Red Hat Integration 2022.Q1

Installing and Deploying Service Registry on OpenShift

Service Registry 2.0

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Legal Notice

Abstract

This guide explains how to install and deploy Service Registry on OpenShift with registry data storage options in AMQ Streams or PostgreSQL database. This guide also shows how to secure, configure, and manage a Service Registry, and provides reference information about the Service Registry Operator.

Table of Contents

PREFACE

MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message.

CHAPTER 1. SERVICE REGISTRY OPERATOR QUICKSTART

This chapter explains how to quickly install Service Registry Operator on the command line.

This quickstart example deploys Service Registry using the SQL database storage option:

- Section 1.1, “Quickstart Service Registry Operator installation”
- Section 1.2, “Quickstart Service Registry deployment”

NOTE

The recommended installation option for production environments is using the OpenShift OperatorHub. The recommended storage option is SQL or Kafka.

1.1. QUICKSTART SERVICE REGISTRY OPERATOR INSTALLATION

You can quickly deploy the Service Registry Operator on the command line, without the Operator Lifecycle Manager, by using a downloaded set of installation files and examples.

Prerequisites

- You must go to Red Hat Integration Downloads, select the product version, and download the examples in the Service Registry CRDs **.zip** file.

Procedure

1. Create a project for the installation, for example, **service-registry**:

```
NAMESPACE="service-registry"
oc new-project "$NAMESPACE"
```

2. Apply the file located in the **install/** folder:

```
cat install/install.yaml | sed "s/apicurio-registry-operator-namespace/$NAMESPACE/g" | oc apply -f -
```

1.2. QUICKSTART SERVICE REGISTRY DEPLOYMENT

To create a new Service Registry deployment, use the SQL database storage option. This requires external PostgreSQL storage to be configured as a prerequisite.

Prerequisites

- Ensure that the Service Registry Operator is already installed.
- You have a PostgreSQL database reachable from your OpenShift cluster.

Procedure

1. Create an **ApicurioRegistry** custom resource (CR), with your database connection configured, for example:

Example CR for SQL storage

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry-sql
spec:
  configuration:
    persistence: "sql"
    sql:
      dataSource:
        url: "jdbc:postgresql://<service name>.<namespace>.svc:5432/<database name>"
        userName: "postgres"
        password: "<password>" # Optional
```

2. Create the **ApicurioRegistry** CR in the same namespace that the Operator is deployed

```
oc project "$NAMESPACE"
oc apply -f ./examples/apicurioregistry_sql_cr.yaml
```

CHAPTER 2. INSTALLING SERVICE REGISTRY ON OPENSHIFT

This chapter explains how to install Service Registry on OpenShift Container Platform:

- Section 2.1, “Installing Service Registry from the OpenShift OperatorHub”

Prerequisites

- Read the introduction in the Service Registry User Guide

2.1. INSTALLING SERVICE REGISTRY FROM THE OPENSHIFT OPERATORHUB

You can install the Service Registry Operator on your OpenShift cluster from the OperatorHub. The OperatorHub is available from the OpenShift Container Platform web console and provides an interface for cluster administrators to discover and install Operators. For more details, see the OpenShift documentation.

NOTE

You can install more than one instance of Service Registry depending on your environment. The number of instances depends on the number and type of artifacts stored in Service Registry and on your chosen storage option.

Prerequisites

- You must have cluster administrator access to an OpenShift cluster.

Procedure

1. In the OpenShift Container Platform web console, log in using an account with cluster administrator privileges.
2. Create a new OpenShift project:
   a. In the left navigation menu, click **Home**, **Project**, and then **Create Project**.
   b. Enter a project name, for example, **my-project**, and click **Create**.
3. In the left navigation menu, click **Operators** and then **OperatorHub**.
4. In the **Filter by keyword** text box, enter **registry** to find the **Red Hat Integration - Service Registry Operator**.
5. Read the information about the Operator, and click **Install** to display the Operator subscription page.
6. Select your subscription settings, for example:
   - **Update Channel**: Select one of the following:
     - **2.0.x**: Includes patch updates only, such as 2.0.1 and 2.0.2. For example, an installation on 2.0.x automatically ignores 2.1.x.

    - **2.x**: Includes all minor and patch updates, such as 2.1.0 and 2.0.1. For example, an installation on 2.0.x automatically upgrades to 2.1.x.

- **Installation Mode**: Select one of the following:
    - **All namespaces on the cluster (default)**
    - **A specific namespace on the cluster**and then **my-project**
- **Approval Strategy**: Select **Automatic** or **Manual**

7. Click **Install**, and wait a few moments until the Operator is ready for use.

Additional resources

- Adding Operators to an OpenShift cluster
- Apicurio Registry Operator community in GitHub

CHAPTER 3. DEPLOYING SERVICE REGISTRY STORAGE IN AMQ STREAMS

This chapter explains how to install and configure Service Registry data storage in AMQ Streams.

- Section 3.1, "Installing AMQ Streams from the OpenShift OperatorHub"
- Section 3.2, "Configuring Service Registry with Kafka storage on OpenShift"
- Section 3.3, "Configuring Kafka storage with TLS security"
- Section 3.4, "Configuring Kafka storage with SCRAM security"
- Section 3.5, "Configuring OAuth authentication for Kafka storage"

Prerequisites

- Chapter 2, *Installing Service Registry on OpenShift*

3.1. INSTALLING AMQ STREAMS FROM THE OPENSHIFT OPERATORHUB

If you do not already have AMQ Streams installed, you can install the AMQ Streams Operator on your OpenShift cluster from the OperatorHub. The OperatorHub is available from the OpenShift Container Platform web console and provides an interface for cluster administrators to discover and install Operators. For more details, see the OpenShift documentation.

Prerequisites

- You must have cluster administrator access to an OpenShift cluster
- See Using AMQ Streams on OpenShift for detailed information on installing AMQ Streams. This section shows a simple example of installing using the OpenShift OperatorHub.

Procedure

1. In the OpenShift Container Platform web console, log in using an account with cluster administrator privileges.
2. Change to the OpenShift project in which you want to install AMQ Streams. For example, from the **Project** drop-down, select **my-project**.
3. In the left navigation menu, click **Operators** and then **OperatorHub**.
4. In the **Filter by keyword** text box, enter **AMQ Streams** to find the **Red Hat Integration - AMQ Streams** Operator.
5. Read the information about the Operator, and click **Install** to display the Operator subscription page.
6. Select your subscription settings, for example:
   - **Update Channel** and then **amq-streams-1.8.x**
   - **Installation Mode**: Select one of the following:

- **All namespaces on the cluster (default)**
- **A specific namespace on the cluster> my-project**

- **Approval Strategy**: Select **Automatic** or **Manual**

7. Click **Install**, and wait a few moments until the Operator is ready for use.

Additional resources

- Adding Operators to an OpenShift cluster
- Using AMQ Streams on OpenShift

3.2. CONFIGURING SERVICE REGISTRY WITH KAFKA STORAGE ON OPENSHIFT

This section explains how to configure Kafka-based storage for Service Registry using AMQ Streams on OpenShift. The **kafkasql** storage option uses Kafka storage with in-memory H2 database. This storage option is suitable for production environments when **persistent** storage is configured for the Kafka cluster on OpenShift.

You can install Service Registry in an existing Kafka cluster or create a new Kafka cluster, depending on your environment.

Prerequisites

- You must have an OpenShift cluster with cluster administrator access.
- You must have already installed Service Registry. See Chapter 2, *Installing Service Registry on OpenShift*.
- You must have already installed AMQ Streams. See Section 3.1, "Installing AMQ Streams from the OpenShift OperatorHub".

Procedure

1. In the OpenShift Container Platform web console, log in using an account with cluster administrator privileges.
2. If you do not already have a Kafka cluster configured, create a new Kafka cluster using AMQ Streams. For example, in the OpenShift OperatorHub:
   a. Click **Installed Operators** and then **Red Hat Integration - AMQ Streams**
   b. Under **Provided APIs** and then **Kafka**, click **Create Instance** to create a new Kafka cluster.
   c. Edit the custom resource definition as appropriate, and click **Create**.

WARNING

The default example creates a cluster with 3 Zookeeper nodes and 3 Kafka nodes with **ephemeral** storage. This temporary storage is suitable for development and testing only, and not for production. For more details, see Using AMQ Streams on OpenShift .

3. After the cluster is ready, click **Provided APIs** > **Kafka** > **my-cluster** > **YAML**.
4. In the **status** block, make a copy of the **bootstrapServers** value, which you will use later to deploy Service Registry. For example:

```
status:
  ...
  conditions:
  ...
  listeners:
    - addresses:
        - host: my-cluster-kafka-bootstrap.my-project.svc
          port: 9092
      bootstrapServers: 'my-cluster-kafka-bootstrap.my-project.svc:9092'
      type: plain
  ...
```

5. Click **Installed Operators** > **Red Hat Integration - Service Registry**> **ApicurioRegistry** > **Create ApicurioRegistry**.
6. Paste in the following custom resource definition, but use your **bootstrapServers** value that you copied earlier:

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry-kafkasql
spec:
  configuration:
    persistence: 'kafkasql'
    kafkasql:
      bootstrapServers: 'my-cluster-kafka-bootstrap.my-project.svc:9092'
```

7. Click **Create** and wait for the Service Registry route to be created on OpenShift.
8. Click **Networking** > **Route** to access the new route for the Service Registry web console. For example:

```
http://example-apicurioregistry-kafkasql.my-project.my-domain-name.com/
```

Additional resources

- For more details on creating Kafka clusters and topics using AMQ Streams, see Using AMQ Streams on OpenShift.

3.3. CONFIGURING KAFKA STORAGE WITH TLS SECURITY

You can configure the AMQ Streams Operator and Service Registry Operator to use an encrypted Transport Layer Security (TLS) connection.

Prerequisites

- You must install the Service Registry Operator using the OperatorHub or command line.
- You must install the AMQ Streams Operator or have Kafka accessible from your OpenShift cluster.

NOTE

This section assumes that the AMQ Streams Operator is available, however you can use any Kafka deployment. In that case, you must manually create the Openshift secrets that the Service Registry Operator expects.

Procedure

1. In the OpenShift web console, click **Installed Operators**, select the **AMQ Streams** Operator details, and then the **Kafka** tab.
2. Click **Create Kafka** to provision a new Kafka cluster for Service Registry storage.
3. Configure the **authorization** and **tls** fields to use TLS authentication for the Kafka cluster, for example:

```
apiVersion: kafka.strimzi.io/v1beta2
kind: Kafka
metadata:
  name: my-cluster
  namespace: registry-example-kafkasql-tls
  # Change or remove the explicit namespace
spec:
  kafka:
    config:
      offsets.topic.replication.factor: 3
      transaction.state.log.replication.factor: 3
      transaction.state.log.min.isr: 2
      log.message.format.version: '2.7'
      inter.broker.protocol.version: '2.7'
    version: 2.7.0
    storage:
      type: ephemeral
    replicas: 3
    listeners:
      - name: tls
        port: 9093
        type: internal
        tls: true
        authentication:
```

```
      type: tls
  authorization:
    type: simple
entityOperator:
  topicOperator: {}
  userOperator: {}
zookeeper:
  storage:
    type: ephemeral
  replicas: 3
```

The default Kafka topic name that Service Registry uses to store data is **kafkasql-journal**. This topic is created automatically by Service Registry. You can override this behavior or the default topic name by setting the appropriate environment variables (default values):

- **REGISTRY_KAFKASQL_TOPIC_AUTO_CREATE=true**
- **REGISTRY_KAFKASQL_TOPIC=kafkasql-journal**

If you decide not to create the Kafka topic manually, skip the next step.

4. Click the **Kafka Topic** tab, and then **Create Kafka Topic** to create the **kafkasql-journal** topic:

```
apiVersion: kafka.strimzi.io/v1beta1
kind: KafkaTopic
metadata:
  name: kafkasql-journal
  labels:
    strimzi.io/cluster: my-cluster
  namespace: registry-example-kafkasql-tls
spec:
  partitions: 2
  replicas: 1
  config:
    retention.ms: 604800000
    segment.bytes: 1073741824
```

5. Create a **Kafka User** resource to configure authentication and authorization for the Service Registry user. You can specify a user name in the **metadata** section or use the default **my-user**.

```
apiVersion: kafka.strimzi.io/v1beta1
kind: KafkaUser
metadata:
  name: my-user
  labels:
    strimzi.io/cluster: my-cluster
  namespace: registry-example-kafkasql-tls
spec:
  authentication:
    type: tls
  authorization:
    acls:
      - operation: All
        resource:
          name: '*'
          patternType: literal
```

```
      type: topic
    - operation: All
      resource:
        name: '*'
        patternType: literal
        type: cluster
    - operation: All
      resource:
        name: '*'
        patternType: literal
        type: transactionalId
    - operation: All
      resource:
        name: '*'
        patternType: literal
        type: group
  type: simple
```

NOTE

You must configure the authorization specifically for the topics and resources that the Service Registry requires. This is a simple permissive example.

6. Click **Workloads** and then **Secrets** to find two secrets that AMQ Streams creates for Service Registry to connect to the Kafka cluster:
   - **my-cluster-cluster-ca-cert** - contains the PKCS12 truststore for the Kafka cluster
   - **my-user** - contains the user's keystore

NOTE

The name of the secret can vary based on your cluster or user name.

7. If you create the secrets manually, they must contain the following key-value pairs:
   - my-cluster-ca-cert
     - **ca.p12** - truststore in PKCS12 format
     - **ca.password** - truststore password
   - my-user
     - **user.p12** - keystore in PKCS12 format
     - **user.password** - keystore password
8. Configure the following example configuration to deploy the Service Registry.

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry-kafkasql
spec:
```

```
configuration:
  persistence: "kafkasql"
  kafkasql:
    bootstrapServers: "my-cluster-kafka-bootstrap.registry-example-kafkasql-tls.svc:9093"
    security:
      tls:
        keystoreSecretName: my-user
        truststoreSecretName: my-cluster-cluster-ca-cert
```

IMPORTANT

You must use a different **bootstrapServers** address than in the plain insecure use case. The address must support TLS connections and is found in the specified **Kafka** resource under the **type: tls** field.

3.4. CONFIGURING KAFKA STORAGE WITH SCRAM SECURITY

You can configure the AMQ Streams Operator and Service Registry Operator to use Salted Challenge Response Authentication Mechanism (SCRAM-SHA-512) for the Kafka cluster.

Prerequisites

- You must install the Service Registry Operator using the OperatorHub or command line.
- You must install the AMQ Streams Operator or have Kafka accessible from your OpenShift cluster.

NOTE

This section assumes that AMQ Streams Operator is available, however you can use any Kafka deployment. In that case, you must manually create the Openshift secrets that the Service Registry Operator expects.

Procedure

1. In the OpenShift web console, click **Installed Operators**, select the **AMQ Streams** Operator details, and then the **Kafka** tab.
2. Click **Create Kafka** to provision a new Kafka cluster for Service Registry storage.
3. Configure the **authorization** and **tls** fields to use SCRAM-SHA-512 authentication for the Kafka cluster, for example:

```
apiVersion: kafka.strimzi.io/v1beta2
kind: Kafka
metadata:
  name: my-cluster
  namespace: registry-example-kafkasql-scram
  # Change or remove the explicit namespace
spec:
  kafka:
    config:
      offsets.topic.replication.factor: 3
      transaction.state.log.replication.factor: 3
```

```
    transaction.state.log.min.isr: 2
    log.message.format.version: '2.7'
    inter.broker.protocol.version: '2.7'
  version: 2.7.0
  storage:
    type: ephemeral
  replicas: 3
  listeners:
    - name: tls
      port: 9093
      type: internal
      tls: true
      authentication:
        type: scram-sha-512
  authorization:
    type: simple
entityOperator:
  topicOperator: {}
  userOperator: {}
zookeeper:
  storage:
    type: ephemeral
  replicas: 3
```

The default Kafka topic name that Service Registry uses to store data is **kafkasql-journal**. This topic is created automatically by Service Registry. You can override this behavior or the default topic name by setting the appropriate environment variables (default values):

- **REGISTRY_KAFKASQL_TOPIC_AUTO_CREATE=true**
- **REGISTRY_KAFKASQL_TOPIC=kafkasql-journal**

If you decide not to create the Kafka topic manually, skip the next step.

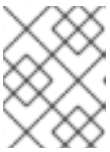
4. Click the **Kafka Topic** tab, and then **Create Kafka Topic** to create the **kafkasql-journal** topic:

```
apiVersion: kafka.strimzi.io/v1beta1
kind: KafkaTopic
metadata:
  name: kafkasql-journal
  labels:
    strimzi.io/cluster: my-cluster
  namespace: registry-example-kafkasql-scram
spec:
  partitions: 2
  replicas: 1
  config:
    retention.ms: 604800000
    segment.bytes: 1073741824
```

5. Create a **Kafka User** resource to configure SCRAM authentication and authorization for the Service Registry user. You can specify a user name in the **metadata** section or use the default **my-user**.

```
apiVersion: kafka.strimzi.io/v1beta1
kind: KafkaUser
```

```
metadata:
  name: my-user
  labels:
    strimzi.io/cluster: my-cluster
  namespace: registry-example-kafkasql-scram
spec:
  authentication:
    type: scram-sha-512
  authorization:
    acls:
      - operation: All
        resource:
          name: '*'
          patternType: literal
          type: topic
      - operation: All
        resource:
          name: '*'
          patternType: literal
          type: cluster
      - operation: All
        resource:
          name: '*'
          patternType: literal
          type: transactionalId
      - operation: All
        resource:
          name: '*'
          patternType: literal
          type: group
    type: simple
```



NOTE

You must configure the authorization specifically for the topics and resources that the Service Registry requires. This is a simple permissive example.

6. Click **Workloads** and then **Secrets** to find two secrets that AMQ Streams creates for Service Registry to connect to the Kafka cluster:

   - **my-cluster-cluster-ca-cert** - contains the PKCS12 truststore for the Kafka cluster
   - **my-user** - contains the user's keystore

NOTE

The name of the secret can vary based on your cluster or user name.

7. If you create the secrets manually, they must contain the following key-value pairs:

   - **my-cluster-ca-cert**
     - **ca.p12** - the truststore in PKCS12 format
     - **ca.password** - truststore password

- **my-user**
  - **password** - user password

8. Configure the following example settings to deploy the Service Registry:

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry-kafkasql
spec:
  configuration:
    persistence: "kafkasql"
    kafkasql:
      bootstrapServers: "my-cluster-kafka-bootstrap.registry-example-kafkasql-scram.svc:9093"
      security:
        scram:
          truststoreSecretName: my-cluster-cluster-ca-cert
          user: my-user
          passwordSecretName: my-user
```

IMPORTANT

You must use a different **bootstrapServers** address than in the plain insecure use case. The address must support TLS connections, and is found in the specified **Kafka** resource under the **type: tls** field.

3.5. CONFIGURING OAUTH AUTHENTICATION FOR KAFKA STORAGE

When using Kafka-based storage in AMQ Streams, Service Registry supports accessing a Kafka cluster that requires OAuth authentication. To enable this support, you must set some environment variables in your Service Registry deployment.

When these environment variables are set, the Kafka producer and consumer applications in Service Registry will use this configuration to authenticate to the Kafka cluster over OAuth.

Prerequisites

- You have already configured Kafka-based storage of Service Registry data in AMQ Streams. See Section 3.2, “Configuring Service Registry with Kafka storage on OpenShift” .

Procedure

- Set the following environment variables in your Service Registry deployment:

Environment variable	Description	Default value

Environment variable	Description	Default value
ENABLE_KAFKA_SASL	Enables SASL OAuth authentication for Service Registry storage in Kafka. You must set this variable to **true** for the other variables to have effect.	**false**
CLIENT_ID	The client ID used to authenticate to the Kafka cluster.	**-**
CLIENT_SECRET	The client secret used to authenticate to the Kafka cluster.	**-**
OAUTH_TOKEN_ENDPOINT_URI	The URL of the OAuth identity server.	**http://localhost:8090**

Additional resources

- For an example of how to set Service Registry environment variables on OpenShift, see Section 6.1, “Configuring Service Registry health checks on OpenShift”

CHAPTER 4. DEPLOYING SERVICE REGISTRY STORAGE IN A POSTGRESQL DATABASE

This chapter explains how to install, configure, and manage Service Registry data storage in a PostgreSQL database.

- Section 4.1, “Installing a PostgreSQL database from the OpenShift OperatorHub”
- Section 4.2, “Configuring Service Registry with PostgreSQL database storage on OpenShift”
- Section 4.3, “Backing up Service Registry PostgreSQL storage”
- Section 4.4, “Restoring Service Registry PostgreSQL storage”

Prerequisites

- Chapter 2, *Installing Service Registry on OpenShift*

4.1. INSTALLING A POSTGRESQL DATABASE FROM THE OPENSHIFT OPERATORHUB

If you do not already have a PostgreSQL database Operator installed, you can install a PostgreSQL Operator on your OpenShift cluster from the OperatorHub. The OperatorHub is available from the OpenShift Container Platform web console and provides an interface for cluster administrators to discover and install Operators. For more details, see the OpenShift documentation.

Prerequisites

- You must have cluster administrator access to an OpenShift cluster.

Procedure

1. In the OpenShift Container Platform web console, log in using an account with cluster administrator privileges.
2. Change to the OpenShift project in which you want to install the PostgreSQL Operator. For example, from the **Project** drop-down, select **my-project**.
3. In the left navigation menu, click **Operators** and then **OperatorHub**.
4. In the **Filter by keyword** text box, enter **PostgreSQL** to find an Operator suitable for your environment, for example, **Crunchy PostgreSQL for OpenShift** or **PostgreSQL Operator by Dev4Ddevs.com**.
5. Read the information about the Operator, and click **Install** to display the Operator subscription page.
6. Select your subscription settings, for example:
   - **Update Channel**: **stable**
   - **Installation Mode**: **A specific namespace on the cluster** and then **my-project**
   - **Approval Strategy**: Select **Automatic** or **Manual**

7. Click **Install**, and wait a few moments until the Operator is ready for use.

IMPORTANT

You must read the documentation from your chosen **PostgreSQL** Operator for details on how to create and manage your database.

Additional resources

- Adding Operators to an OpenShift cluster
- Crunchy PostgreSQL Operator QuickStart

4.2. CONFIGURING SERVICE REGISTRY WITH POSTGRESQL DATABASE STORAGE ON OPENSHIFT

This section explains how to configure storage for Service Registry on OpenShift using a PostgreSQL database Operator. You can install Service Registry in an existing database or create a new database, depending on your environment. This section shows a simple example using the PostgreSQL Operator by Dev4Ddevs.com.

Prerequisites

- You must have an OpenShift cluster with cluster administrator access.
- You must have already installed Service Registry. See Chapter 2, *Installing Service Registry on OpenShift*.
- You must have already installed a PostgreSQL Operator on OpenShift. For example, see Section 4.1, “Installing a PostgreSQL database from the OpenShift OperatorHub” .

Procedure

1. In the OpenShift Container Platform web console, log in using an account with cluster administrator privileges.
2. Change to the OpenShift project in which Service Registry and your PostgreSQL Operator are installed. For example, from the **Project** drop-down, select **my-project**.
3. Create a PostgreSQL database for your Service Registry storage. For example, click **Installed Operators**, **PostgreSQL Operator by Dev4Ddevs.com**, and then **Create database**.
4. Click **YAML** and edit the database settings as follows:
   - **name**: Change the value to **registry**
   - **image**: Change the value to **centos/postgresql-12-centos7**
5. Edit any other database settings as needed depending on your environment, for example:

```
apiVersion: postgresql.dev4devs.com/v1alpha1
kind: Database
metadata:
  name: registry
  namespace: my-project
```

```
spec:
  databaseCpu: 30m
  databaseCpuLimit: 60m
  databaseMemoryLimit: 512Mi
  databaseMemoryRequest: 128Mi
  databaseName: example
  databaseNameKeyEnvVar: POSTGRESQL_DATABASE
  databasePassword: postgres
  databasePasswordKeyEnvVar: POSTGRESQL_PASSWORD
  databaseStorageRequest: 1Gi
  databaseUser: postgres
  databaseUserKeyEnvVar: POSTGRESQL_USER
  image: centos/postgresql-12-centos7
  size: 1
```

6. Click **Create**, and wait until the database is created.
7. Click **Installed Operators** > **Red Hat Integration - Service Registry**> **ApicurioRegistry** > **Create ApicurioRegistry**.
8. Paste in the following custom resource definition, and edit the values for the database **url** and credentials to match your environment:

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry-sql
spec:
  configuration:
    persistence: 'sql'
    sql:
      dataSource:
        url: 'jdbc:postgresql://<service name>.<namespace>.svc:5432/<database name>'
        # e.g. url: 'jdbc:postgresql://acid-minimal-cluster.my-project.svc:5432/registry'
        userName: 'postgres'
        password: '<password>' # Optional
```

9. Click **Create** and wait for the Service Registry route to be created on OpenShift.
10. Click **Networking** > **Route** to access the new route for the Service Registry web console. For example:

```
http://example-apicurioregistry-sql.my-project.my-domain-name.com/
```

Additional resources

- Crunchy PostgreSQL Operator QuickStart
- Apicurio Registry Operator QuickStart

4.3. BACKING UP SERVICE REGISTRY POSTGRESQL STORAGE

When using storage in a PostgreSQL database, you must ensure that the data stored by Service Registry is backed up regularly.

SQL Dump is a simple procedure that works with any PostgreSQL installation. This uses the pg_dump utility to generate a file with SQL commands that you can use to recreate the database in the same state that it was in at the time of the dump.

pg_dump is a regular PostgreSQL client application, which you can execute from any remote host that has access to the database. Like any other client, the operations that can perform are limited to the user permissions.

Procedure

- Use the **pg_dump** command to redirect the output to a file:

```
$ pg_dump dbname > dumpfile
```

  You can specify the database server that **pg_dump** connects to using the **-h host** and **-p port** options.

- You can reduce large dump files using a compression tool, such as gzip, for example:

```
$ pg_dump dbname | gzip > filename.gz
```

Additional resources

- For details on client authentication, see the PostgreSQL documentation.
- For details on importing and exporting registry content, see Managing Apicurio Registry content using the REST API.

4.4. RESTORING SERVICE REGISTRY POSTGRESQL STORAGE

You can restore SQL Dump files created by **pg_dump** using the **psql** utility.

Prerequisites

- You must have already backed up your PostgreSQL datbase using **pg_dump**. See Section 4.3, “Backing up Service Registry PostgreSQL storage”.
- All users who own objects or have permissions on objects in the dumped database must already exist.

Procedure

1. Enter the following command to create the database:

```
$ createdb -T template0 dbname
```

2. Enter the following command to restore the SQL dump

```
$ psql dbname < dumpfile
```

3. Run ANALYZE on each database so the query optimizer has useful statistics.

CHAPTER 5. SECURING A SERVICE REGISTRY DEPLOYMENT

This chapter explains how to configure security settings for your Service Registry deployment on OpenShift:

- Section 5.1, “Securing Service Registry using the Red Hat Single Sign-On Operator”
- Section 5.2, “Configuring Service Registry authentication and authorization with Red Hat Single Sign-On”
- Section 5.3, “Configuring an HTTPS connection to Service Registry from inside the OpenShift cluster”
- Section 5.4, “Configuring an HTTPS connection to Service Registry from outside the OpenShift cluster”

Service Registry provides authentication and authorization using Red Hat Single Sign-On based on OpenID Connect (OIDC) or HTTP basic. You can configure the required settings automatically using the Red Hat Single Sign-On Operator, or manually configure them in Red Hat Single Sign-On and Service Registry.

Service Registry provides role-based authentication and authorization for the Service Registry web console and core REST API using Red Hat Single Sign-On. Service Registry also provides content-based authorization at the schema or API level, where only the artifact creator has write access. You can also configure an HTTPS connection to Service Registry from inside or outside an OpenShift cluster.

Additional resources

- For details on security configuration for Java client applications, see the following:
  - Service Registry Java client configuration
  - Service Registry serializer/deserializer configuration

5.1. SECURING SERVICE REGISTRY USING THE RED HAT SINGLE SIGN-ON OPERATOR

The following procedure shows how to configure a Service Registry REST API and web console to be protected by Red Hat Single Sign-On. The Red Hat Single Sign-On Operator is available as a Technology Preview feature.

IMPORTANT

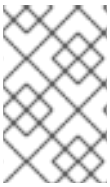
Technology Preview features are not supported with Red Hat production service-level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend implementing any Technology Preview features in production environments.

This Technology Preview feature provides early access to upcoming product innovations, enabling you to test functionality and provide feedback during the development process. For more information about support scope, see Technology Preview Features Support Scope.

Service Registry supports the following user roles:

Table 5.1. Service Registry user roles

Name	Capabilities
sr-admin	Full access, no restrictions.
sr-developer	Create artifacts and configure artifact rules. Cannot modify global rules, perform import/export, or use **/admin** REST API endpoint.
sr-readonly	View and search only. Cannot modify artifacts or rules, perform import/export, or use **/admin** REST API endpoint.



NOTE

There is a related configuration option in the **ApicurioRegistry** CRD that you can use to set the web console to read-only mode. However, this configuration does not affect the REST API.

Prerequisites

- You must have already installed the Service Registry Operator.
- You must install the Red Hat Single Sign-On Operator or have Red Hat Single Sign-On accessible from your OpenShift cluster.

IMPORTANT

The example configuration in this procedure is intended for development and testing only. To keep the procedure simple, it does not use HTTPS and other defenses recommended for a production environment. For more details, see the Red Hat Single Sign-On documentation.

Procedure

1. In the OpenShift web console, click **Installed Operators** and **Red Hat Single Sign-On Operator**, and then the **Keycloak** tab.
2. Click **Create Keycloak** to provision a new Red Hat Single Sign-On instance for securing a Service Registry deployment. You can use the default value, for example:

```
apiVersion: keycloak.org/v1alpha1
kind: Keycloak
metadata:
  name: example-keycloak
  labels:
    app: sso
spec:
  instances: 1
  externalAccess:
    enabled: True
  podDisruptionBudget:
    enabled: True
```

3. Wait until the instance has been created, and click **Networking** and then **Routes** to access the new route for the **keycloak** instance.

4. Click the **Location** URL and copy the displayed **../auth** URL value for later use when deploying Service Registry.

5. Click **Installed Operators** and **Red Hat Single Sign-On Operator**, and click the **Keycloak Realm** tab, and then **Create Keycloak Realm** to create a **registry** example realm:

```
apiVersion: keycloak.org/v1alpha1
kind: KeycloakRealm
metadata:
  name: registry-keycloakrealm
spec:
  instanceSelector:
    matchLabels:
      app: sso
  realm:
    displayName: Registry
    enabled: true
    id: registry
    realm: registry
    sslRequired: none
    roles:
      realm:
        - name: sr-admin
        - name: sr-developer
        - name: sr-readonly
    clients:
      - clientId: registry-client-ui
        implicitFlowEnabled: true
        redirectUris:
          - '*'
        standardFlowEnabled: true
        webOrigins:
          - '*'
        publicClient: true
      - clientId: registry-client-api
        implicitFlowEnabled: true
        redirectUris:
          - '*'
        standardFlowEnabled: true
        webOrigins:
          - '*'
        publicClient: true
    users:
      - credentials:
          - temporary: false
            type: password
            value: changeme
        enabled: true
        realmRoles:
          - sr-admin
        username: registry-admin
      - credentials:
          - temporary: false
```

```
      type: password
      value: changeme
  enabled: true
  realmRoles:
    - sr-developer
  username: registry-developer
- credentials:
    - temporary: false
      type: password
      value: changeme
  enabled: true
  realmRoles:
    - sr-readonly
  username: registry-user
```

IMPORTANT

You must customize this **KeycloakRealm** resource with values suitable for your environment if you are deploying to production. You can also create and manage realms using the Red Hat Single Sign-On web console.

6. If your cluster does not have a valid HTTPS certificate configured, you can create the following HTTP **Service** and **Ingress** resources as a temporary workaround:

   a. Click **Networking** and then **Services**, and click **Create Service** using the following example:

```
apiVersion: v1
kind: Service
metadata:
  name: keycloak-http
  labels:
    app: keycloak
spec:
  ports:
    - name: keycloak-http
      protocol: TCP
      port: 8080
      targetPort: 8080
  selector:
    app: keycloak
    component: keycloak
  type: ClusterIP
  sessionAffinity: None
status:
  loadBalancer: {}
```

   b. Click **Networking** and then **Ingresses**, and click **Create Ingress** using the following example::

```
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  name: keycloak-http
  labels:
    app: keycloak
```

```
spec:
  rules:
    - host: keycloak-http.local
      http:
        paths:
          - path: /
            pathType: ImplementationSpecific
            backend:
              serviceName: keycloak-http
              servicePort: 8080
```

Modify the **host** value to create a route accessible for the Service Registry user, and use it instead of the HTTPS route created by Red Hat Single Sign-On Operator.

7. Click the **Service Registry Operator**, and on the **ApicurioRegistry** tab, click **Create ApicurioRegistry**, using the following example, but replace your values in the **keycloak** section.

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry-kafkasql-keycloak
spec:
  configuration:
    security:
      keycloak:
        url: "http://keycloak-http-<namespace>.apps.<cluster host>/auth"
        # ^ Required
        # Keycloak server URL, must end with `/auth`.
        # Use an HTTP URL in development.
        realm: "registry"
        # apiClientId: "registry-client-api"
        # ^ Optional (default value)
        # uiClientId: "registry-client-ui"
        # ^ Optional (default value)
    persistence: 'kafkasql'
    kafkasql:
      bootstrapServers: '<my-cluster>-kafka-bootstrap.<my-namespace>.svc:9092'
```

5.2. CONFIGURING SERVICE REGISTRY AUTHENTICATION AND AUTHORIZATION WITH RED HAT SINGLE SIGN-ON

This section explains how to manually configure authentication and authorization options for Service Registry using Red Hat Single Sign-On.

NOTE

Alternatively, for details on how to configure these settings automatically, see Section 5.1, “Securing Service Registry using the Red Hat Single Sign-On Operator” .

You can enable authentication for the Service Registry web console and core REST API using Red Hat Single Sign-On based on OAuth using OpenID Connect (OIDC). The same Red Hat Single Sign-On realm and users are federated across the Service Registry web console and core REST API using OpenID Connect so that you only require one set of credentials.

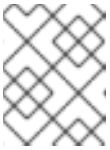
Service Registry provides role-based authorization for default admin, write, and read-only user roles. Service Registry also provides content-based authorization at the schema or API level, where only the creator of the registry artifact can update or delete it. Service Registry authentication and authorization settings are disabled by default.

Prerequisites

- Red Hat Single Sign-On is installed and running. For more details, see the Red Hat Single Sign-On user documentation.
- Service Registry is installed and running.

Procedure

1. In the Red Hat Single Sign-On Admin Console, create a Red Hat Single Sign-On realm for Service Registry. By default, Service Registry expects a realm name of **registry**. For more details on creating realms, see the Red Hat Single Sign-On user documentation .
2. Create a Red Hat Single Sign-On client for the Service Registry API. By default, Service Registry expects the following settings:
   - Client ID: **registry-api**
   - Client Protocol: **openid-connect**
   - Access Type: **bearer-only**
     You can use the defaults for the other client settings.

   NOTE

   If you are using Red Hat Single Sign-On service accounts, the client **Access Type** must be **confidential** instead of **bearer-only**.
3. Create a Red Hat Single Sign-On client for the Service Registry web console. By default, Service Registry expects the following settings:
   - Client ID: **apicurio-registry**
   - Client Protocol: **openid-connect**
   - Access Type: **public**
   - Valid Redirect URLs: **http://my-registry-url:8080/***
   - Web Origins: **+**
     You can use the defaults for the other client settings.
4. In your Service Registry deployment on OpenShift, set the following Service Registry environment variables to configure authentication using Red Hat Single Sign-On:

   Table 5.2. Configuration for Service Registry authentication

Environment variable	Description	Type	Default

Environment variable	Description	Type	Default
AUTH_ENABLED	If set to **true**, the environment variables that follow are required.	String	**false**
KEYCLOAK_URL	The URL of the Red Hat Single Sign-On authentication server to use. Must end with /**auth**.	String	None
KEYCLOAK_REALM	The Red Hat Single Sign-On realm used for authentication.	String	**registry**
KEYCLOAK_API_CLIENT_ID	The client ID for the Service Registry REST API.	String	**registry-api**
KEYCLOAK_UI_CLIENT_ID	The client ID for the Service Registry web console.	String	**apicurio-registry**

TIP

For an example of setting environment variables on OpenShift, see Section 6.1, "Configuring Service Registry health checks on OpenShift".

5. Set the following option to **true** to enable Service Registry user roles in Red Hat Single Sign-On:

Table 5.3. Configuration for Service Registry user roles

Environment variable	Java system property	Type	Default value
ROLES_ENABLED	**registry.auth.roles.enabled**	Boolean	**false**

6. When Service Registry user roles are enabled, you must assign Service Registry users to at least one of the following default user roles in your Red Hat Single Sign-On realm:

Table 5.4. Default user roles for registry authentication and authorization

Role	Read artifacts	Write artifacts	Global rules	Summary
sr-admin	Yes	Yes	Yes	Full access to all create, read, update, and delete operations.

Role	Read artifacts	Write artifacts	Global rules	Summary
sr-developer	Yes	Yes	No	Access to create, read, update, and delete operations, except configuring global rules. This role can configure artifact rules.
sr-readonly	Yes	No	No	Access to read and search operations only. This role cannot configure any rules.

7. Set the following to **true** to enable owner-only authorization for updates to schema and API artifacts in Service Registry:

Table 5.5. Configuration for owner-only authorization

Environment variable	Java system property	Type	Default value
REGISTRY_AUTH_OWNER_ONLY_AUTHORIZATION	**registry.auth.owner-only-authorization**	Boolean	**false**

Additional resources

- For an open source example application and Keycloak realm, see Docker Compose-based example of using Keycloak with Apicurio Registry
- For details on how to use Red Hat Single Sign-On in a production environment, see see Red Hat Single Sign-On documentation
- For details on custom security configuration, the see Quarkus Open ID Connect documentation

5.3. CONFIGURING AN HTTPS CONNECTION TO SERVICE REGISTRY FROM INSIDE THE OPENSHIFT CLUSTER

The following procedure shows how to configure Service Registry deployment to expose a port for HTTPS connections from inside the OpenShift cluster.

WARNING

This kind of connection is not directly available outside of the cluster. Routing is based on hostname, which is encoded in the case of an HTTPS connection. Therefore, edge termination or other configuration is still needed. See Section 5.4, "Configuring an HTTPS connection to Service Registry from outside the OpenShift cluster".

Prerequisites

- You must have already installed the Service Registry Operator.

Procedure

1. Generate a **keystore** with a self-signed certificate. You can skip this step if you are using your own certificates.

```
keytool -genkey -trustcacerts -keyalg RSA -keystore registry-keystore.jks -storepass password
```

2. Create a new secret to hold the keystore and keystore password.

   a. In the left navigation menu of the OpenShift web console, click **Workloads** > **Secrets** > **Create Key/Value Secret**

   b. Use the following values:
   Name: **registry-keystore**
   Key 1: **keystore.jks**
   Value 1: *registry-keystore.jks* (uploaded file)
   Key 2: **password**
   Value 2: *password*

NOTE

If you encounter a **java.io.IOException: Invalid keystore format**, the upload of the binary file did not work properly. As an alternative, encode the file as a base64 string using **cat registry-keystore.jks | base64 -w0 > data.txt** and edit the **Secret** resource as yaml to manually add the encoded file.

3. Edit the **Deployment** resource of the Service Registry instance. You can find the correct name in a status field of the Service Registry Operator.

   a. Add the keystore secret as a volume:

```
template:
  spec:
    volumes:
    - name: registry-keystore-secret-volume
      secret:
      secretName: registry-keystore
```

b. Add a volume mount:

```
volumeMounts:
  - name: registry-keystore-secret-volume
    mountPath: /etc/registry-keystore
    readOnly: true
```

c. Add **JAVA_OPTIONS** and **KEYSTORE_PASSWORD** environment variables:

```
- name: KEYSTORE_PASSWORD
  valueFrom:
    secretKeyRef:
      name: registry-keystore
      key: password
- name: JAVA_OPTIONS
    value: >-
     -Dquarkus.http.ssl.certificate.key-store-file=/etc/registry-keystore/keystore.jks
     -Dquarkus.http.ssl.certificate.key-store-file-type=jks
     -Dquarkus.http.ssl.certificate.key-store-password=$(KEYSTORE_PASSWORD)
```

NOTE

Order is important when using string interpolation.

d. Enable the HTTPS port:

```
ports:
  - containerPort: 8080
    protocol: TCP
  - containerPort: 8443
    protocol: TCP
```

4. Edit the **Service** resource of the Service Registry instance. You can find the correct name in a status field of the Service Registry Operator.

```
ports:
  - name: http
    protocol: TCP
    port: 8080
    targetPort: 8080
  - name: https
    protocol: TCP
    port: 8443
    targetPort: 8443
```

5. Verify that the connection is working:

a. Connect into a pod on the cluster using SSH (you can use the Service Registry pod):

```
oc rsh -n default example-apicurioregistry-deployment-vx28s-4-lmtqb
```

b. Find the cluster IP of the Service Registry pod from the **Service** resource (see the **Location** column in the web console). Afterwards, execute a test request (we are using self-signed certificate, so an insecure flag is required):

```
curl -k https://172.30.209.198:8443/health
[...]
```

5.4. CONFIGURING AN HTTPS CONNECTION TO SERVICE REGISTRY FROM OUTSIDE THE OPENSHIFT CLUSTER

The following procedure shows how to configure Service Registry deployment to expose an HTTPS edge-terminated route for connections from outside the OpenShift cluster.

Prerequisites

- You must have already installed the Service Registry Operator.
- Read the OpenShift documentation for creating secured routes.

Procedure

1. Add a second **Route** in addition to the HTTP route created by the Service Registry Operator. See the following example:

```
kind: Route
apiVersion: route.openshift.io/v1
metadata:
  [...]
  labels:
    app: example-apicurioregistry
    [...]
spec:
  host: example-apicurioregistry-default.apps.example.com
  to:
    kind: Service
    name: example-apicurioregistry-service-9whd7
    weight: 100
  port:
    targetPort: 8080
  tls:
    termination: edge
    insecureEdgeTerminationPolicy: Redirect
  wildcardPolicy: None
```

NOTE

Make sure the **insecureEdgeTerminationPolicy: Redirect** configuration property is set.

If you do not specify a certificate, OpenShift will use a default. You can alternatively generate a custom self-signed certificate using the following commands:

```
openssl genrsa 2048 > host.key &&
openssl req -new -x509 -nodes -sha256 -days 365 -key host.key -out host.cert
```

and then create a route using the OpenShift CLI:

```
oc create route edge \
  --service=example-apicurioregistry-service-9whd7 \
  --cert=host.cert --key=host.key \
  --hostname=example-apicurioregistry-default.apps.example.com \
  --insecure-policy=Redirect \
  -n default
```

CHAPTER 6. CONFIGURING AND MANAGING A SERVICE REGISTRY DEPLOYMENT

This chapter explains how to configure and manage optional settings for your Service Registry deployment on OpenShift:

6.1. CONFIGURING SERVICE REGISTRY HEALTH CHECKS ON OPENSHIFT

You can configure optional environment variables for liveness and readiness probes to monitor the health of the Service Registry server on OpenShift:

- *Liveness probes* test if the application can make progress. If the application cannot make progress, OpenShift automatically restarts the failing Pod.
- *Readiness probes* test if the application is ready to process requests. If the application is not ready, it can become overwhelmed by requests, and OpenShift stops sending requests for the time that the probe fails. If other Pods are OK, they continue to receive requests.

IMPORTANT

The default values of the liveness and readiness environment variables are designed for most cases and should only be changed if required by your environment. Any changes to the defaults depend on your hardware, network, and amount of data stored. These values should be kept as low as possible to avoid unnecessary overhead.

Prerequisites

- You must have an OpenShift cluster with cluster administrator access.
- You must have already installed Service Registry on OpenShift.
- You must have already installed and configured your chosen Service Registry storage in AMQ Streams or PostgreSQL.

Procedure

1. In the OpenShift Container Platform web console, log in using an account with cluster administrator privileges.
2. Click **Installed Operators** > **Red Hat Integration - Service Registry**

3. On the **ApicurioRegistry** tab, click the Operator custom resource for your deployment, for example, **example-apicurioregistry**.

4. In the main overview page, find the **Deployment Name** section and the corresponding **DeploymentConfig** name for your Service Registry deployment, for example, **example-apicurioregistry**.

5. In the left navigation menu, click **Workloads** > **Deployment Configs**, and select your **DeploymentConfig** name.

6. Click the **Environment** tab, and enter your environment variables in the **Single values env** section, for example:

   - NAME: **LIVENESS_STATUS_RESET**
   - VALUE: **350**

7. Click **Save** at the bottom.
   Alternatively, you can perform these steps using the OpenShift **oc** command. For more details, see the OpenShift CLI documentation.

Additional resources

- Section 6.2, "Environment variables for Service Registry health checks"
- OpenShift documentation on monitoring application health

6.2. ENVIRONMENT VARIABLES FOR SERVICE REGISTRY HEALTH CHECKS

This section describes the available environment variables for Service Registry health checks on OpenShift. These include liveness and readiness probes to monitor the health of the Service Registry server on OpenShift. For an example procedure, see Section 6.1, "Configuring Service Registry health checks on OpenShift".

IMPORTANT

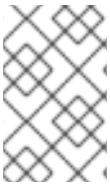
The following environment variables are provided for reference only. The default values are designed for most cases and should only be changed if required by your environment. Any changes to the defaults depend on your hardware, network, and amount of data stored. These values should be kept as low as possible to avoid unnecessary overhead.

Liveness environment variables

Table 6.1. Environment variables for Service Registry liveness probes

Name	Description	Type	Default
LIVENESS_ERROR_THRESHOLD	Number of liveness issues or errors that can occur before the liveness probe fails.	Integer	**1**

Name	Description	Type	Default
LIVENESS_COUNTER_RESET	Period in which the threshold number of errors must occur. For example, if this value is 60 and the threshold is 1, the check fails after two errors occur in 1 minute	Seconds	**60**
LIVENESS_STATUS_RESET	Number of seconds that must elapse without any more errors for the liveness probe to reset to OK status.	Seconds	**300**
LIVENESS_ERRORS_IGNORED	Comma-separated list of ignored liveness exceptions.	String	**io.grpc.StatusRuntimeException,org.apache.kafka.streams.errors.InvalidStateStoreException**



NOTE

Because OpenShift automatically restarts a Pod that fails a liveness check, the liveness settings, unlike readiness settings, do not directly affect behavior of Service Registry on OpenShift.

Readiness environment variables

Table 6.2. Environment variables for Service Registry readiness probes

Name	Description	Type	Default
READINESS_ERROR_THRESHOLD	Number of readiness issues or errors that can occur before the readiness probe fails.	Integer	**1**
READINESS_COUNTER_RESET	Period in which the threshold number of errors must occur. For example, if this value is 60 and the threshold is 1, the check fails after two errors occur in 1 minute.	Seconds	**60**
READINESS_STATUS_RESET	Number of seconds that must elapse without any more errors for the liveness probe to reset to OK status. In this case, this means how long the Pod stays not ready, until it returns to normal operation.	Seconds	**300**

Name	Description	Type	Default
READINESS_TIMEOUT	Readiness tracks the timeout of two operations: • How long it takes for storage requests to complete • How long it takes for HTTP REST API requests to return a response If these operations take more time than the configured timeout, this is counted as a readiness issue or error. This value controls the timeouts for both operations.	Seconds	**5**

Additional resources

- Section 6.1, "Configuring Service Registry health checks on OpenShift"
- OpenShift documentation on monitoring application health

6.3. MANAGING SERVICE REGISTRY ENVIRONMENT VARIABLES

Service Registry Operator manages most common Service Registry configuration, but there are some options that you can adjust manually. You can update these by setting an environment variable on the Service Registry **Deployment** resource. If the specific configuration option is not available in the **ApicurioRegistry** CR, you can use an environment variable to adjust it.

Procedure

OpenShift web console

1. Select the **Installed Operators** tab, and then the **Red Hat Integration - Service Registry Operator**.
2. On the **Apicurio Registry** tab, click the **ApicurioRegistry** CR for your Service Registry deployment.
3. On the main overview page, view the **managedResources** section, which contains the name of the **Deployment** managed by the Operator to deploy your Service Registry instance.
4. Find that **Deployment** in the **Workloads** > **Deployments** in the left menu.
5. Select the **Deployment** with the correct name, and select the **Environment** tab.
6. You can add or modify your environment variable to the **Single values (env)** section.
7. Click **Save** at the bottom.

OpenShift CLI

1. Select the project where Service Registry is installed.
2. Run **oc get apicurioregistry** to get the list of **ApicurioRegistry** CRs
3. Run **oc describe** on the CR representing the Service Registry instance that you want to configure.
4. View the **managedResource** in the **status** section.
5. Find that **Deployment** and enter **oc edit**.
6. Add or modify the environment variable in the **spec.template.spec.containers[0].env** section.

6.4. CONFIGURING THE SERVICE REGISTRY WEB CONSOLE

You can configure the Service Registry web console specifically for your deployment environment or to customize its behavior. This section provides details on how to configure optional environment variables for the Service Registry web console.

Prerequisites

- You must have already installed Service Registry.

Configuring the web console deployment environment

When a user navigates their browser to the Service Registry web console, some initial configuration settings are loaded. Two important configuration properties are:

- URL for backend Service Registry REST API
- URL for frontend Service Registry web console

Typically, Service Registry automatically detects and generates these settings, but there are some deployment environments where this automatic detection can fail. If this happens, you can configure environment variables to explicitly set these URLs for your environment.

Procedure

Configure the following environment variables to override the default URLs:

- **REGISTRY_UI_CONFIG_APIURL**: Set the URL for the backend Service Registry REST API. For example, **https://registry.my-domain.com/apis/registry**
- **REGISTRY_UI_CONFIG_UIURL**: Set the URL for the frontend Service Registry web console. For example, **https://registry.my-domain.com/ui**

Configuring the console in read-only mode

You can configure the Service Registry web console in read-only mode as an optional feature. This mode disables all features in the Service Registry web console that allow users to make changes to registered artifacts. For example, this includes the following:

- Creating an artifact
- Uploading a new version of an artifact
- Updating an artifact's metadata

- Deleting an artifact

Procedure

Configure the following environment variable to set the Service Registry web console in read-only mode:

- **REGISTRY_UI_FEATURES_READONLY**: Set to **true** to enable read-only mode. Defaults to **false**.

6.5. CONFIGURING SERVICE REGISTRY LOGGING

You can set Service Registry logging configuration at runtime. Service Registry provides a REST endpoint to set the log level for specific loggers for finer grained logging. This section explains how to view and set Service Registry log levels at runtime using the Service Registry **/admin** REST API.

Prerequisites

- Get the URL to access your Service Registry instance, or get your Service Registry route if you have Service Registry deployed on OpenShift. This simple example uses a URL of **localhost:8080**.

Procedure

1. Use this **curl** command to obtain the current log level for the logger **io.apicurio.registry.storage**:

```
$ curl -i localhost:8080/apis/registry/v2/admin/loggers/io.apicurio.registry.storage
HTTP/1.1 200 OK
[...]
Content-Type: application/json
{"name":"io.apicurio.registry.storage","level":"INFO"}
```

2. Use this **curl** command to change the log level for the logger **io.apicurio.registry.storage** to **DEBUG**:

```
$ curl -X PUT -i -H "Content-Type: application/json" --data '{"level":"DEBUG"}'
localhost:8080/apis/registry/v2/admin/loggers/io.apicurio.registry.storage
HTTP/1.1 200 OK
[...]
Content-Type: application/json
{"name":"io.apicurio.registry.storage","level":"DEBUG"}
```

3. Use this **curl** command to revert the log level for the logger **io.apicurio.registry.storage** to its default value:

```
$ curl -X DELETE -i localhost:8080/apis/registry/v2/admin/loggers/io.apicurio.registry.storage
HTTP/1.1 200 OK
[...]
Content-Type: application/json
{"name":"io.apicurio.registry.storage","level":"INFO"}
```

6.6. CONFIGURING SERVICE REGISTRY EVENT SOURCING

You can configure Service Registry to send events when changes are made to the registry. For example, Service Registry can trigger events when schema and API artifacts are created, updated, deleted, and so on. You can configure Service Registry to send events to your applications and to third-party integrations in this way.

There are different protocols available for transporting the events. The currently implemented protocols are HTTP and Apache Kafka. However, regardless of the protocol, the events are sent using the CNCF CloudEvents specification.

All of the event types are defined in **io.apicurio.registry.events.dto.RegistryEventType**. For example, the event types include:

- **io.apicurio.registry.artifact-created**
- **io.apicurio.registry.artifact-updated**
- **io.apicurio.registry.artifact-rule-created**
- **io.apicurio.registry.global-rule-created**

You can configure cloud events in Service Registry using Java system properties or equivalent environment variables.

Prerequisites

- You must have an application that you want to send Service Registry cloud events to. For example, this can be a custom application or a third-party application.

Configuring Service Registry event sourcing using HTTP

The example in this section shows a custom application running at **http://my-app-host:8888/events**.

Procedure

1. When using the HTTP protocol, set your Service Registry configuration to send events to a your application as follows:
   - **registry.events.sink.my-custom-consumer=http://my-app-host:8888/events**
2. If required, you can configure multiple event consumers as follows:
   - **registry.events.sink.my-custom-consumer=http://my-app-host:8888/events**
   - **registry.events.sink.other-consumer=http://my-consumer.com/events**

Configuring Service Registry event sourcing using Apache Kafka

The example in this section shows a Kafka topic named **my-registry-events** running on **my-kafka-host:9092**.

Procedure

1. When using the Kafka protocol, set your Kafka topic as follows:
   - **registry.events.kafka.topic=my-registry-events**
2. You can set the configuration for the Kafka producer using the **KAFKA_BOOTSTRAP_SERVERS** environment variable:

- **KAFKA_BOOTSTRAP_SERVERS=my-kafka-host:9092**
  Alternatively, you can set the properties for the kafka producer using the **registry.events.kafka.config** prefix, for example:
  registry.events.kafka.config.bootstrap.servers=my-kafka-host:9092

3. If required, you can also set the Kafka topic partition to use to produce events:

   - **registry.events.kafka.topic-partition=1**

Additional resources

- For more details, see the CNCF CloudEvents specification

CHAPTER 7. SERVICE REGISTRY OPERATOR CONFIGURATION REFERENCE

This chapter provides detailed information on the custom resource used to configure the Service Registry Operator to deploy Service Registry:

- Section 7.1, “Service Registry Custom Resource”
- Section 7.2, “Service Registry CR spec”
- Section 7.3, “Service Registry CR status”
- Section 7.5, “Service Registry Operator labels”
- Section 7.4, “Service Registry managed resources”

7.1. SERVICE REGISTRY CUSTOM RESOURCE

The Service Registry Operator defines an **ApicurioRegistry** custom resource (CR) that represents a single deployment of Service Registry on OpenShift.

These resource objects are created and maintained by users to instruct the Service Registry Operator how to deploy and configure Service Registry.

Example ApicurioRegistry CR

The following command displays the **ApicurioRegistry** resource:

```
oc get apicurioregistry
oc edit apicurioregistry example-apicurioregistry
```

```
apiVersion: registry.apicur.io/v1
kind: ApicurioRegistry
metadata:
  name: example-apicurioregistry
  namespace: demo-kafka
  # ...
spec:
  configuration:
    persistence: kafkasql
    kafkasql:
      bootstrapServers: 'my-cluster-kafka-bootstrap.demo-kafka.svc:9092'
  deployment:
    host: >-
      example-apicurioregistry.demo-kafka.example.com
status:
  conditions:
  - lastTransitionTime: "2021-05-03T10:47:11Z"
    message: ""
    reason: Reconciled
    status: "True"
    type: Ready
  info:
    host: example-apicurioregistry.demo-kafka.example.com
  managedResources:
```

```
- kind: Deployment
  name: example-apicurioregistry-deployment
  namespace: demo-kafka
- kind: Service
  name: example-apicurioregistry-service
  namespace: demo-kafka
- kind: Ingress
  name: example-apicurioregistry-ingress
  namespace: demo-kafka
```

IMPORTANT

By default, the Service Registry Operator only watches its own project namespace. Therefore you must create the **ApicurioRegistry** CR in the same namespace, if you are deploying the operator manually. You can modify this behavior by updating **WATCH_NAMESPACE** environment variable in the Operator **Deployment** resource.

Additional resources

- Extending the Kubernetes API with Custom Resource Definitions

7.2. SERVICE REGISTRY CR SPEC

The **spec** is the part of the **ApicurioRegistry** CR that is used to provide the desired state or configuration for the Operator to achieve.

ApicurioRegistry CR spec contents

The following example block contains the full tree of possible **spec** configuration options. Some fields may not be required or should not be defined at the same time.

```
spec:
  configuration:
    persistence: <string>
    sql:
      dataSource:
        url: <string>
        userName: <string>
        password: <string>
    kafkasql:
      bootstrapServers: <string>
      security:
        tls:
          truststoreSecretName: <string>
          keystoreSecretName: <string>
        scram:
          mechanism: <string>
          truststoreSecretName: <string>
          user: <string>
          passwordSecretName: <string>
    ui:
      readOnly: <string>
    logLevel: <string>
    security:
      keycloak:
```

```
      url: <string>
      realm: <string>
      apiClientId: <string>
      uiClientId: <string>
  deployment:
    replicas: <int32>
    host: <string>
    affinity: <k8s.io/api/core/v1 Affinity struct>
    tolerations: <k8s.io/api/core/v1 []Toleration slice>
```

The following table describes each configuration option:

Table 7.1. ApicurioRegistry CR spec configuration options

Configuration option	type	Default value	Description
configuration	-	-	Section for configuration of Service Registry application
configuration/persistence	string	*required*	Storage backend. One of **sql**, **kafkasql**
configuration/sql	-	-	SQL storage backend configuration
configuration/sql/dataSource	-	-	Database connection configuration for SQL storage backend
configuration/sql/dataSource/url	string	*required*	Database connection URL string
configuration/sql/dataSource/userName	string	*required*	Database connection user
configuration/sql/dataSource/password	string	*empty*	Database connection password
configuration/kafkasql	-	-	Kafka storage backend configuration
configuration/kafkasql/bootstrapServers	string	*required*	Kafka bootstrap server URL, for Streams storage backend
configuration/kafkasql/security/tls	-	-	Section to configure TLS authentication for Kafka storage backend

Configuration option	type	Default value	Description
configuration/kafkasql/security/tls/truststoreSecretName	string	*required*	Name of a secret containing TLS truststore for Kafka
configuration/kafkasql/security/tls/keystoreSecretName	string	*required*	Name of a secret containing user TLS keystore
configuration/kafkasql/security/scram/truststoreSecretName	string	*required*	Name of a secret containing TLS truststore for Kafka
configuration/kafkasql/security/scram/user	string	*required*	SCRAM user name
configuration/kafkasql/security/scram/passwordSecretName	string	*required*	Name of a secret containing SCRAM user password
configuration/kafkasql/security/scram/mechanism	string	**SCRAM-SHA-512**	SASL mechanism
configuration/ui	-	-	Service Registry web console settings
configuration/ui/readOnly	string	**false**	Set Service Registry web console to read-only mode
configuration/logLevel	string	**INFO**	Service Registry log level. One of **INFO**, **DEBUG**
configuration/security	-	-	Service Registry web console and REST API security settings
configuration/security/keycloak	-	-	Web console and REST API security configuration using Keycloak
configuration/security/keycloak/url	string	*required*	Keycloak URL, must end with **/auth**
configuration/security/keycloak/realm	string	*required*	Keycloak realm

Configuration option	type	Default value	Description
configuration/security/keycloak/apiClientId	string	**registry-client-api**	Keycloak client for REST API
configuration/security/keycloak/uiClientId	string	**registry-client-ui**	Keycloak client for web console
deployment	-	-	Section for Service Registry deployment settings
deployment/replicas	positive integer	**1**	Number of Service Registry pods to deploy
deployment/host	string	*auto-generated*	Host/URL where the Service Registry console and API are available. If possible, Service Registry Operator attempts to determine the correct value based on the settings of your cluster router. The value is auto-generated only once, so user can override it afterwards.
deployment/affinity	k8s.io/api/core/v1 Affinity struct	*empty*	Service Registry deployment affinity configuration
deployment/tolerations	k8s.io/api/core/v1 []Toleration slice	*empty*	Service Registry deployment tolerations configuration

NOTE

If an option is marked as *required*, it might be conditional on other configuration options being enabled. Empty values might be accepted, but the Operator does not perform the specified action.

7.3. SERVICE REGISTRY CR STATUS

The **status** is the section of the CR managed by the Service Registry Operator that contains a description of the current deployment and application state.

ApicurioRegistry CR status contents

The **status** section contains the following fields:

```
status:
  info:
    host: <string>
  conditions: <list of:>
  - type: <string>
    status: <string, one of: True, False, Unknown>
    reason: <string>
    message: <string>
    lastTransitionTime: <string, RFC-3339 timestamp>
  managedResources: <list of:>
  - kind: <string>
    namespace: <string>
    name: <string>
```

Table 7.2. ApicurioRegistry CR status fields

Status field	Type	Description
info	-	Section with information about the deployed Service Registry.
info/host	string	URL where the Service Registry UI and REST API are accessible.
conditions	-	List of conditions that report the status of the Service Registry, or the Operator with respect to that deployment.
conditions/type	string	Type of the condition.
conditions/status	string	Status of the condition, one of **True**, **False**, **Unknown**.
conditions/reason	string	A programmatic identifier indicating the reason for the condition's last transition.
conditions/message	string	A human readable message indicating details about the transition.
conditions/lastTransitionTime	string	The last time the condition transitioned from one status to another.
managedResources	-	List of OpenShift resources managed by Service Registry Operator
managedResources/kind	string	Resource kind.
managedResources/namespace	string	Resource namespace.

Status field	Type	Description
managedResources/name	string	Resource name.

7.4. SERVICE REGISTRY MANAGED RESOURCES

The resources managed by the Service Registry Operator when deploying Service Registry are as follows:

- **Deployment**
- **Service**
- **Ingress** (and **Route**)
- **PodDisruptionBudget**

7.5. SERVICE REGISTRY OPERATOR LABELS

Resources managed by the Service Registry Operator are usually labeled as follows:

Table 7.3. Service Registry Operator labels for managed resources

Label	Description
app	Name of the Service Registry deployment that the resource belongs to, based on the name of the specified **ApicurioRegistry** CR.
apicur.io/type	Type of the deployment: **apicurio-registry** or **operator**
apicur.io/name	Name of the deployment: same value as **app** or **apicurio-registry-operator**
apicur.io/version	Version of the Service Registry or the Service Registry Operator
app.kubernetes.io/*	A set of recommended Kubernetes labels for application deployments.
com.company and **rht.*`**	Metering labels for Red Hat products.

Additional resources

- Recommended Kubernetes labels for application deployments

APPENDIX A. USING YOUR SUBSCRIPTION

Service Registry 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 Integration** entries in the **Integration and Automation** category.
3. Select the desired Service Registry 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 .