Red Hat AMQ 7.6

Using AMQ Online on OpenShift

For use with AMQ Online 1.4

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Legal Notice

Abstract

This guide describes how to use AMQ Online.

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CHAPTER 1. INTRODUCTION

1.1. AMQ ONLINE OVERVIEW

Red Hat AMQ Online is an OpenShift-based mechanism for delivering messaging as a managed service. With Red Hat AMQ Online, administrators can configure a cloud-native, multi-tenant messaging service either in the cloud or on premise. Developers can provision messaging using the Red Hat AMQ Console. Multiple development teams can provision the brokers and queues from the Console, without requiring each team to install, configure, deploy, maintain, or patch any software.

AMQ Online can provision different types of messaging depending on your use case. A user can request messaging resources by creating an address space. AMQ Online currently supports two address space types, standard and brokered, each with different semantics. The following diagrams illustrate the high-level architecture of each address space type:

Figure 1.1. Standard address space

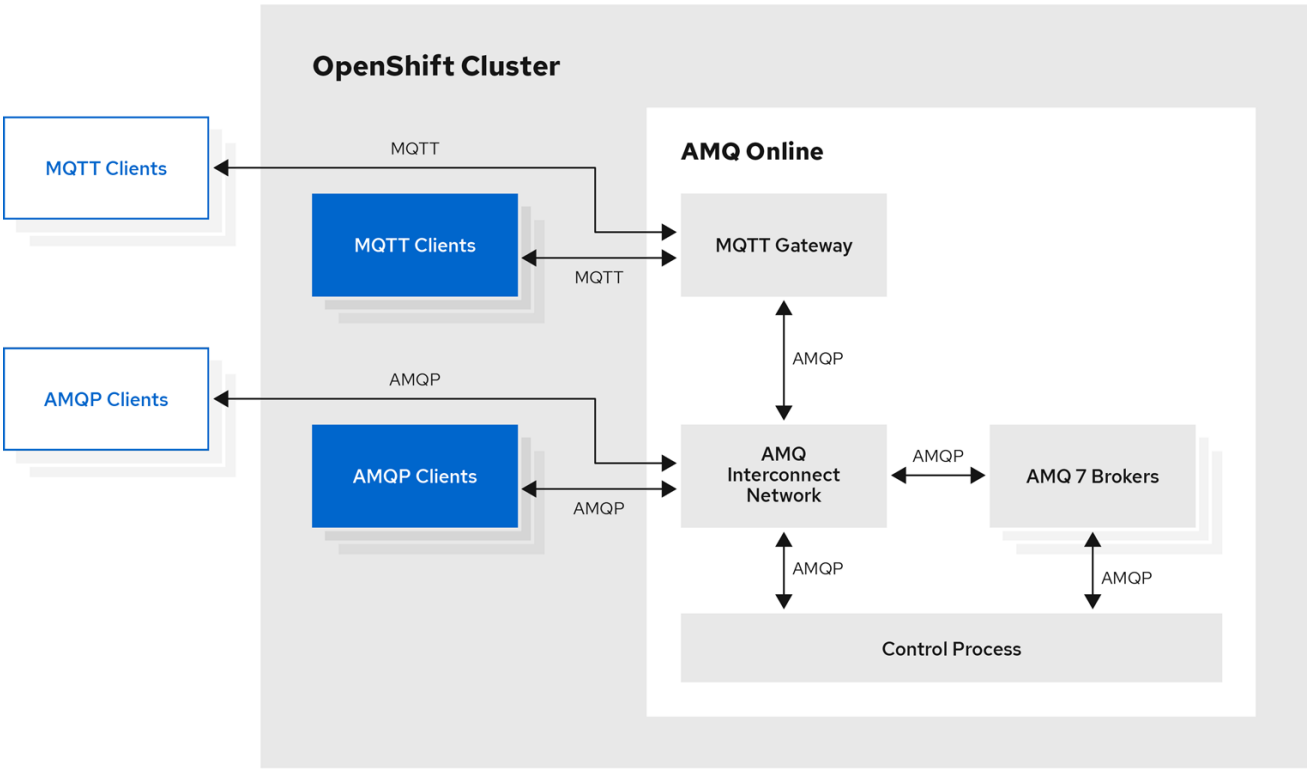
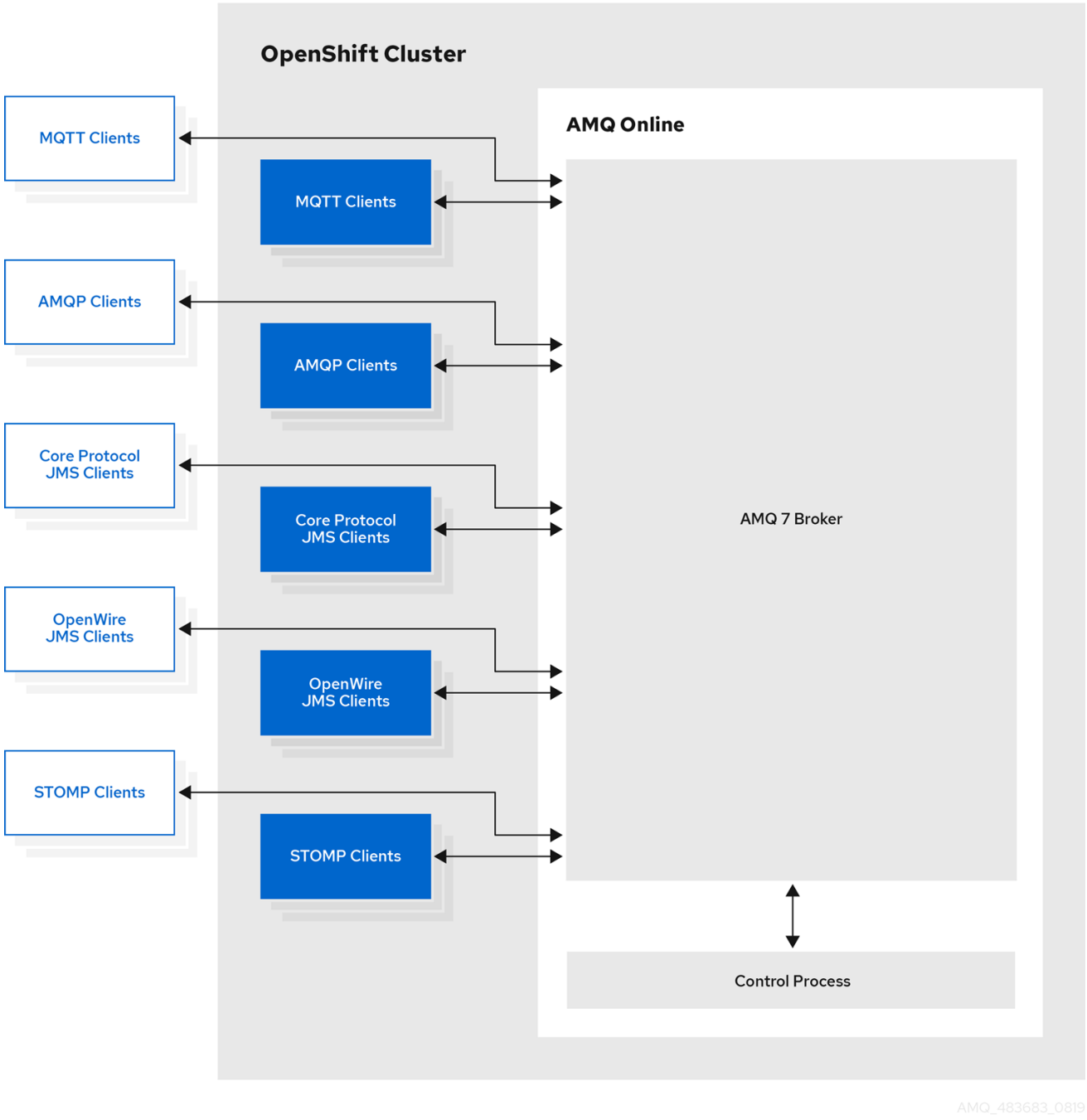


Figure 1.2. Brokered address space



1.2. SUPPORTED FEATURES

The following table shows the supported features for AMQ Online 1.4:

Table 1.1. Supported features reference table

Feature		Brokered address space	Standard address space
Address type	Queue	Yes	Yes
	Topic	Yes	Yes

Feature		Brokered address space	Standard address space
	Multicast	No	Yes
	Anycast	No	Yes
	Subscription	No	Yes
Messaging protocol	AMQP	Yes	Yes
	MQTT	Yes	Technology preview only
	CORE	Yes	No
	OpenWire	Yes	No
	STOMP	Yes	No
Transports	TCP	Yes	Yes
	WebSocket	Yes	Yes
Durable subscriptions	JMS durable subscriptions	Yes	No
	"Named" durable subscriptions	No	Yes
JMS	Transaction support	Yes	No
	Selectors on queues	Yes	No
	Message ordering guarantees (including prioritization)	Yes	No
Scalability	Scalable distributed queues and topics	No	Yes

1.3. AMQ ONLINE USER ROLES

AMQ Online users can be defined broadly in terms of two user roles: service administrator and messaging tenant. Depending on the size of your organization, these roles might be performed by the same person or different people.

The messaging tenant can request messaging resources, using both cloud-native APIs and tools. The messaging tenant can also manage the users and permissions of a particular address space within the

messaging system as well as create address spaces and addresses. *Using AMQ Online on OpenShift* provides information about how to accomplish these tasks.

The service administrator role performs the initial installation and any subsequent upgrades. The service administrator might also deploy and manage the messaging infrastructure, such as monitoring the routers, brokers, and administration components; and creating the address space plans and address plans. For more information about how to set up and manage AMQ Online as well as configure the infrastructure and plans, see *Installing and Managing AMQ Online on OpenShift* .

1.4. SUPPORTED CONFIGURATIONS

For more information about AMQ Online supported configurations see Red Hat AMQ 7 Supported Configurations.

1.5. DOCUMENT CONVENTIONS

1.5.1. Variable text

This document contains code blocks with variables that you must replace with values specific to your installation. In this document, such text is styled as italic monospace.

For example, in the following code block, replace ***my-namespace*** with the namespace used in your installation:

```
sed -i 's/amq-online-infra/my-namespace/' install/bundles/enmasse-with-standard-authservice/*.yaml
```

CHAPTER 2. MANAGING ADDRESS SPACES

AMQ Online is configured to support managing address spaces using the OpenShift command-line tools. Address spaces are managed like any other OpenShift resource using **oc**.

2.1. ADDRESS SPACE

An address space is a group of addresses that can be accessed through a single connection (per protocol). This means that clients connected to the endpoints of an address space can send messages to or receive messages from any authorized address within that address space. An address space can support multiple protocols, as defined by the address space type.

NOTE

You cannot modify endpoints for an existing address space.

AMQ Online has two types of address spaces:

- Standard
- Brokered

2.2. STANDARD ADDRESS SPACE

The standard address space is the default address space in AMQ Online. It consists of an AMQP router network in combination with attachable storage units. Clients connect to a message router, which forwards messages to or from one or more message brokers. This address space type is appropriate when you have many connections and addresses. However, the standard address space has the following limitations:

- No transaction support
- No message ordering
- No selectors on queues
- No browsing on queues
- No message groups

Clients connect and send and receive messages in this address space using the AMQP or MQTT protocols. Note that MQTT does not support qos2 or retained messages.

2.2.1. Standard address types

The standard address space supports five different address types:

- queue
- topic
- anycast
- multicast

- subscription

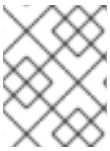
2.2.1.1. Queue

The queue address type is a store-and-forward queue. This address type is appropriate for implementing a distributed work queue, handling traffic bursts, and other use cases when you want to decouple the producer and consumer. A queue can be sharded across multiple storage units. Message ordering might be lost for queues in the standard address space.

Regarding dead-letter queues (DLQs), you can determine if any messages are stored in a DLQ by logging in to the Red Hat AMQ Console and viewing the Addresses page . To resolve this situation, you must connect to a client and consume from a DLQ address.

2.2.1.2. Topic

The topic address type supports the publish-subscribe messaging pattern where there are 1..N producers and 1..M consumers. Each message published to a topic address is forwarded to all subscribers for that address. A subscriber can also be durable, in which case messages are kept until the subscriber has acknowledged them.



NOTE

If you create a subscription on a topic, any senders to that topic must specify the **topic** capability.

2.2.1.2.1. Hierarchical topics and wildcards

A client receiving from a topic address can specify a wildcard address with the topic address as the root. The wildcard behavior follows the MQTT syntax:

- / is a separator
- **+** matches one level
- **#** matches one or more levels

So, for example:

- **a/#/b** matches **a/foo/b**, **a/bar/b**, and **a/foo/bar/b**
- **a/+/b** matches **a/foo/b** and **a/bar/b**, but would not match **a/foo/bar**

In the standard address space, the first level must always be a defined topic address; that is, **#** and **+** are not valid as the first characters of a subscribing address.

2.2.1.2.2. Known issue with creating a subscriber on a hierarchical topic

A known issue exists where creating a subscriber on a hierarchical topic in AMQ Online causes the broker to instead create it as a competing consumer (handling the address like a queue rather than a topic). For more information about the specific workaround for your client, see the applicable client example section in Connecting applications to AMQ Online .

2.2.1.3. Anycast

The anycast address type is a scalable direct address for sending messages to one consumer. Messages

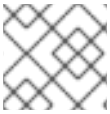
sent to an anycast address are not stored, but are instead forwarded directly to the consumer. This method makes this address type ideal for request-reply (RPC) uses or even work distribution. This is the cheapest address type as it does not require any persistence.

2.2.1.4. Multicast

The multicast address type is a scalable direct address for sending messages to multiple consumers. Messages sent to a multicast address are forwarded to all consumers receiving messages on that address. Because message acknowledgments from consumers are not propagated to producers, only pre-settled messages can be sent to multicast addresses.

2.2.1.5. Subscription

Using the subscription address type you can create a subscription for a topic that holds messages published to the topic even if the subscriber is not attached. The consumer accesses the subscription using the following address syntax: <topic-address>::<subscription-address>. For example, for a subscription **mysub** on a topic **mytopic** the consumer accesses the subscription from the address **mytopic::mysub**. The default setting permits only a single consumer per subscription. This setting can be changed by editing the **maxConsumers** field of the subscription address.



NOTE

The **maxConsumers** setting cannot be modified for existing subscriptions.

2.3. BROKERED ADDRESS SPACE

The brokered address space is designed to support broker-specific features, at the cost of limited scale in terms of the number of connections and addresses. This address space supports JMS transactions, message groups, and selectors on queues and topics.

Clients can connect as well as send and receive messages in this address space using the following protocols:

- AMQP
- CORE
- OpenWire
- MQTT
- STOMP

2.3.1. Brokered address types

The brokered address space supports two address types:

- queue
- topic

2.3.1.1. Queue

The queue address type is a store-and-forward queue. This address type is appropriate for implementing a distributed work queue, handling traffic bursts, and other use cases where you want to

decouple the producer and consumer. A queue in the brokered address space supports selectors, message groups, transactions, and other JMS features. Message order can be lost with released messages.

2.3.1.2. Topic

The topic address type supports the publish-subscribe messaging pattern in which there are 1..N producers and 1..M consumers. Each message published to a topic address is forwarded to all subscribers for that address. A subscriber can also be durable, in which case messages are kept until the subscriber has acknowledged them.

2.3.1.2.1. Hierarchical topics and wildcards

A client receiving from a topic address can specify a wildcard address with the topic address as the root. The wildcard behavior follows the MQTT syntax:

- / is a separator
- **+** matches one level
- **#** matches one or more levels

So, for example:

- **a**/**#**/**b** matches **a**/**foo**/**b**, **a**/**bar**/**b**, **a**/**foo**/**bar**/**b**
- **a**/**+**/**b** matches **a**/**foo**/**b** and **a**/**bar**/**b**, but would not match **a**/**foo**/**bar**

2.3.1.2.2. Known issue with creating a subscriber on a hierarchical topic

A known issue exists where creating a subscriber on a hierarchical topic in AMQ Online causes the broker to instead create it as a competing consumer (handling the address like a queue rather than a topic). For more information about the specific workaround for your client, see the applicable client example section in Connecting applications to AMQ Online .

2.4. ADDRESS SPACE PLANS

An address space is configured with an address space plan, which describes the allowed resource usage of that address space. The address space plans are configured by the service administrator and can vary between AMQ Online installations.

The address space plan can be changed if the address space requires more, or less, resources.

2.5. LISTING AVAILABLE ADDRESS SPACE PLANS USING THE COMMAND LINE

You can list the address space plans available for your address space type.

Procedure

1. Log in as a messaging tenant:

```
oc login -u developer
```

2. Retrieve the schema showing available address space plans (replace **standard** with **brokered** for the brokered address space type):

```
oc get addressspaceschema standard -o jsonpath='{.spec.plans[*].name}'
```

2.6. LISTING AVAILABLE AUTHENTICATION SERVICES USING THE COMMAND LINE

You can list the authentication services available for your address space type.

Procedure

1. Log in as a messaging tenant:

```
oc login -u developer
```

2. Retrieve the schema with the authentication services listed (replace **standard** with **brokered** for the brokered address space type):

```
oc get addressspaceschema standard -o jsonpath='{.spec.authenticationServices}'
```

2.7. ADDRESS SPACE EXAMPLES

2.7.1. Address space example

This address space example shows only the required options to create an **AddressSpace**.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard (1)
  plan: standard-unlimited (2)
```

(1) The address space type can be either **brokered** or **standard**.

(2) The address space plan depends on the address space type and what has been configured by the AMQ Online administrator. To view your available address space plans, see Listing available address space plans.

2.7.2. Address space example using an authentication service

This address space example shows how you can configure the authentication service of an **AddressSpace**.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
```

```
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: standard-authservice 1
```

1 The authentication service name depends on the available authentication services configured by the AMQ Online administrator. To view the available authentication services for your address space type, see Listing available authentication services.

2.7.3. Address space example using an external authentication service allowing overrides

This address space example shows how you can override the host name, port number, and realm for an external authentication service. Note that the ability to specify overrides depends on how the external authentication service is configured by the AMQ Online administrator.

For more information about how to configure an external authentication service to allow a messaging tenant to override host name, port number, and realm, see External authentication service example allowing overrides.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: external-authservice 1
    type: external
    overrides: 2
      realm: amq-online-infra-space-standard-auth
      host: standard-authservice-amq-online-infra.apps.wfd-28d9.openshiftworkshop.com
      port: 5671
      caCertSecret:
        name: my-ca-cert
```

1 The authentication service name depends on the available authentication services configured by the AMQ Online administrator. To view the available authentication services for your address space type, see Listing available authentication services.

2 Specifies the override values.

2.7.4. Address space examples exposing endpoints externally

These address space examples show how you can configure the external endpoints of an **AddressSpace** to access messaging endpoints outside the OpenShift cluster.

2.7.4.1. OpenShift LoadBalancer service example

To expose **AddressSpace** endpoints through OpenShift **LoadBalancer** services, the **loadbalancer** type is used:

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: standard-authservice
  endpoints:
  - name: messaging (1)
    service: messaging (2)
    expose:
      type: loadbalancer (3)
      loadBalancerPorts: (4)
      - amqp
      - amqps
    annotations: (5)
      mykey: myvalue
    loadBalancerSourceRanges: (6)
    - 10.0.0.0/8
```

(1) (Required) The name of the endpoint. The name specified affects the name of the OpenShift service to be created as well as the name of the endpoint in the status section of the **AddressSpace**.

(2) (Required) The service configured for the endpoint. Valid values for **service** are **messaging** and **mqtt**. However, the **mqtt** service is supported for the **standard** address space type only.

(3) (Required) The type of endpoint being exposed. The **loadbalancer** type creates an OpenShift **LoadBalancer** service. Valid values are **route** and **loadbalancer**.

(4) (Required) A list of the ports to be exposed on the **LoadBalancer** service. For the **messaging** service, the valid values are **amqp** and **amqps**.

(5) (Optional) A set of key-value annotation pairs that are added to the **LoadBalancer Service** object.

(6) (Optional) The allowed source ranges that are accepted by the load balancer.

2.7.4.2. OpenShift route example

To expose **AddressSpace** endpoints as OpenShift routes, the **route** type is used:

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
```

```
authenticationService:
  name: standard-authservice
endpoints:
- name: messaging (1)
  service: messaging (2)
  expose:
   type: route
   routeServicePort: amqps (3)
   routeTlsTermination: passthrough (4)
   routeHost: messaging.example.com (5)
```

1. (Required) The name of the endpoint. The name specified affects the name of the OpenShift service to be created as well as the name of the endpoint in the status section of the **AddressSpace**.
2. (Required) The service configured for the endpoint. Valid values for **service** are **messaging**, or **mqtt**. However, the **mqtt** service is supported for the **standard** address space type only.
3. (Required) The name of the port to be exposed. With the **route** type, only a single TLS-enabled port can be specified. For the **messaging** service, the valid values are **amqps** or **https**.
4. (Required) The TLS termination policy to be used for the OpenShift route. For the **messaging** service, the **amqps** port requires **passthrough** to be specified, whereas **https** (websockets) also allows **reencrypt**.
5. (Optional) The host name to use for the created route.

2.7.5. Address space certificate provider configuration examples

The following address space examples show how you can configure the endpoints of an **AddressSpace** using different certificate providers. The certificate provider determines how certificates are issued for the endpoints of an **AddressSpace**.

2.7.5.1. openshift provider

The **openshift** certificate provider can be used to configure endpoints with certificates signed by the OpenShift cluster certificate authority (CA).

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: standard-authservice
  endpoints:
  - name: messaging
    service: messaging
    cert:
     provider: openshift (1)
```

1 (Required) The certificate provider type. Valid values are **openshift** (on OpenShift only), **certBundle**, and **selfsigned** (default value).

2.7.5.2. selfsigned provider

The **selfsigned** certificate provider can be used to configure endpoints with self-signed certificates. The CA for these certificates can be found in the **status.caCert** field of the **AddressSpace** resource.

NOTE

Using a self-signed certificate in production environments is not recommended.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: standard-authservice
  endpoints:
  - name: messaging
    service: messaging
    cert:
     provider: selfsigned 1
```

1 (Required) The certificate provider type. Valid values are **openshift** (on OpenShift only), **certBundle**, and **selfsigned** (default value).

2.7.5.3. certBundle provider

The **certBundle** certificate provider can be used to configure endpoints with user-supplied certificates signed by your own CA. Certificate rotation can be performed by updating the **tlsKey** and **tlsCert** fields with updated certificates, and then updating the **AddressSpace** resource.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: standard-authservice
  endpoints:
  - name: messaging
    service: messaging
    cert:
```

```
    provider: certBundle (1)
    tlsKey: Y2VydGJ1bmRsZXByb3ZpZGVyY2VydA== (2)
    tlsCert: Y2VydGJ1bmRsZXByb3ZpZGVyY2VydA== (3)
```

(1) (Required) The certificate provider type. Valid values are **openshift** (on OpenShift only), **certBundle**, and **selfsigned** (default value).

(2) (Required) The base64-encoded value of the PEM private key (including the preamble).

(3) (Required) The base64-encoded value of the PEM certificate (including the preamble).

2.7.6. Address space example exports

You can export your address space information using the following three export types:

- **ConfigMap**
- **Secret**
- **Service**

2.7.6.1. ConfigMap and Secret type export examples

This example shows the format used by the **ConfigMap** export type. The format of the **Secret** export type uses the same keys as the **ConfigMap** export type, but the values are Base64-encoded.

```
service.host: messaging.svc
service.port.amqp: 5672
external.host: external.example.com
external.port: 5671
ca.crt: // PEM formatted CA
```

2.7.6.2. Service type export example

This example shows the format used by the **Service** export type.

```
  externalName:  messaging.svc
    ports:
    - name: amqp
      port: 5672
      protocol: TCP
      targetPort: 5672
```

2.8. EXAMPLE ADDRESS SPACE STATUS OUTPUT

The **AddressSpace** resource contains a **status** field that can be used to retrieve information about its state and endpoints. The following output is an example of the output you can get from running **oc get addressspace myspace -o yaml**:

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
```

```
  name: myspace
spec:
  ...
status:
  isReady: false (1)
  messages:
    - "One or more deployments are not ready: "
  endpointStatuses: (2)
    - name: messaging
      cert: aGVsbG8= (3)
      serviceHost: messaging-123.enmasse-infra.svc (4)
      servicePorts: (5)
        - name: amqp
          port: 5672
        - name: amqps
          port: 5671
      externalHost: messaging.example.com (6)
      externalPorts: (7)
        - name: amqps
          port: 443
```

1. The **status.isReady** field can be either **true** or **false**.
2. The **status.endpointStatuses** field provides information about available endpoints for this address space.
3. The **cert** field contains the base64-encoded certificate for a given endpoint.
4. The **serviceHost** field contains the cluster-internal host name for a given endpoint.
5. The **servicePorts** field contains the available ports for the cluster-internal host.
6. The **externalHost** field contains the external host name for a given endpoint.
7. The **externalPorts** field contains the available ports for the external host.

2.9. EXAMPLE OF EXPORTING ADDRESS SPACE INFORMATION INTO THE APPLICATION NAMESPACE

This address space example shows how you can export the endpoint information of an **AddressSpace** resource to a **ConfigMap**, **Secret**, or **Service** in the same namespace as the messaging application.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  authenticationService:
    name: standard-authservice
  endpoints:
  - name: messaging
```

```
service: messaging
exports:
- kind: ConfigMap (1)
  name: my-config (2)
```

(1) (Required) The type of export: **ConfigMap**, **Secret**, or **Service**. The resulting **ConfigMap** contains the values in the format shown in example exports format. For **Secret**, the same keys are used, but the values are base64-encoded. For **Service**, a OpenShift service of the type **ExternalName** is created. This provides applications running on OpenShift with a way to inject endpoint information or provide a proxy service in the same namespace as the application. For more information see example exports format.

(2) (Required) The name of the resource to create and update.

When exporting endpoint information, the **system:serviceaccounts:_amq-online-infra_** group must be granted privileges to create, update, and delete the configmap specified in the exports list. You can do this by creating an RBAC role and role-binding such as this one:

```
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: rbac
rules:
  - apiGroups: [ "" ]
    resources: [ "configmaps" ]
    verbs: [ "create" ]
  - apiGroups: [ "" ]
    resources: [ "configmaps" ]
    resourceNames: [ "my-config" ]
    verbs: [ "get", "update", "patch" ]
---
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: rbac-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: rbac
subjects:
- kind: Group
  name: system:serviceaccounts:_amq-online-infra_
```

2.10. ADDRESS SPACE CONNECTOR EXAMPLES

You can federate a **standard** address space type with another AMQP server. Two methods of operation are supported: *remote address connection* and *message store-and-forward*.

Remote address connection involves mapping addresses on a remote AMQP endpoint into an address space. For example, suppose an AMQP server is running on the host **messaging.example.com** that you want to access by connecting using the AMQ Online endpoints. To enable remote address connection, you need to create an address space connector.

Message store-and-forward involves enabling address forwarding. First you need to create an address space connector. Then, you need to create an address forwarder for each address. For more information about address forwarding, see Address forwarding examples.

The following examples show how you can configure an address space connector.

2.10.1. Address space connector using SASL PLAIN

You can use SASL PLAIN when you do not want to use mutual TLS for authentication. Not enabling TLS is not recommended, since any user names and passwords are then sent as plain text.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  connectors:
  - name: remote1 (1)
    endpointHosts: (2)
    - host: messaging.example.com
      port: 5672
    - host: messaging2.example.com
    idleTimeout: (3)
    maxFrameSize: (4)
    tls: {} (5)
    credentials: (6)
      username:
        value: test
      password:
        valueFromSecret:
          name: password-secret
          key: password.txt
    role: (7)
    addresses: (8)
    - name: p1
      pattern: "prices/*"
    - name: p2
      pattern: "clients/*/1"
```

(1) (Required) Specifies the name of the connector. All remote addresses are prefixed with the connector name and a forward slash, /.

(2) (Required) Specifies a list of endpoints for this connector. This list must contain at least one entry, and any additional entries are used for failover. If not otherwise specified, the **port** field value is set to the registered IANA port for AMQP (or AMQPS if TLS is enabled).

(3) (Optional) Idle timeout of the AMQP connection (seconds). 0 disables the idle timeout.

(4) (Optional) Max frame size of the AMQP connection.

(5) (Optional) Enable TLS. The connector trusts global root CAs by default. To use a custom CA, specify a value for the **caCert** field.

6 (Optional) Specifies the username and password credentials to use for this connector. The values can be specified inline or by referencing a secret along with an optional key specifying the location

7 (Optional) Role of the connector. Valid values are "normal", "edge", and "route-container" (default value).

8 (Required) Specifies a list of patterns matching addresses to be exposed on the remote endpoint. The pattern consists of one or more tokens separated by a forward slash, /. A token can be one of the following: a * character, a # character, or a sequence of characters that do not include /, *, or #. The * token matches any single token. The # token matches zero or more tokens. * has higher precedence than #, and exact match has the highest precedence.

2.10.2. Address space connector using mutual TLS

Configuring a client TLS certificate enables SASL EXTERNAL to be used for authentication. The certificates can be specified inline or using a secret reference.

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
  connectors:
  - name: remote1 1
    endpointHosts: 2
    - host: messaging.example.com
      port: 5671
    tls:
      caCert: 3
        valueFromSecret:
          name: remote-certs
          key: ca.crt
      clientCert: 4
        valueFromSecret:
          name: remote-certs
          key: tls.crt
      clientKey: 5
        valueFromSecret:
          name: remote-certs
          key: tls.key
    addresses:
    - name: p1
      pattern: "*"
```

1 (Required) Specifies the name of the connector. All remote addresses are prefixed with the connector name and a forward slash, /.

2 (Required) Specifies a list of endpoints for this connector. This list must contain at least one entry, and any additional entries are used for failover. If not otherwise specified, the **port** field value is set to the registered IANA port for AMQP (or AMQPS if TLS is enabled).

3 (Optional) Specifies the CA certificate to trust for the remote connection. The referenced secret must be readable by the **system:serviceaccounts:_amq-online-infra_** group

must be readable by the **system:serviceaccounts:_amq-online-infra_** group.

4. (Optional) Specifies the client certificate to use for mutual TLS authentication. The referenced secret must be readable by the **system:serviceaccounts:_amq-online-infra_** group.

5. (Optional) Specifies the client private key to use for mutual TLS authentication. The referenced secret must be readable by the **system:serviceaccounts:_amq-online-infra_** group.

2.11. CREATING ADDRESS SPACES USING THE COMMAND LINE

In AMQ Online, you create address spaces using standard command-line tools.

Procedure

1. Log in as a messaging tenant:

```
oc login -u developer
```

2. Create the project for the messaging application:

```
oc new-project myapp
```

3. Create an address space definition:

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-unlimited
```

4. Create the address space:

```
oc create -f standard-address-space.yaml
```

5. Check the status of the address space:

```
oc get addressspace myspace -o jsonpath={.status.isReady}
```

The address space is ready for use when the previous command outputs **true**.

2.12. CREATING AN ADDRESS SPACE USING THE RED HAT AMQ CONSOLE

You can create a new address space using the Red Hat AMQ Console.

Procedure

1. Log in to the Red Hat AMQ Console.
For more information about how to access the Red Hat AMQ Console, see Accessing the Red Hat AMQ Console.

2. Click **Create Address Space**. The Create an instance wizard opens.
3. Complete the required fields and when you are finished, click **Finish** to create the new address space.

When the address space has been successfully created, you can click the address space name to view information about the newly created address space.

2.13. CHANGING THE ADDRESS SPACE PLAN ASSOCIATED WITH AN ADDRESS SPACE USING THE RED HAT AMQ CONSOLE

You can change the address space plan that is associated with an address space using the Red Hat AMQ Console.

Prerequisites

- You must have already created an address space. For more information see Creating an address space using the Red Hat AMQ Console.

Procedure

1. Log in to the Red Hat AMQ Console. For more information, see Accessing the Red Hat AMQ Console.
2. Locate the address space for which you want to change the address space plan.
3. In the far right column, click the vertical ellipsis icon and select **Edit**. The Edit window opens.
4. In the **Address space plan** field, select a different plan from the list and click **Confirm**. The address space plan is changed for that address space.

2.14. CHANGING THE AUTHENTICATION SERVICE ASSOCIATED WITH AN ADDRESS SPACE USING THE RED HAT AMQ CONSOLE

You can change the authentication service that is associated with an address space using the Red Hat AMQ Console.

Prerequisites

- You must have already created an address space. For more information see Creating an address space using the Red Hat AMQ Console.

Procedure

1. Log in to the Red Hat AMQ Console. For more information, see Accessing the Red Hat AMQ Console.
2. Locate the address space for which you want to change the authentication service.
3. In the far right column, click the vertical ellipsis icon and select **Edit**. The Edit window opens.
4. In the **Authentication Service** field, select a different authentication service from the list and click **Confirm**. The authentication service is changed for that address space.

2.15. DELETING AN ADDRESS SPACE USING THE RED HAT AMQ CONSOLE

You can delete an existing address space using the Red Hat AMQ Console.

Procedure

1. Log in to the Red Hat AMQ Console.
   For more information about how to access the Red Hat AMQ Console, see Accessing the Red Hat AMQ Console.
2. Locate the address space that you want to delete.
3. In the far right column, click the vertical ellipsis icon and select **Delete**. The delete confirmation window opens.
4. Confirm your selection by clicking **Delete**. The address space is deleted.

2.16. EXAMPLE COMMANDS FOR RETRIEVING ADDRESS SPACE INFORMATION

The following table shows the commands for retrieving address space information.

Table 2.1. Retrieving address space information commands table

To retrieve the...	Run this command:
status of an address space	**oc get addressspace myspace -o jsonpath={.status.isReady}**
base64-encoded PEM certificate for the messaging endpoint	**oc get addressspace myspace -o 'jsonpath={.status.caCert}'**
host name for the messaging endpoint	**oc get addressspace myspace -o 'jsonpath={.status.endpointStatuses[?(@.name=="messaging")].externalHost}'**

2.17. REPLACING ADDRESS SPACES USING THE COMMAND LINE

Address spaces can be replaced in order to change the plan, endpoints, or network policies, or to replace certificates if using the **certBundle** certificate provider. When changing the plan, AMQ Online will attempt to apply the new plan if the current set of addresses fits within the new quota. If it does not, an error is provided on the **AddressSpace** resource.

Procedure

1. Log in as a messaging tenant:

   ```
   oc login -u developer
   ```

2. Select the project for the messaging application:

```
oc project myapp
```

3. Update address space definition:

```
apiVersion: enmasse.io/v1beta1
kind: AddressSpace
metadata:
  name: myspace
spec:
  type: standard
  plan: standard-small
```

4. Replace the address space:

```
oc replace -f standard-address-space-replace.yaml
```

5. Check the status of the address space:

```
oc get addressspace myspace -o jsonpath={.status.isReady}
```

The address space is ready for use when the above command outputs **true**.

CHAPTER 3. MANAGING ADDRESSES

AMQ Online is configured to support managing addresses using the OpenShift command-line tools and the Red Hat AMQ Console. **Address** resources can be managed like any other OpenShift API resource using **oc**.

3.1. ADDRESS

An address is part of an address space and represents a destination for sending and receiving messages. An address has a type, which defines the semantics of sending messages to and receiving messages from that address.

The types of addresses available in AMQ Online depend on the address space type.

3.2. ADDRESS PLANS

An address is configured with an address plan, which describes the resource usage of that address. The address plans are configured by the service administrator and can vary between AMQ Online installations. The number of addresses that can be created, and what plans are available, depends on quota enforced by the address space plan.

Some address types also support changing the **plan** field: **queue**, **anycast**, and **multicast** address types in the **standard** address space support changing the plan as long as the new plan does not exceed the allowed quota. For queues, addresses are dynamically migrated across brokers, which might cause reordering of messages.

3.2.1. Address example

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.myqueue (1)
spec:
  address: myqueue (2)
  type: queue (3)
  plan: standard-small-queue (4)
```

1. The address name must be prefixed with the address space name and a dot. Address names can only include alphanumeric characters.
2. The address is the messaging address this address resource represents.
3. The address type dictates the semantics of this address.
4. The address plan describes the resource usage for the address. For more information about how to view the available plans see Listing available address plans.

3.2.2. Topic and subscription address example

When using topics and subscriptions, the subscription references the topic to which it belongs using the **topic:** field, as shown in the following example.

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.mytopic
spec:
  address: mytopic
  type: topic
  plan: standard-small-topic
```

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.mysub
spec:
  address: mysub
  type: subscription
  plan: standard-small-subscription
  topic: mytopic (1)
```

(1) The address of topic that this subscription refers to.

3.2.3. Address forwarding examples

You can use forwarders to:

- automatically forward messages from a local address to a remote AMQP server outside of AMQ Online, or
- forward messages from a remote AMQP server to a local address.

To use an address forwarder, you must first configure a connector to the remote AMQP server for the address space. For more information about address space connectors, see Address space connector examples.

Address forwarding is supported only in the **standard** address space type, and only for the **queue** and **subscription** address types. With the **queue** address type, you can forward messages to a remote AMQP server or from a remote AMQP server to a local queue. With the **subscription** address type, you can create a forwarder to a remote AMQP address, but you cannot create a forwarder that copies messages to the subscription. That is, the **subscription** address type supports forwarding in the **out** direction only, as shown in the example.

In the following examples, it is assumed that a connector, **remote1**, has been configured for the address space.

3.2.3.1. Forwarding messages from a local queue to a remote AMQP server

In this example, messages in **myqueue** are forwarded to the remote AMQP server with an address of **clients/me/1**.

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.myqueue
spec:
```

```
address: myqueue
type: queue
plan: standard-small-queue
forwarders:
- name: f1 (1)
  remoteAddress: remote1/clients/me/1 (2)
  direction: out (3)
```

(1) (Required) Specifies the name of the forwarder, which is used to ensure a unique identity.

(2) (Required) Specifies the remote address to forward messages to. The address must be prefixed with the connector name and must be identical to the address matching patterns defined on the connector.

(3) (Required) Specifies the direction of message flow, which is either **out** or **in**. A value of **out** forwards messages to the remote endpoint. A value of **in** forwards messages from the remote endpoint.

3.2.3.2. Forwarding messages from a remote AMQP server to a local queue

In this example, you receive messages from an an address **prices/milk** on a remote AMQP server. The messages are then moved to a local queue, **myqueue**.

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.myqueue
spec:
  address: myqueue
  type: queue
  plan: standard-small-queue
  forwarders:
  - name: f1 (1)
    remoteAddress: remote1/prices/milk (2)
    direction: in (3)
```

(1) (Required) Specifies the name of the forwarder, which is used to ensure a unique identity.

(2) (Required) Specifies the remote address to forward messages to. The address must be prefixed with the connector name and must be identical to the address matching patterns defined on the connector.

(3) (Required) Specifies the direction of message flow, which is either **out** or **in**. A value of **out** forwards messages to the remote endpoint. A value of **in** forwards messages from the remote endpoint.

3.3. LISTING AVAILABLE ADDRESS PLANS USING THE COMMAND LINE

You can list the address plans available for an address type, such as **queue**.

Procedure

1. Log in as a messaging tenant:

```
oc login -u developer
```

2. Retrieve the schema with the address plans listed (replace **standard** with **brokered** for the brokered address space type):

```
oc get addressspaceschema standard -o 'jsonpath={.spec.addressTypes[?(@.name=="queue")].plans[*].name}'
```

3.4. CREATING ADDRESSES USING THE COMMAND LINE

You can create addresses using the command line.

Procedure

1. Create an address definition:

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.myqueue
spec:
  address: myqueue
  type: queue
  plan: standard-small-queue
```

NOTE

Prefixing the name with the address space name is required to ensure addresses from different address spaces do not collide.

2. Create the address:

```
oc create -f standard-small-queue.yaml
```

3. List the addresses:

```
oc get addresses -o yaml
```

3.5. CREATING ADDRESSES USING THE RED HAT AMQ CONSOLE

You can create new addresses using the Red Hat AMQ Console. The type of addresses that you can create are determined by the type of address space.

Prerequisites

- You must have created an address space. For more information see Creating an address space.

Procedure

1. Log in to the Red Hat AMQ Console. For more information, see Accessing the Red Hat AMQ Console.
2. Click the address space link for the address space where you want to create a new address.
3. Click **Create**. The Create new address window opens.
4. Type a name and select the address type. If selecting **subscription**, from the **Topic** list select the topic name to which you want to create a subscription.
5. Click **Next**.
6. Select a plan and click **Next**.
7. Click **Create**. Your address is displayed in the Red Hat AMQ Console.

3.6. REPLACING ADDRESSES USING THE COMMAND LINE

Procedure

1. Update an address definition:

```
apiVersion: enmasse.io/v1beta1
kind: Address
metadata:
  name: myspace.myqueue
spec:
  address: myqueue
  type: queue
  plan: standard-xlarge-queue
```

2. Replace the address:

```
oc replace -f standard-xlarge-queue.yaml
```

3. List the addresses:

```
oc get addresses -o yaml
```

CHAPTER 4. USING THE RED HAT AMQ CONSOLE

You can use the Red Hat AMQ Console to perform tasks such as creating and deleting an address space, creating an address, and viewing message and connection statistics .

4.1. RED HAT AMQ CONSOLE USER PERMISSIONS

Red Hat AMQ Console uses the OpenShift RBAC permissions model. For more information about the OpenShift RBAC permissions model, see the OpenShift 3.11 documentation.

To use Red Hat AMQ Console, the OpenShift user requires a role that grants access to **addressspace** and **address** resources. For example, for edit access, **create**, **update** and **delete** permissions need be to given to the associated role object, and for view-only access, **list** permissions need to be granted.

For more information about the AMQ Online example roles, see AMQ Online example roles .

4.2. ACCESSING THE RED HAT AMQ CONSOLE

Prerequisites

- On OpenShift Container Platform 3.x, obtain the host name for the Red Hat AMQ Console by running the following command:

```
oc get routes console -o jsonpath={.spec.host}
```

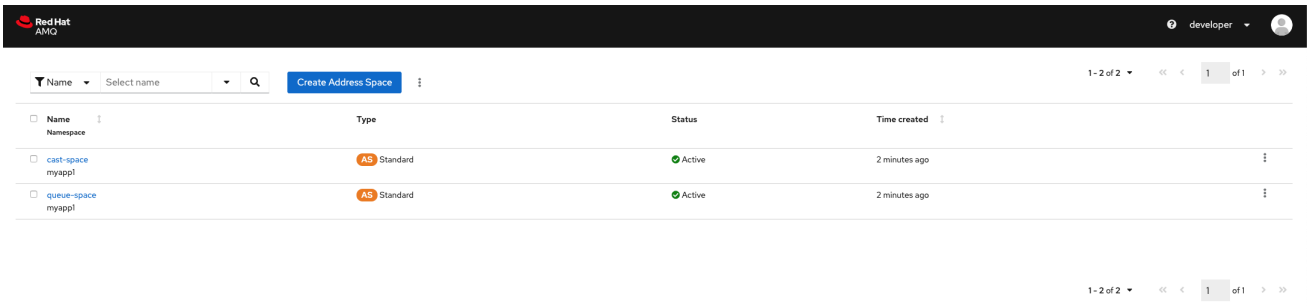
- On OpenShift Container Platform 4.x, obtain the host name for the Red Hat AMQ Console by running the following command:

```
oc get consolelink -l app=enmasse -o jsonpath={.spec.href}
```

Procedure

1. In a web browser, navigate to **https://*console-host-name*** where ***console-host-name*** is the Red Hat AMQ Console host name.

2. Log in with your OpenShift user credentials. The Red Hat AMQ Console opens.



4.3. VIEWING MESSAGE AND APPLICATION CONNECTION STATISTICS USING THE RED HAT AMQ CONSOLE

Prerequisites

- You must be logged into the Red Hat AMQ Console.

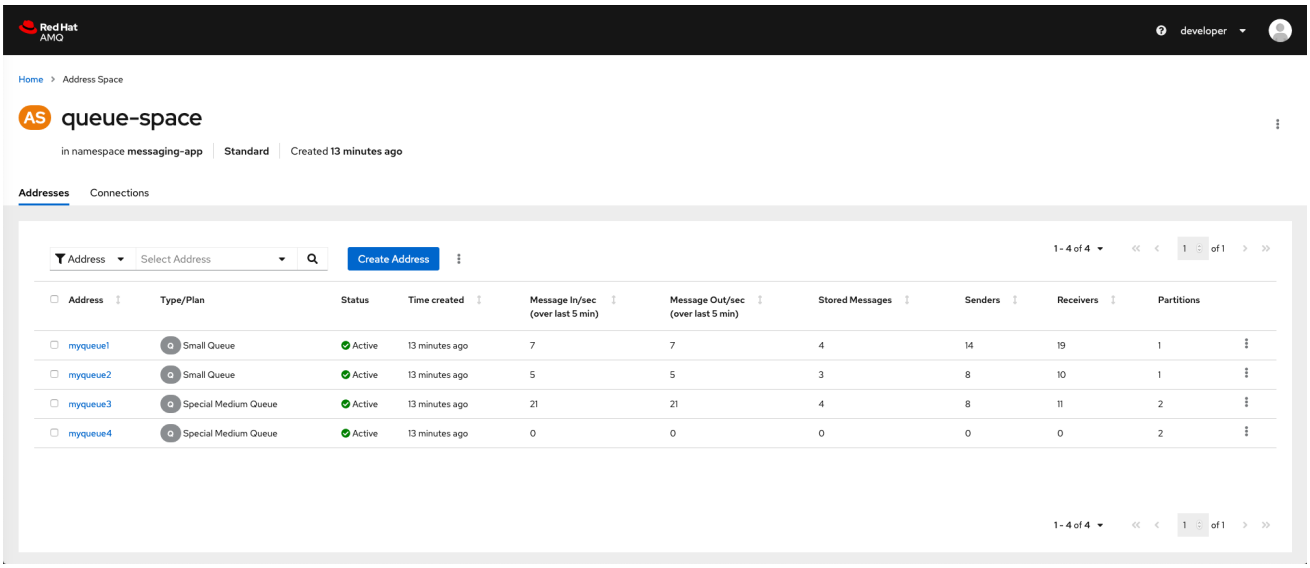
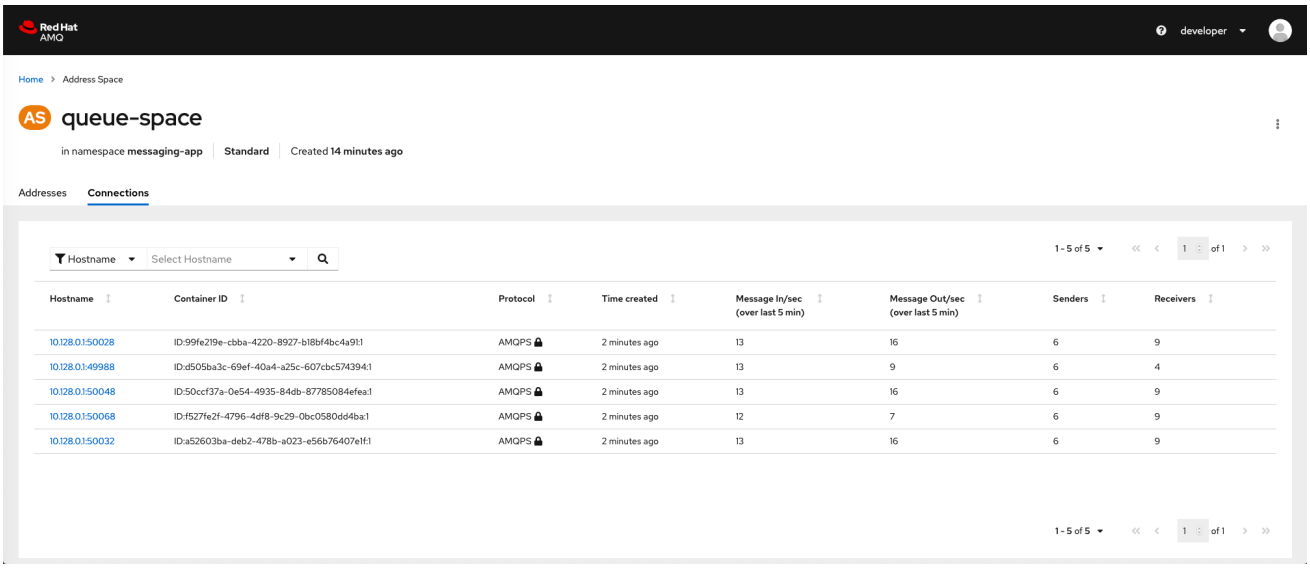


Table 4.1. Message statistics reference table

To view...	On the Addresses page...
Address type	See the first icon in the second column, **Type/plan**
Address plan	See the string that follows the icon in the second column, **Type/plan**
Address status	See the third column, **Status**
Messages received per second (computed over the last 5 minutes)	See **Messages In/sec**
Messages sent per second (computed over the last 5 minutes)	See **Messages Out/sec**
Queue and topic address types only: Number of stored messages on the broker or brokers	**Stored Messages**
Number of senders attached	See **Senders**
Number of receivers attached	See **Receivers**
Standard address space only: Message deliveries per second	Click the desired address, which then shows the links page for that address; see the **Delivery Rate** column.

Figure 4.1. Application connection statistics reference table



To view...	On the Connections page...
Messages received per second (computed over the last 5 minutes)	See **Messages In/sec**
Standard address space only: Messages sent per second (computed over the last 5 minutes)	See **Messages Out/sec**
Total number of messages delivered	Click the desired host name to show the list of senders and receivers; see the **Deliveries** column.

NOTE

For the brokered address space only, on the Connections page, the number of senders is either **0** or **1**. As soon as one or more senders exist, **1** is displayed rather than reflecting the actual number of senders.

4.4. PURGING QUEUES AND SUBSCRIPTIONS

You can purge—that is, clear all messages from—a **queue** or **subscription** address type of its stored messages by using the Red Hat AMQ Console.

Prerequisites

- You must have a queue or subscription that contains stored messages.

Procedure

1. Log in to the Red Hat AMQ Console. For more information, see Accessing the Red Hat AMQ Console.
2. Navigate to the **Addresses** page.
3. Select the check box next to the queue or subscription that you want to purge.

4. At the top of the page, right-click the vertical ellipsis icon and select **Purge**. The queue or subscription is purged, and the **Stored** message count drops to zero for the selected queue or subscription.

CHAPTER 5. USER MODEL

A messaging client connects using a MessagingUser. A MessagingUser specifies an authorization policy that controls which addresses may be used and the operations that may be performed on those addresses.

Users are configured as **MessagingUser** resources. Users can be created, deleted, read, updated, and listed.

The following example shows the **user-example1.yaml** file:

```
apiVersion: user.enmasse.io/v1beta1
kind: MessagingUser
metadata:
  name: myspace.user1
spec:
  username: user1
  authentication:
    type: password
    password: cGFzc3dvcmQ= # Base64 encoded
  authorization:
    - addresses: ["myqueue", "queue1", "queue2", "topic*"]
      operations: ["send", "recv"]
    - addresses: ["anycast1"]
      operations: ["send"]
```

The following fields are required:

- **metadata.name**
- **metadata.namespace**
- **spec.authentication**
- **spec.authorization**

The **spec.authentication** object defines how the user is authenticated, whereas **spec.authorization** defines the authorization policies for that user.

5.1. AUTHENTICATION

The supported values for the authentication type are **password** and **serviceaccount**. When using the **password** authentication type, you specify the username and password to be used by your messaging client when connecting. With the **serviceaccount** authentication type, you use the special string **@@serviceaccount@@** as the username, and a OpenShift service account token as the password.

5.1.1. Password authentication type

For the **password** type, an additional field **password** must be set to a base64-encoded value of the password for that user. The password will not be printed out when reading the resource.

A password can be base64-encoded on the command line. To encode **my-password**, for example:

```
$ echo -n my-password | base64
bXktcGFzc3dvcmQ=
```

5.1.2. Serviceaccount authentication type

For the **serviceaccount** type, the **username** field must contain the OpenShift serviceaccount name that will be used to authenticate. When connecting with the messaging client, use the string **@@serviceaccount@@** as the username, and the service account token as the password. The AMQP client used by the application must be configured to use the SASL mechanism type **PLAIN**.

5.2. AUTHORIZATION

In addition, authorization policies can be defined using operations and addresses. Valid operations are **send**, **recv**, **view**, and **manage**.

The **manage** and **view** operations apply to all addresses in the address space.

In the **standard** address space, the asterisk wildcard can be used at the end of an address. The address **top*** matches addresses **topic** and **topic/sub**.

In the **brokered** address space, the plus sign and asterisk wildcards can be used at the end of an address to match a single word (plus sign) or all words (asterisk) after the forward slash delimiter. So, the address **topic/+** matches **topic/sub** but not **topic/s/sub**. The address **topic/*** matches **topic/sub** and **topic/s/sub**.

5.3. MANAGING USERS

AMQ Online user management is only supported when using the **standard** authentication service. On OpenShift, users can be managed using the OpenShift command-line tools.

Prerequisites

- You must have already created an address space.

5.3.1. Creating users using the command line

In AMQ Online users can be created using standard command-line tools.

Prerequisites

- You must have already created an address space.

Procedure

1. To correctly base64 encode a password for the user definition file, run the following command:

```
echo -n password | base64 #cGFzc3dvcmQ=
```

NOTE

Be sure to use the **-n** parameter when running this command. Not specifying that parameter will result in an improperly coded password and cause log-in issues.

2. Save the user definition to a file:

```
apiVersion: user.enmasse.io/v1beta1
kind: MessagingUser
metadata:
  name: myspace.user1
spec:
  username: user1
  authentication:
    type: password
    password: cGFzc3dvcmQ= # Base64 encoded
  authorization:
    - addresses: ["myqueue", "queue1", "queue2", "topic*"]
      operations: ["send", "recv"]
    - addresses: ["anycast1"]
      operations: ["send"]
```

3. Create the user and associated user permissions:

```
oc create -f user-example1.yaml
```

4. Confirm that the user was created:

```
oc get messagingusers
```

5.3.2. Deleting users using the command line

Users can be deleted using standard command-line tools.

Prerequisites

- An address space must have been created.
- A user must have been created.

Procedure

1. List the current users:

```
oc get messagingusers
```

2. Delete the desired user:

```
oc delete messaginguser myspace.user1
```

5.3.3. Managing user permissions using the command line

You can edit the permissions for an existing user using the command line.

Prerequisites

- You must have already created a user. For more information see Creating users using the command line.

Procedure

Procedure

1. Retrieve the user whose permissions you want to edit:

```
oc get messaginguser myspace.user1 -o yaml > user-example1.yaml
```

2. Make the desired permissions change and save the file.

3. From the command line, run the following command to apply the change:

```
oc apply -f user-example1.yaml
```

The new user permissions are applied.

CHAPTER 6. CONNECTING APPLICATIONS TO AMQ ONLINE

You can connect your application to AMQ Online using one of the following client examples.

- AMQ Online Python
- AMQ Online JMS
- AMQ Online JavaScript
- AMQ Online C++
- AMQ Online .NET

To connect to the messaging service from outside the OpenShift cluster, TLS must be used with SNI set to specify the fully qualified host name for the address space. The port used is 443.

The messaging protocols supported depends on the type of address space used. For more information about address space types, see Address space.

6.1. CLIENT EXAMPLES

6.1.1. AMQ Online Python example

You can use the following AMQ Online Python example to connect your application to AMQ Online. This example assumes you have created an address of type **queue** named **myqueue**.

```
from __future__ import print_function, unicode_literals
from proton import Message
from proton.handlers import MessagingHandler
from proton.reactor import Container

class HelloWorld(MessagingHandler):
    def __init__(self, server, address):
        super(HelloWorld, self).__init__()
        self.server = server
        self.address = address

    def on_start(self, event):
        conn = event.container.connect(self.server)
        event.container.create_receiver(conn, self.address)
        event.container.create_sender(conn, self.address)

    def on_sendable(self, event):
        event.sender.send(Message(body="Hello World!"))
        event.sender.close()

    def on_message(self, event):
        print(event.message.body)
        event.connection.close()

Container(HelloWorld("amqps://_messaging-route-hostname_:443", "myqueue")).run()
```

6.1.1.1. Known issue with creating a subscriber on a hierarchical topic

A known issue exists where creating a subscriber on a hierarchical topic in AMQ Online causes the broker to instead create it as a competing consumer (handling the address like a queue rather than a topic).

The workaround for this issue involves setting the capability **"topic"** in the source.

Procedure

1. In the **simple_recv.py** file, modify the **from proton.reactor import Container** to add the **ReceiverOption**:

```
class CapabilityOptions(ReceiverOption):
    def apply(self, receiver):
        receiver.source.capabilities.put_object(symbol("topic"))
```

1. Modify the following line to add **options=CapabilityOptions()**:

```
def on_start(self, event):
        event.container.create_receiver(conn, self.address, options=CapabilityOptions())
```

6.1.2. AMQ Online JMS example

You can use the following AMQ Online JMS example to connect your application to AMQ Online. This example assumes you have created an address of type **queue** named **myqueue**.

```
package org.apache.qpid.jms.example;

import javax.jms.Connection;
import javax.jms.ConnectionFactory;
import javax.jms.DeliveryMode;
import javax.jms.Destination;
import javax.jms.ExceptionListener;
import javax.jms.JMSException;
import javax.jms.Message;
import javax.jms.MessageConsumer;
import javax.jms.MessageProducer;
import javax.jms.Session;
import javax.jms.TextMessage;
import javax.naming.Context;
import javax.naming.InitialContext;

public class HelloWorld {
    public static void main(String[] args) throws Exception {
        try {
            // The configuration for the Qpid InitialContextFactory has been supplied in
            // a jndi.properties file in the classpath, which results in it being picked
            // up automatically by the InitialContext constructor.
            Context context = new InitialContext();

            ConnectionFactory factory = (ConnectionFactory) context.lookup("myFactoryLookup");
            Destination queue = (Destination) context.lookup("myQueueLookup");

            Connection connection = factory.createConnection(System.getProperty("USER"),
System.getProperty("PASSWORD"));
            connection.setExceptionListener(new MyExceptionListener());
```

```
            connection.start();

            Session session = connection.createSession(false, Session.AUTO_ACKNOWLEDGE);

            MessageProducer messageProducer = session.createProducer(queue);
            MessageConsumer messageConsumer = session.createConsumer(queue);

            TextMessage message = session.createTextMessage("Hello world!");
            messageProducer.send(message, DeliveryMode.NON_PERSISTENT,
Message.DEFAULT_PRIORITY, Message.DEFAULT_TIME_TO_LIVE);
            TextMessage receivedMessage = (TextMessage) messageConsumer.receive(2000L);

            if (receivedMessage != null) {
                System.out.println(receivedMessage.getText());
            } else {
                System.out.println("No message received within the given timeout!");
            }

            connection.close();
        } catch (Exception exp) {
            System.out.println("Caught exception, exiting.");
            exp.printStackTrace(System.out);
            System.exit(1);
        }
    }

    private static class MyExceptionListener implements ExceptionListener {
        @Override
        public void onException(JMSException exception) {
            System.out.println("Connection ExceptionListener fired, exiting.");
            exception.printStackTrace(System.out);
            System.exit(1);
        }
    }
}
```

with jndi.properties:

```
connectionfactory.myFactoryLookup = amqps://messaging-route-hostname:443?
transport.trustAll=true&transport.verifyHost=false
queue.myQueueLookup = myqueue
```

6.1.3. AMQ Online JavaScript example

You can use the following AMQ Online JavaScript example to connect your application to AMQ Online. This example assumes you have created an address of type **queue** named **myqueue**.

```
var container = require('rhea');
container.on('connection_open', function (context) {
    context.connection.open_receiver('myqueue');
    context.connection.open_sender('myqueue');
});
container.on('message', function (context) {
    console.log(context.message.body);
    context.connection.close();
```

```
});
container.on('sendable', function (context) {
    context.sender.send({body:'Hello World!'});
    context.sender.detach();
});
container.connect({username: 'username', password: 'password', port:443, host:'messaging-route-hostname', transport:'tls', rejectUnauthorized:false});
```

6.1.3.1. AMQ Online JavaScript example using WebSockets

```
var container = require('rhea');
var WebSocket = require('ws');

container.on('connection_open', function (context) {
    context.connection.open_receiver('myqueue');
    context.connection.open_sender('myqueue');
});
container.on('message', function (context) {
    console.log(context.message.body);
    context.connection.close();
});
container.on('sendable', function (context) {
    context.sender.send({body:'Hello World!'});
    context.sender.detach();
});

var ws = container.websocket_connect(WebSocket);
container.connect({username: 'username', password: 'password', connection_details:
ws("wss://messaging-route-hostname:443", ["binary"], {rejectUnauthorized: false})});
```

6.1.4. AMQ Online C++ example

The C++ client has equivalent **simple_recv** and **simple_send** examples with the same options as Python. However, the C++ library does not perform the same level of processing on the URL; in particular it will not accept **amqps://** to imply using TLS, so the example needs to be modified as follows:

```
#include <proton/connection.hpp>
#include <proton/container.hpp>
#include <proton/default_container.hpp>
#include <proton/delivery.hpp>
#include <proton/message.hpp>
#include <proton/messaging_handler.hpp>
#include <proton/ssl.hpp>
#include <proton/thread_safe.hpp>
#include <proton/tracker.hpp>
#include <proton/url.hpp>

#include <iostream>

#include "fake_cpp11.hpp"

class hello_world : public proton::messaging_handler {
  private:
    proton::url url;
```

```
  public:
    hello_world(const std::string& u) : url(u) {}

    void on_container_start(proton::container& c) OVERRIDE {
        proton::connection_options co;
        co.ssl_client_options(proton::ssl_client_options());
        c.client_connection_options(co);
        c.connect(url);
    }

    void on_connection_open(proton::connection& c) OVERRIDE {
        c.open_receiver(url.path());
        c.open_sender(url.path());
    }

    void on_sendable(proton::sender &s) OVERRIDE {
        proton::message m("Hello World!");
        s.send(m);
        s.close();
    }

    void on_message(proton::delivery &d, proton::message &m) OVERRIDE {
        std::cout << m.body() << std::endl;
        d.connection().close();
    }
};

int main(int argc, char **argv) {
    try {
        std::string url = argc > 1 ? argv[1] : "messaging-route-hostname:443/myqueue";

        hello_world hw(url);
        proton::default_container(hw).run();

        return 0;
    } catch (const std::exception& e) {
        std::cerr << e.what() << std::endl;
    }

    return 1;
}
```

6.1.4.1. Known issue with creating a subscriber on a hierarchical topic

A known issue exists where creating a subscriber on a hierarchical topic in AMQ Online causes the broker to instead create it as a competing consumer (handling the address like a queue rather than a topic).

The workaround involves setting the capability **"topic"** in the source.

Procedure

- In the **topic_receive.cpp** file, edit the code so that it is similar to what is shown in this example:

```
void on_container_start(proton::container& cont) override {
```

```
        proton::connection conn = cont.connect(conn_url_);
        proton::receiver_options opts {};
        proton::source_options sopts {};

        sopts.capabilities(std::vector<proton::symbol> { "topic" });
        opts.source(sopts);

        conn.open_receiver(address_, opts);
    }
```

6.1.5. AMQ Online .NET example

You can use the following AMQ Online .NET example to connect your application to AMQ Online. This example assumes you have created an address of type **queue** named **myqueue**.

```
using System;
using Amqp;

namespace Test
{
   public class Program
   {
      public static void Main(string[] args)
      {
         String url = (args.Length > 0) ? args[0] : "amqps://messaging-route-hostname:443";
         String address = (args.Length > 1) ? args[1] : "myqueue";

         Connection.DisableServerCertValidation = true;
         Connection connection = new Connection(new Address(url));
         Session session = new Session(connection);
         SenderLink sender = new SenderLink(session, "test-sender", address);

         Message messageSent = new Message("Test Message");
         sender.Send(messageSent);

         ReceiverLink receiver = new ReceiverLink(session, "test-receiver", address);
         Message messageReceived = receiver.Receive(TimeSpan.FromSeconds(2));
         Console.WriteLine(messageReceived.Body);
         receiver.Accept(messageReceived);

         sender.Close();
         receiver.Close();
         session.Close();
         connection.Close();
      }
   }
}
```

APPENDIX A. USING YOUR SUBSCRIPTION

AMQ Online 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 Red Hat 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 Online** entries in the **JBOSS INTEGRATION AND AUTOMATION** category.
3. Select the desired AMQ Online 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 .

APPENDIX B. AMQ ONLINE RESOURCES FOR MESSAGING TENANTS

The following table describes the AMQ Online resources that pertain to the messaging tenant role.

Table B.1. AMQ Online messaging tenant resources table

Resource	Description
addresses	Specifies the address.
addressspaces	Specifies the address space.
messagingusers	Specifies the authorization policy that controls which addresses may be used and the operations that may be performed on those addresses.

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