNAL
- Modern [TCP](#) with [IPv6](#)

1.3. SUPPORTED CONFIGURATIONS

AMQ JavaScript supports the following OS and language versions:

- Red Hat Enterprise Linux 6 and 7 with Node.js 4, 6, and 8 from Software Collections
- Red Hat Enterprise Linux 8 with Node.js 10
- Microsoft Windows 10 Pro with Node.js 4, 6, and 8
- Microsoft Windows Server 2012 R2 and 2016 with Node.js 4, 6, and 8

AMQ JavaScript is supported in combination with the following AMQ components and versions:

- All versions of AMQ Broker
- All versions of AMQ Interconnect

- All versions of AMQ Online
- A-MQ 6 versions 6.2.1 and higher

For more information, see [Red Hat AMQ Supported Configurations](#) .

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. It contains sessions.
Session	A context for sending and receiving messages. It contains senders and receivers.
Sender	A channel for sending messages to a target. It has a target.
Receiver	A channel for receiving messages from a source. It has a source.
Source	A named point of origin for messages.
Target	A named destination for messages.
Message	An application-specific piece of information.
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 to install AMQ JavaScript in your environment.

2.1. PREREQUISITES

To begin installation, [use your subscription](#) to access AMQ distribution files and 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 AMQ Clients** entry in the **JBOSS INTEGRATION AND AUTOMATION** category.
3. Click **Red Hat 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 creates a new subdirectory named **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 returns 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 AMQ Clients** entry in the **JBOSS INTEGRATION AND AUTOMATION** category.
3. Click **Red Hat 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 creates a new subdirectory named **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 produces a file named **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.

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:

Procedure

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 or 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.

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 constructed.

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 programmatically.

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.

Table 6.1. AMQP types

AMQP type	Description
null	An empty value
boolean	A true or false value
char	A single Unicode character
string	A sequence of Unicode characters
binary	A sequence of bytes
byte	A signed 8-bit integer
short	A signed 16-bit integer
int	A signed 32-bit integer
long	A signed 64-bit integer
ubyte	An unsigned 8-bit integer
ushort	An unsigned 16-bit integer
uint	An unsigned 32-bit integer
ulong	An unsigned 64-bit integer
float	A 32-bit floating point number

AMQP type	Description
double	A 64-bit floating point number
array	A sequence of values of a single type
list	A sequence of values of variable type
map	A mapping from distinct keys to values
uuid	A universally unique identifier
symbol	A 7-bit ASCII string from a constrained domain
timestamp	An absolute point in time

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 6.2. AMQ JavaScript types before encoding and after decoding

AMQP type	AMQ JavaScript type before encoding	AMQ JavaScript type after decoding
null	null	null
boolean	boolean	boolean
char	wrap_char(number)	number
string	string	string
binary	wrap_binary(string)	string
byte	wrap_byte(number)	number
short	wrap_short(number)	number
int	wrap_int(number)	number
long	wrap_long(number)	number
ubyte	wrap_ubyte(number)	number
ushort	wrap_ushort(number)	number
uint	wrap_uint(number)	number

AMQP type	AMQ JavaScript type before encoding	AMQ JavaScript type after decoding
ulong	wrap_ulong(number)	number
float	wrap_float(number)	number
double	wrap_double(number)	number
array	wrap_array(Array, code)	Array
list	wrap_list(Array)	Array
map	wrap_map(object)	object
uuid	wrap_uuid(number)	number
symbol	wrap_symbol(string)	string
timestamp	wrap_timestamp(number)	number

Table 6.3. AMQ JavaScript and other AMQ client types (1 of 2)

AMQ JavaScript type before encoding	AMQ C++ type	AMQ .NET type
null	nullptr	null
boolean	bool	System.Boolean
wrap_char(number)	wchar_t	System.Char
string	std::string	System.String
wrap_binary(string)	proton::binary	System.Byte[]
wrap_byte(number)	int8_t	System.SByte
wrap_short(number)	int16_t	System.Int16
wrap_int(number)	int32_t	System.Int32
wrap_long(number)	int64_t	System.Int64
wrap_ubyte(number)	uint8_t	System.Byte
wrap_ushort(number)	uint16_t	System.UInt16

AMQ JavaScript type before encoding	AMQ C++ type	AMQ .NET type
<code>wrap_uint(number)</code>	<code>uint32_t</code>	<code>System.UInt32</code>
<code>wrap_ulong(number)</code>	<code>uint64_t</code>	<code>System.UInt64</code>
<code>wrap_float(number)</code>	<code>float</code>	<code>System.Single</code>
<code>wrap_double(number)</code>	<code>double</code>	<code>System.Double</code>
<code>wrap_array(Array, code)</code>	-	-
<code>wrap_list(Array)</code>	<code>std::vector</code>	<code>Amqp.List</code>
<code>wrap_map(object)</code>	<code>std::map</code>	<code>Amqp.Map</code>
<code>wrap_uuid(number)</code>	<code>proton::uuid</code>	<code>System.Guid</code>
<code>wrap_symbol(string)</code>	<code>proton::symbol</code>	<code>Amqp.Symbol</code>
<code>wrap_timestamp(number)</code>	<code>proton::timestamp</code>	<code>System.DateTime</code>

Table 6.4. AMQ JavaScript and other AMQ client types (2 of 2)

AMQ JavaScript type before encoding	AMQ Python type	AMQ Ruby type
<code>null</code>	<code>None</code>	<code>nil</code>
<code>boolean</code>	<code>bool</code>	<code>true, false</code>
<code>wrap_char(number)</code>	<code>unicode</code>	<code>String</code>
<code>string</code>	<code>unicode</code>	<code>String</code>
<code>wrap_binary(string)</code>	<code>bytes</code>	<code>String</code>
<code>wrap_byte(number)</code>	<code>int</code>	<code>Integer</code>
<code>wrap_short(number)</code>	<code>int</code>	<code>Integer</code>
<code>wrap_int(number)</code>	<code>long</code>	<code>Integer</code>
<code>wrap_long(number)</code>	<code>long</code>	<code>Integer</code>
<code>wrap_ubyte(number)</code>	<code>long</code>	<code>Integer</code>

AMQ JavaScript type before encoding	AMQ Python type	AMQ Ruby type
<code>wrap_ushort(number)</code>	<code>long</code>	<code>Integer</code>
<code>wrap_uint(number)</code>	<code>long</code>	<code>Integer</code>
<code>wrap_ulong(number)</code>	<code>long</code>	<code>Integer</code>
<code>wrap_float(number)</code>	<code>float</code>	<code>Float</code>
<code>wrap_double(number)</code>	<code>float</code>	<code>Float</code>
<code>wrap_array(Array, code)</code>	<code>proton.Array</code>	<code>Array</code>
<code>wrap_list(Array)</code>	<code>list</code>	<code>Array</code>
<code>wrap_map(object)</code>	<code>dict</code>	<code>Hash</code>
<code>wrap_uuid(number)</code>	-	-
<code>wrap_symbol(string)</code>	<code>str</code>	<code>Symbol</code>
<code>wrap_timestamp(number)</code>	<code>long</code>	<code>Time</code>

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 6.5. AMQ JavaScript and JMS message types

AMQ JavaScript body type	JMS message type
<code>string</code>	<code>TextMessage</code>
<code>null</code>	<code>TextMessage</code>
<code>wrap_binary(string)</code>	<code>BytesMessage</code>

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 [Default acceptor settings](#).
- 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. 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 AMQ** entries in the **JBOSS INTEGRATION AND AUTOMATION** category.
3. Select the desired AMQ product. The **Software Downloads** page opens.
4. Click 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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