Red Hat Integration 2022.q3

Service Registry User Guide

Using Service Registry 2.3

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Legal Notice

Abstract

This guide introduces Service Registry and explains how to manage event schemas and API designs using the Service Registry web console, REST API, Maven plug-in, or Java client. This guide also explains how to to use Kafka client serializers and deserializers in your Java consumer and producer applications. It also describes the supported Service Registry content types, and optional rule configuration.

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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. INTRODUCTION TO SERVICE REGISTRY

This chapter introduces Service Registry concepts and features and provides details on the supported artifact types that are stored in the registry:

1.1. WHAT IS SERVICE REGISTRY?

Service Registry is a datastore for sharing standard event schemas and API designs across event-driven and API architectures. You can use Service Registry to decouple the structure of your data from your client applications, and to share and manage your data types and API descriptions at runtime using a REST interface.

For example, client applications can dynamically push or pull the latest schema updates to or from Service Registry at runtime without needing to redeploy. Developer teams can query the registry for existing schemas required for services already deployed in production, and can register new schemas required for new services in development.

You can enable client applications to use schemas and API designs stored in Service Registry by specifying the registry URL in your client application code. For example, the registry can store schemas used to serialize and deserialize messages, which are then referenced from your client applications to ensure that the messages that they send and receive are compatible with those schemas.

Using Service Registry to decouple your data structure from your applications reduces costs by decreasing overall message size, and creates efficiencies by increasing consistent reuse of schemas and API designs across your organization. Service Registry provides a web console to make it easy for developers and administrators to manage registry content.

In addition, you can configure optional rules to govern the evolution of your registry content. For example, these include rules to ensure that uploaded content is syntactically and semantically valid, or is backwards and forwards compatible with other versions. Any configured rules must pass before new versions can be uploaded to the registry, which ensures that time is not wasted on invalid or incompatible schemas or API designs.

Service Registry is based on the Apicurio Registry open source community project. For details, see https://github.com/apicurio/apicurio-registry.

Service Registry capabilities

- Multiple payload formats for standard event schema and API specifications such as Apache

Avro, JSON Schema, Protobuf, AsyncAPI, OpenAPI, and more

- Pluggable registry storage options in AMQ Streams or PostgreSQL database
- Rules for content validation and version compatibility to govern how registry content evolves over time
- Registry content management using web console, REST API, command line, Maven plug-in, or Java client
- Full Apache Kafka schema registry support, including integration with Kafka Connect for external systems
- Kafka client serializers/deserializers (SerDes) to validate message types at runtime
- Compatibility with existing Confluent or IBM schema registry client applications
- Cloud-native Quarkus Java runtime for low memory footprint and fast deployment times
- Operator-based installation of Service Registry on OpenShift
- OpenID Connect (OIDC) authentication using Red Hat Single Sign-On

1.2. SCHEMA AND API ARTIFACTS IN SERVICE REGISTRY

The items stored in Service Registry, such as event schemas and API designs, are known as registry *artifacts*. The following shows an example of an Apache Avro schema artifact in JSON format for a simple share price application:

Example Avro schema

```
{
  "type": "record",
  "name": "price",
  "namespace": "com.example",
  "fields": [
    {
      "name": "symbol",
      "type": "string"
    },
    {
      "name": "price",
      "type": "string"
    }
  ]
}
```

When a schema or API design is added as an artifact in the registry, client applications can then use that schema or API design to validate that the client messages conform to the correct data structure at runtime.

Service Registry supports a wide range of message payload formats for standard event schemas and API specifications. For example, supported formats include Apache Avro, Google Protobuf, GraphQL, AsyncAPI, OpenAPI, and others.

Groups of schemas and APIs

An *artifact group* is an optional named collection of schema or API artifacts. Each group contains a logically related set of schemas or API designs, typically managed by a single entity, belonging to a particular application or organization.

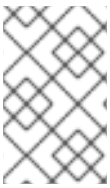
You can create optional artifact groups when adding your schemas and API designs to organize them in Service Registry. For example, you could create groups to match your **development** and **production** application environments, or your **sales** and **engineering** organizations.

Schema and API groups can contain multiple artifact types. For example, you could have Protobuf, Avro, JSON Schema, OpenAPI, or AsyncAPI artifacts all in the same group.

You can create schema and API artifacts and groups using the Service Registry web console, core REST API, command line, Maven plug-in, or Java client application. The following simple example shows using the registry core REST API:

```
$ curl -X POST -H "Content-type: application/json; artifactType=AVRO" \
  -H "X-Registry-ArtifactId: share-price" \
  --data '{"type":"record","name":"price","namespace":"com.example", \
   "fields":[{"name":"symbol","type":"string"},{"name":"price","type":"string"}]}' \
  https://my-registry.example.com/apis/registry/v2/groups/my-group/artifacts
```

This example creates an artifact group named **my-group** and adds an Avro schema with an artifact ID of **share-price**.



NOTE

Specifying a group is optional when using the Service Registry web console, where a **default** group is automatically created. When using the REST API or Maven plug-in, specify the **default** group in the API path if you do not want to create a unique group.

Additional resources

- For more details on schemas and groups, see the Cloud Native Computing Foundation (CNCF) Schema Registry API
- For details on the Service Registry core REST API, see the Apicurio Registry REST API documentation

References to other schemas and APIs

Some Service Registry artifact types can include *artifact references* from one artifact file to another. You can create efficiencies by defining reusable schema or API components, and then referencing them from multiple locations. For example, you can specify a reference in JSON Schema or OpenAPI using a **$ref** statement, or in Google protobuf using an **import** statement, or in Apache Avro using a nested namespace.

The following example shows a simple Avro schema named **TradeKey** that includes a reference to another schema named **Exchange** using a nested namespace:

Tradekey schema with nested Exchange schema

```
{
 "namespace": "com.kubetrade.schema.trade",
 "type": "record",
 "name": "TradeKey",
 "fields": [
```

```
    {
      "name": "exchange",
      "type": "com.kubetrade.schema.common.Exchange"
    },
    {
      "name": "key",
      "type": "string"
    }
  ]
}
```

Exchange schema

```
{
 "namespace": "com.kubetrade.schema.common",
 "type": "enum",
 "name": "Exchange",
 "symbols" : ["GEMINI"]
}
```

An artifact reference is stored in Service Registry as a collection of artifact metadata that maps from an artifact type-specific reference to an internal Service Registry reference. Each artifact reference in Service Registry is composed of the following:

- Group ID
- Artifact ID
- Artifact version
- Artifact reference name

You can manage artifact references using the Service Registry core REST API, Maven plug-in, and Java serializers/deserializers (SerDes). Service Registry stores the artifact references along with the artifact content. Service Registry also maintains a collection of all artifact references so you can search them or list all references for a specific artifact.

Supported artifact types
Service Registry currently supports artifact references for the following artifact types only:

- Avro
- Protobuf
- JSON Schema

Additional resources

- For details on managing artifact references, see:
  - Chapter 4, *Managing Service Registry content using the REST API*
- For a Java code example, see Apicurio Registry SerDes with references

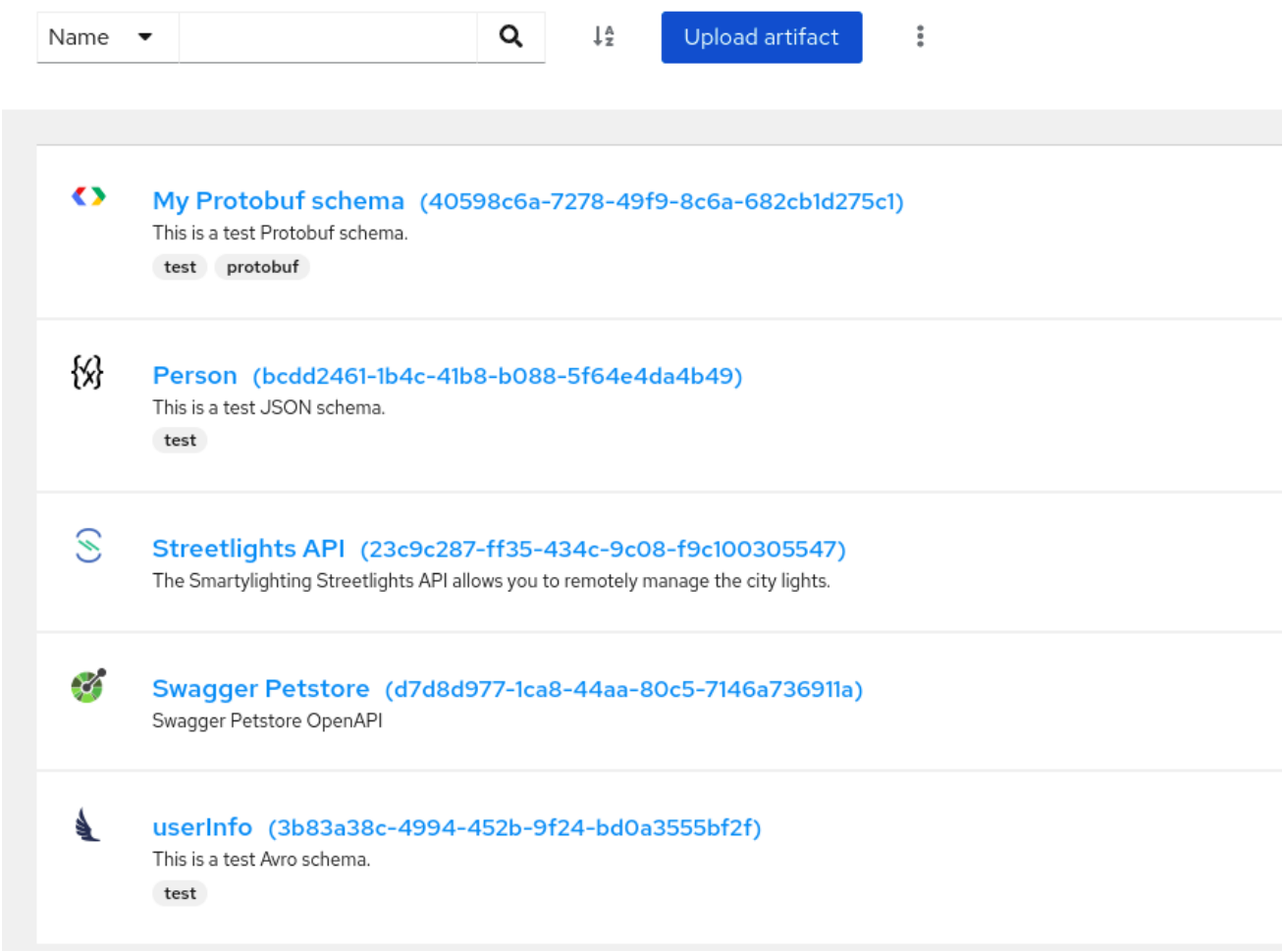
1.3. MANAGE CONTENT USING THE SERVICE REGISTRY WEB CONSOLE

You can use the Service Registry web console to browse and search the schema and API artifacts and optional groups stored in the registry, and to add new schema and API artifacts, groups, and versions. You can search for artifacts by label, name, group, and description. You can view an artifact's content or its available versions, or download an artifact file locally.

You can also configure optional rules for registry content, both globally and for each schema and API artifact. These optional rules for content validation and compatibility are applied when new schema and API artifacts or versions are uploaded to the registry.

For more details, see Chapter 9, *Service Registry artifact reference* .

Figure 1.1. Service Registry web console



The Service Registry web console is available from **http://MY_REGISTRY_URL/ui**.

Additional resources

- Chapter 3, *Managing Service Registry content using the web console*

1.4. SERVICE REGISTRY CORE REST API

Client applications can use the Using the Service Registry core v2 REST API to manage the schema and API artifacts in Service Registry. This API provides create, read, update, and delete operations for:

Artifacts

Manage schema and API artifacts stored in the registry. You can also manage the lifecycle state of an artifact: enabled, disabled, or deprecated.

Artifact versions

Manage versions that are created when a schema or API artifact is updated. You can also manage the lifecycle state of an artifact version: enabled, disabled, or deprecated.

Artifact metadata

Manage details about a schema or API artifact, such as when it was created or modified, and its current state. You can edit the artifact name, description, or labels. The artifact group and when the artifact was created or modified are read-only.

Artifact rules

Configure rules to govern the content evolution of a specific schema or API artifact to prevent invalid or incompatible content from being added to the registry. Artifact rules override any global rules configured.

Global rules

Configure rules to govern the content evolution of all schema and API artifacts to prevent invalid or incompatible content from being added to the registry. Global rules are applied only if an artifact does not have its own specific artifact rules configured.

Search

Browse or search for schema and API artifacts and versions, for example, by name, group, description, or label.

Admin

Export or import registry content in a **.zip** file, and manage logging levels for the registry server instance at runtime.

Compatibility with other schema registry REST APIs

Service Registry provides compatibility with the following schema registries by including implementations of their respective REST APIs:

- Service Registry core v1
- Confluent Schema Registry v6
- IBM Event Streams schema registry v1
- CNCF CloudEvents Schema Registry v0

Applications using Confluent client libraries can use Service Registry as a drop-in replacement. For more details, see Replacing Confluent Schema Registry.

Additional resources

- For detailed reference information, see the Apicurio Registry REST API documentation
- API documentation for the core Service Registry REST API and for all compatible APIs is available from the main endpoint of your Service Registry instance, for example, on **http://MY-REGISTRY-URL/apis**

1.5. SERVICE REGISTRY STORAGE OPTIONS

Service Registry provides the following options for the underlying storage of registry data:

Table 1.1. Service Registry data storage options

Storage option	Description
PostgreSQL 12 database	PostgreSQL is the recommended data storage option for performance, stability, and data management (backup/restore, and so on) in a production environment.
AMQ Streams 2.1	Kafka storage is provided for production environments where database management expertise is not available, or where storage in Kafka is a specific requirement.

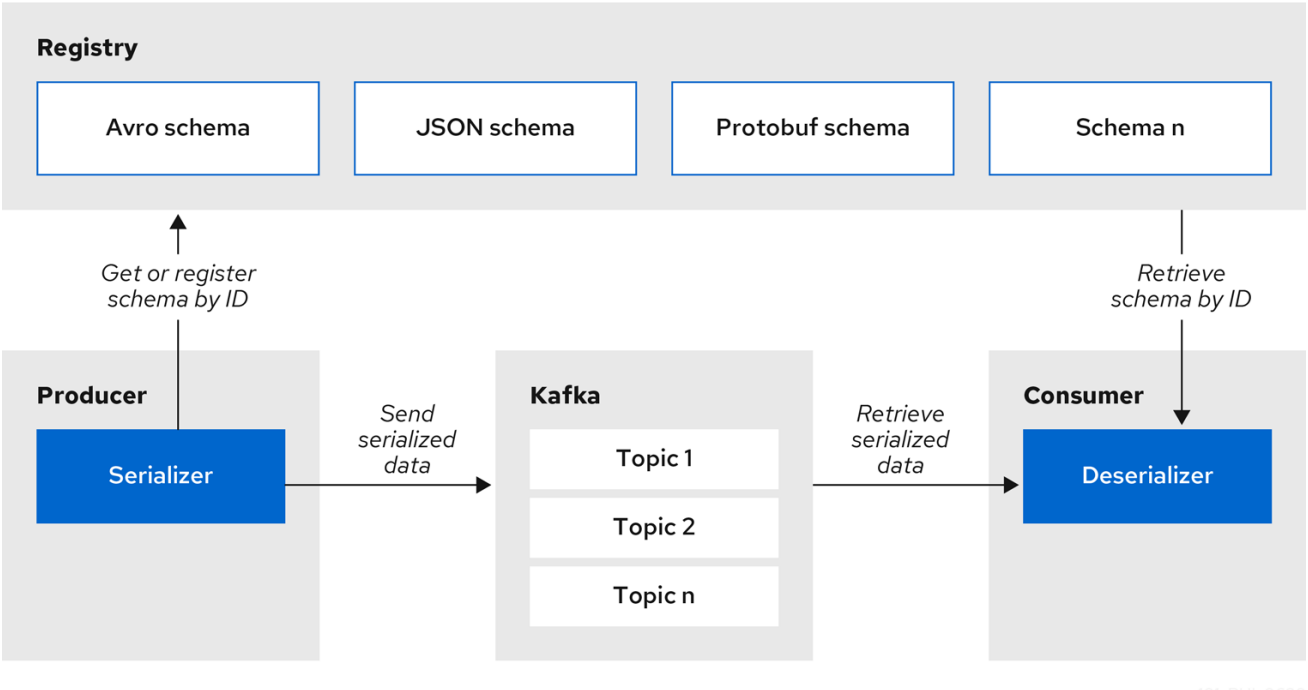
Additional resources

- For more details on storage options, see Installing and deploying Service Registry on OpenShift .

1.6. VALIDATE KAFKA MESSAGES USING SCHEMAS AND JAVA CLIENT SERIALIZERS/DESERIALIZERS

Kafka producer applications can use serializers to encode messages that conform to a specific event schema. Kafka consumer applications can then use deserializers to validate that messages have been serialized using the correct schema, based on a specific schema ID.

Figure 1.2. Service Registry and Kafka client SerDes architecture



Service Registry provides Kafka client serializers/deserializers (SerDes) to validate the following message types at runtime:

- Apache Avro
- Google protocol buffers

- JSON Schema

The Service Registry Maven repository and source code distributions include the Kafka SerDes implementations for these message types, which Kafka client application developers can use to integrate with the registry.

These implementations include custom Java classes for each supported message type, for example, **io.apicurio.registry.serde.avro**, which client applications can use to pull schemas from the registry at runtime for validation.

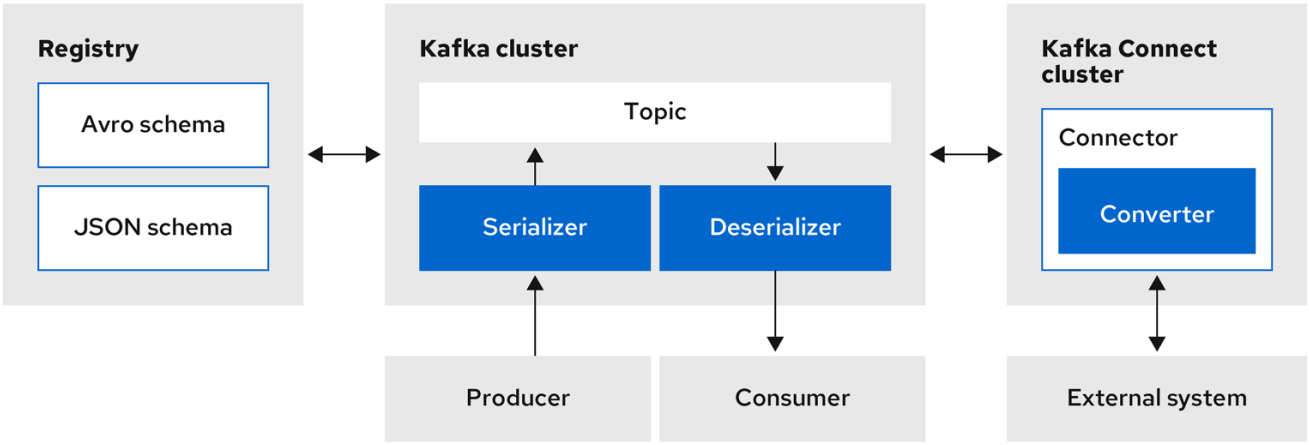
Additional resources

- Chapter 7, *Validating Kafka messages using serializers/deserializers in Java clients*

1.7. STREAM DATA TO EXTERNAL SYSTEMS WITH KAFKA CONNECT CONVERTERS

You can use Service Registry with Apache Kafka Connect to stream data between Kafka and external systems. Using Kafka Connect, you can define connectors for different systems to move large volumes of data into and out of Kafka-based systems.

Figure 1.3. Service Registry and Kafka Connect architecture



Service Registry provides the following features for Kafka Connect:

- Storage for Kafka Connect schemas
- Kafka Connect converters for Apache Avro and JSON Schema
- Registry REST API to manage schemas

You can use the Avro and JSON Schema converters to map Kafka Connect schemas into Avro or JSON schemas. Those schemas can then serialize message keys and values into the compact Avro binary format or human-readable JSON format. The converted JSON is also less verbose because the messages do not contain the schema information, only the schema ID.

Service Registry can manage and track the Avro and JSON schemas used in the Kafka topics. Because the schemas are stored in Service Registry and decoupled from the message content, each message must only include a tiny schema identifier. For an I/O bound system like Kafka, this means more total throughput for producers and consumers.

The Avro and JSON Schema serializers and deserializers (SerDes) provided by Service Registry are also used by Kafka producers and consumers in this use case. Kafka consumer applications that you write to consume change events can use the Avro or JSON Serdes to deserialize these change events. You can install these SerDes into any Kafka-based system and use them along with Kafka Connect, or with Kafka Connect-based systems such as Debezium and Camel Kafka Connector.

Additional resources

- Apache Kafka Connect documentation
- Configuring Debezium to use Apache Avro serialization
- Getting Started with Camel Kafka Connector
- Demonstration of using Kafka Connect with Debezium and Apicurio Registry

1.8. SERVICE REGISTRY DEMONSTRATION EXAMPLES

Service Registry provides open source example applications that demonstrate how to use Service Registry in different use case scenarios. For example, these include storing schemas used by Kafka serializer and deserializer (SerDes) classes. These Java classes fetch the schema from the registry for use when producing or consuming operations to serialize, deserialize, or validate the Kafka message payload.

These example applications include the following:

- Apache Avro SerDes
- Google Protobuf SerDes
- JSON Schema SerDes
- Confluent SerDes
- Custom ID strategy
- REST client
- Cloud Events
- Quarkus and Kafka
- Apache Camel with Quarkus and Kafka

Additional resources

- For more details, see https://github.com/Apicurio/apicurio-registry-examples

1.9. SERVICE REGISTRY AVAILABLE DISTRIBUTIONS

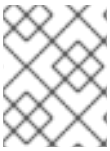
Service Registry provides the following distribution options.

Table 1.2. Service Registry Operator and images

Distribution	Location	Release category
Service Registry Operator	OpenShift web console under **Operators → OperatorHub**	General Availability
Container image for Service Registry Operator	Red Hat Ecosystem Catalog	General Availability
Container image for Kafka storage in AMQ Streams	Red Hat Ecosystem Catalog	General Availability
Container image for database storage in PostgreSQL	Red Hat Ecosystem Catalog	General Availability

Table 1.3. Service Registry zip downloads

Distribution	Location	Release category
Example custom resource definitions for installation	Red Hat Software Downloads	General Availability
Service Registry v1 to v2 migration tool	Red Hat Software Downloads	General Availability
Maven repository	Red Hat Software Downloads	General Availability
Source code	Red Hat Software Downloads	General Availability
Kafka Connect converters	Red Hat Software Downloads	General Availability



NOTE

You must have a subscription for Red Hat Integration and be logged into the Red Hat Customer Portal to access the available Service Registry distributions.

CHAPTER 2. SERVICE REGISTRY CONTENT RULES

This chapter introduces the optional rules used to govern registry content and provides details on the available rule configuration:

- Section 2.1, “Govern registry content using rules”
- Section 2.1.1, “When rules are applied”
- Section 2.1.2, “Rule precedence”
- Section 2.1.3, “How rules work”
- Section 2.1.4, “Content rule configuration”

2.1. GOVERN REGISTRY CONTENT USING RULES

To govern the evolution of registry content, you can configure optional rules for artifact content added to the registry. All configured global rules or artifact rules must pass before a new artifact version can be uploaded to the registry. Configured artifact rules override any configured global rules.

The goal of these rules is to prevent invalid content from being added to the registry. For example, content can be invalid for the following reasons:

- Invalid syntax for a given artifact type (for example, **AVRO** or **PROTOBUF**)
- Valid syntax, but semantics violate a specification
- Incompatibility, when new content includes breaking changes relative to the current artifact version

You can enable optional content rules using the Service Registry web console, REST API commands, or a Java client application.

2.1.1. When rules are applied

Rules are applied only when content is added to the registry. This includes the following REST operations:

- Adding an artifact
- Updating an artifact
- Adding an artifact version

If a rule is violated, Service Registry returns an HTTP error. The response body includes the violated rule and a message showing what went wrong.

2.1.2. Rule precedence

You can configure Service Registry content rules at a global level and at an artifact level. The order of precedence is as follows:

- If you enable an artifact rule and the equivalent global rule, the artifact rule overrides the global rule.

- If you disable an artifact rule, and enable the equivalent global rule, the global rule applies.
- If you disable a rule at the artifact level and at the global level, you disable the rule for all artifacts.
- If you set a rule value to **NONE** at the artifact level, you override the enabled global rule. In this case, the artifact rule value **NONE** takes precedence for this artifact, but the enabled global rule continues to apply to any other artifacts that have the rule disabled at the artifact level.

2.1.3. How rules work

Each rule has a name and configuration information. The registry maintains the list of rules for each artifact and the list of global rules. Each rule in the list consists of a name and configuration for the rule implementation.

A rule is provided with the content of the current version of the artifact (if one exists) and the new version of the artifact being added. The rule implementation returns true or false depending on whether the artifact passes the rule. If not, the registry reports the reason why in an HTTP error response. Some rules might not use the previous version of the content. For example, compatibility rules use previous versions, but syntax or semantic validity rules do not.

Additional resources

For more details, see Chapter 9, *Service Registry artifact reference* .

2.1.4. Content rule configuration

You can configure rules individually for each artifact, as well as globally. Service Registry applies the rules configured for the specific artifact. If no rules are configured at that level, Service Registry applies the globally configured rules. If no global rules are configured, no rules are applied.

Configure artifact rules

You can configure artifact rules using the Service Registry web console or REST API. For details, see the following:

- Chapter 3, *Managing Service Registry content using the web console*
- Apicurio Registry REST API documentation

Configure global rules

You can configure global rules in several ways:

- Use the **/rules** operations in the REST API
- Use the Service Registry web console
- Set default global rules using Service Registry application properties

Configure default global rules

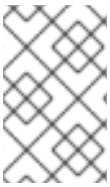
You can configure Service Registry at the application level to enable or disable global rules. You can configure default global rules at installation time without post-install configuration using the following application property format:

```
registry.rules.global.<ruleName>
```

The following rule names are currently supported:

- **compatibility**
- **validity**

The value of the application property must be a valid configuration option that is specific to the rule being configured.



NOTE

You can configure these application properties as Java system properties or include them in the Quarkus **application.properties** file. For more details, see the Quarkus documentation.

CHAPTER 3. MANAGING SERVICE REGISTRY CONTENT USING THE WEB CONSOLE

This chapter explains how to manage schema and API artifacts stored in the registry by using the Service Registry web console. This includes uploading and browsing registry content, and configuring optional rules:

- Section 3.1, “Viewing artifacts using the Service Registry web console”
- Section 3.2, “Adding artifacts using the Service Registry web console”
- Section 3.3, “Configuring content rules using the Service Registry web console”
- Section 3.4, “Configuring Service Registry instance settings using the web console”
- Section 3.5, “Changing an artifact owner using the Service Registry web console”
- Section 3.6, “Exporting and importing registry content using the Service Registry web console”

3.1. VIEWING ARTIFACTS USING THE SERVICE REGISTRY WEB CONSOLE

You can use the Service Registry web console to browse the event schema and API artifacts stored in the registry. This section shows a simple example of viewing Service Registry artifacts, groups, versions, and artifact rules.

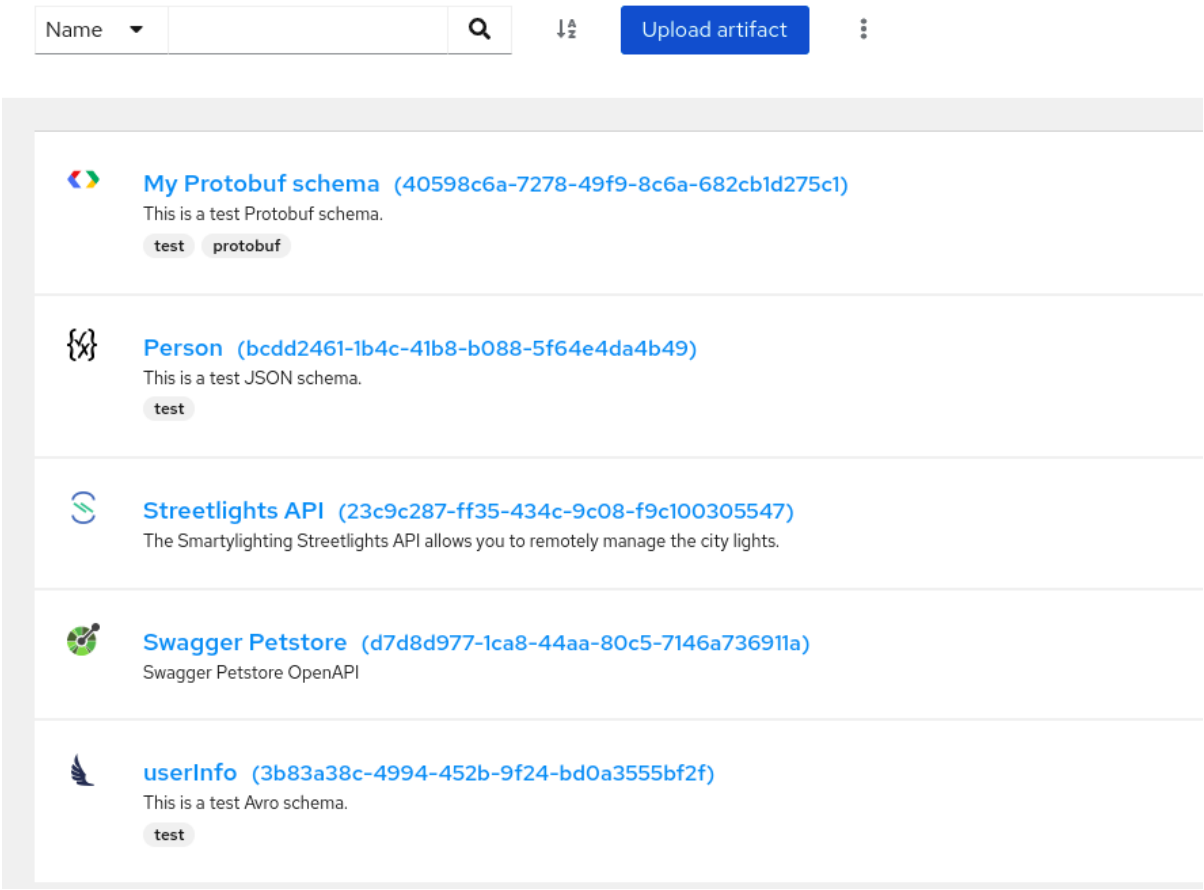
Prerequisites

- Service Registry is installed and running in your environment.
- You are logged in to the Service Registry web console: **http://MY_REGISTRY_URL/ui**
- Artifacts have been added to Service Registry using the web console, command line, Maven plug-in, or a Java client application.

Procedure

1. On the **Artifacts** tab, browse the list of artifacts stored in Service Registry, or enter a search string to find an artifact. You can select from the list to search by specific criteria such as name, group, labels, or global ID.

Figure 3.1. Artifacts in Service Registry web console



2. Click an artifact to view the following details:

   - **Overview**: Displays the artifact version metadata such as name, optional group and ID, global ID, content ID, labels, and properties. Also displays rules for validity and compatibility that you can configure for artifact content.
   - **Documentation** (OpenAPI and AsyncAPI only): Displays automatically-generated REST API documentation.
   - **Content**: Displays a read-only view of the full artifact content. For JSON content, you can click **JSON** or **YAML** to display your preferred format.

3. If additional versions of this artifact have been added, you can select them from the **Version** list in page header.

4. To save the artifact contents to a local file, for example, **my-protobuf-schema.proto**, click **Download** at the end of the page.

Additional resources

- Section 3.2, "Adding artifacts using the Service Registry web console"
- Section 3.3, "Configuring content rules using the Service Registry web console"
- Chapter 9, *Service Registry artifact reference*

3.2. ADDING ARTIFACTS USING THE SERVICE REGISTRY WEB CONSOLE

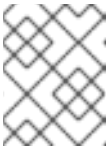
You can use the Service Registry web console to upload event schema and API artifacts to the registry. This section shows simple examples of uploading Service Registry artifacts and adding new artifact versions.

Prerequisites

- Service Registry is installed and running in your environment.
- You are logged in to the Service Registry web console:
  http://MY_REGISTRY_URL/ui

Procedure

1. On the **Artifacts** tab, click **Upload artifact**, and specify the following details:
   - **Group & ID**: Use the default empty settings to automatically generate an artifact ID and add the artifact to the **default** artifact group. Alternatively, you can enter an optional artifact group name or ID.
   - **Type**: Use the default **Auto-Detect** setting to automatically detect the artifact type, or select the artifact type from the list, for example, **Avro Schema** or **OpenAPI**.

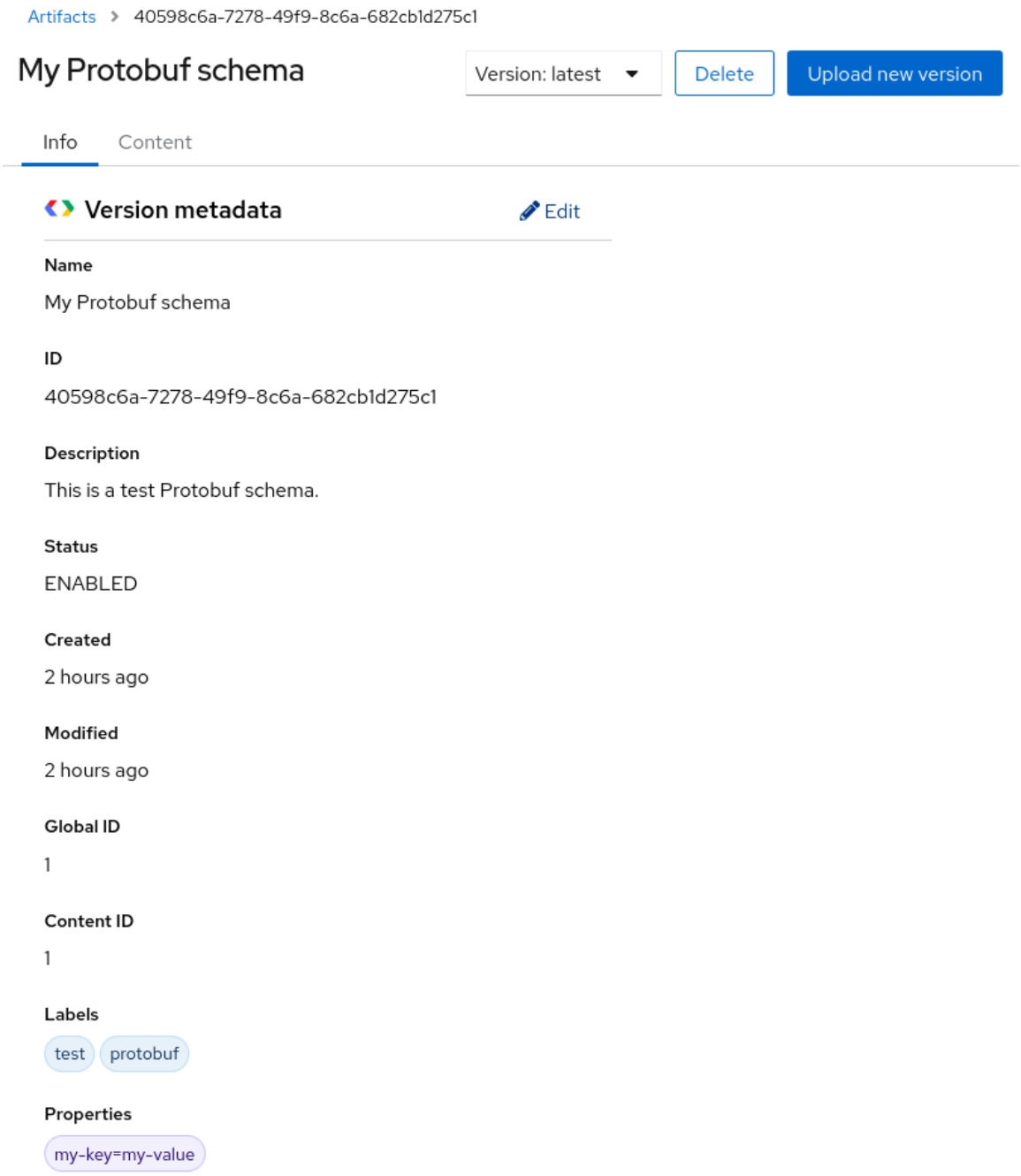
     

     NOTE

     Service Registry cannot automatically detect the **Kafka Connect Schema** artifact type. You must manually select this artifact type.

   - **Artifact**: Specify the artifact location using either of the following options:
     - **From file**: Click **Browse**, and select a file, or drag and drop a file. For example, **my-openapi.json** or **my-schema.proto**.
     - **From URL**: Enter a valid and accessible URL, and click **Fetch**. For example: **https://petstore3.swagger.io/api/v3/openapi.json**.
2. Click **Upload** and view the artifact details:
   - **Overview**: Displays the artifact version metadata such as name, artifact ID, global ID, content ID, labels, and properties. Also displays rules for validity and compatibility that you can configure for artifact content.
   - **Documentation** (OpenAPI and AsyncAPI only): Displays automatically-generated REST API documentation.
   - **Content**: Displays a read-only view of the full artifact content. For JSON content, you can click **JSON** or **YAML** to display your preferred format.
     The following example shows an example Protobuf schema artifact:

Figure 3.2. Artifact details in Service Registry web console



3. On the **Overview** tab, click the **Edit** pencil icon to edit artifact metadata such as name or description.
   You can also enter an optional comma-separated list of labels for searching, or add key-value pairs of arbitrary properties associated with the artifact. To add properties, perform the following steps:

   a. Click **Add property**.

   b. Enter the key name and the value.

   c. Repeat the first two steps to add multiple properties.

   d. Click **Save**.

4. To save the artifact contents to a local file, for example, **my-protobuf-schema.proto**, click **Download** at the end of the page.

5. To add a new artifact version, click **Upload new version** in the page header, and drag and drop or click **Browse** to upload the file, for example, **my-avro-schema.json** or **my-openapi.json**.

6. To delete an artifact, click **Delete** in the page header.

WARNING

Deleting an artifact deletes the artifact and all of its versions, and cannot be undone. Artifact versions are immutable and cannot be deleted individually.

Additional resources

- Section 3.1, "Viewing artifacts using the Service Registry web console"
- Section 3.3, "Configuring content rules using the Service Registry web console"
- Chapter 9, *Service Registry artifact reference*

3.3. CONFIGURING CONTENT RULES USING THE SERVICE REGISTRY WEB CONSOLE

You can use the Service Registry web console to configure optional rules to prevent invalid content from being added to the registry. All configured artifact rules or global rules must pass before a new artifact version can be uploaded to Service Registry. Configured artifact rules override any configured global rules. This section shows a simple example of configuring global and artifact rules.

Prerequisites

- Service Registry is installed and running in your environment.
- You are logged in to the Service Registry web console: **http://MY_REGISTRY_URL/ui**
- Artifacts have been added to Service Registry using the web console, command line, Maven plug-in, or a Java client application.

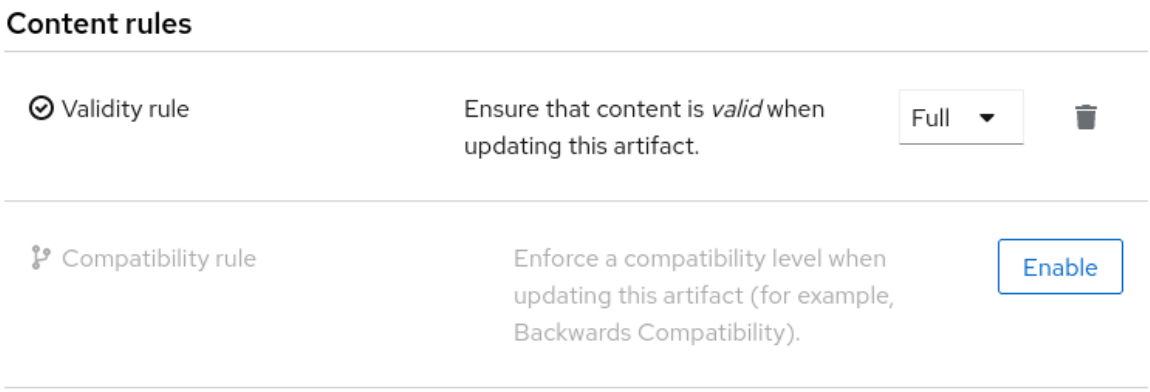
Procedure

1. On the **Artifacts** tab, browse the list of artifacts in Service Registry, or enter a search string to find an artifact. You can select from the list to search by specific criteria such as artifact name, group, labels, or global ID.

2. Click an artifact to view its version details and content rules.

3. In **Content rules**, click **Enable** to configure an validity rule or compatibility rule for artifact content, and select the appropriate rule configuration from the list, for example, **Full** for the validity rule.

Figure 3.3. Artifact content rules in Service Registry web console



4. To access global rules, click the Service Registry instance, and click the **Global rules** tab. Click **Enable** to configure a global validity rule or compatibility rule for all artifact content, and select the appropriate rule configuration from the list.

5. To disable an artifact rule or global rule, click the trash icon next to the rule.

Additional resources

- Section 3.2, "Adding artifacts using the Service Registry web console"
- Chapter 9, *Service Registry artifact reference*

3.4. CONFIGURING SERVICE REGISTRY INSTANCE SETTINGS USING THE WEB CONSOLE

As an administrator, you can use the Service Registry web console to configure dynamic settings for Service Registry instances at runtime. You can manage configuration options for features such as authentication, authorization, and API compatibility.

NOTE

Authentication and authorization settings are only displayed in the web console if authentication was already enabled when the Service Registry instance was deployed. For more details, see the Installing and deploying Service Registry on OpenShift .

Prerequisites

- The Service Registry instance is already deployed.
- You are logged in to the Service Registry web console with administrator access: **http://MY_REGISTRY_URL/ui**

Procedure

1. In the Service Registry web console, click the **Settings** tab.
2. Select the settings that you want to configure for this Service Registry instance:

Table 3.1. Authentication settings

Setting	Description
HTTP basic authentication	Displayed only when authentication is already enabled. When selected, Service Registry users can authenticate using HTTP basic authentication, in addition to OAuth. Not selected by default.

Table 3.2. Authorization settings

Setting	Description
Anonymous read access	Displayed only when authentication is already selected. When selected, Service Registry grants read-only access to requests from anonymous users without any credentials. This setting is useful if you want to use this instance to publish schemas or APIs externally. Not selected by default.
Artifact owner-only authorization	Displayed only when authentication is already enabled. When selected, only the user who created an artifact can modify that artifact. Not selected by default.
Artifact group owner-only authorization	Displayed only when authentication is already enabled and **Artifact owner-only authorization** is selected. When selected, only the user who created an artifact group has write access to that artifact group, for example, to add or remove artifacts in that group. Not selected by default.
Authenticated read access	Displayed only when authentication is already enabled. When selected, Service Registry grants at least read-only access to requests from any authenticated user regardless of their user role. Not selected by default.

Table 3.3. Compatibility settings

Setting	Description
Legacy ID mode (compatibility API)	When selected, the Confluent Schema Registry compatibility API uses **globalId** instead of **contentId** as an artifact identifier. This setting is useful when migrating from legacy Service Registry instances based on the v1 Core Registry API. Not selected by default.

Table 3.4. Web console settings

Setting	Description
Download link expiry	The number of seconds that a generated link to a **.zip** download file is active before expiring for security reasons, for example, when exporting artifact data from the instance. Defaults to 30 seconds.

Setting	Description
UI read-only mode	When selected, the Service Registry web console is set to read-only, preventing create, read, update, or delete operations. Changes made using the Core Registry API are not affected by this setting. Not selected by default.

Additional resources

- Installing and deploying Service Registry on OpenShift

3.5. CHANGING AN ARTIFACT OWNER USING THE SERVICE REGISTRY WEB CONSOLE

As an administrator or as an owner of a schema or API artifact, you can use the Service Registry web console to change the artifact owner to another user account.

For example, this feature is useful if the **Artifact owner-only authorization** option is set for the Service Registry instance on the **Settings** tab so that only owners or administrators can modify artifacts. You might need to change owner if the owner user leaves the organization or the owner account is deleted.

NOTE

The **Artifact owner-only authorization** setting and the artifact **Owner** field are displayed *only if* authentication was enabled when the Service Registry instance was deployed. For more details, see Installing and deploying Service Registry on OpenShift .

Prerequisites

- The Service Registry instance is deployed and the artifact is created.
- You are logged in to the Service Registry web console as the artifact's current owner or as an administrator:
  http://MY_REGISTRY_URL/ui

Procedure

1. On the **Artifacts** tab, browse the list of artifacts stored in Service Registry, or enter a search string to find the artifact. You can select from the list to search by criteria such as name, group, labels, or global ID.
2. Click the artifact that you want to reassign.
3. In the **Version metadata** section, click the pencil icon next to the **Owner** field.
4. In the **New owner** field, select or enter an account name.
5. Click **Change owner**.

Additional resources

- Installing and deploying Service Registry on OpenShift

3.6. EXPORTING AND IMPORTING REGISTRY CONTENT USING THE SERVICE REGISTRY WEB CONSOLE

As an administrator, you can use the Service Registry web console to export data from one Service Registry instance, and import it into another Service Registry instance. You can use this feature to easily migrate data between different instances.

The following example shows how to export and import existing data in a **.zip** file from one Service Registry instance to another instance. All of the artifact data contained in the Service Registry instance is exported in the **.zip** file.

NOTE

You can import only Service Registry data that has been exported from another Service Registry instance.

Prerequisites

- Service Registry instances have been created as follows:
  - The source instance that you are exporting from contains at least one schema or API artifact
  - The target instance that you are importing into is empty to preserve unique IDs
- You are logged into the Service Registry web console with administrator access: **http://MY_REGISTRY_URL/ui**

Procedure

1. In the web console for the source Service Registry instance, view the **Artifacts** tab.
2. Click the options icon (three vertical dots) next to **Upload artifact**, and select **Download all artifacts (.zip file)** to export the registry data for this instance to a **.zip** download file.
3. In the the web console for the target Service Registry instance, view the **Artifacts** tab.
4. Click the options icon next to **Upload artifact**, and select **Upload multiple artifacts**.
5. Drag and drop or browse to the **.zip** download file that you exported earlier.
6. Click **Upload** and wait for the data to be imported.

CHAPTER 4. MANAGING SERVICE REGISTRY CONTENT USING THE REST API

Client applications can use Registry REST API operations to manage schema and API artifacts in Service Registry, for example, in a CI/CD pipeline deployed in production. The Registry REST API provides create, read, update, and delete operations for artifacts, versions, metadata, and rules stored in the registry. For detailed information, see the Apicurio Registry REST API documentation .

This chapter describes the Service Registry core REST API and shows how to use it to manage schema and API artifacts stored in the registry:

- Section 4.1, “Managing schema and API artifacts using Service Registry REST API commands”
- Section 4.2, “Managing schema and API artifact versions using Service Registry REST API commands”
- Section 4.3, “Managing artifact references using Service Registry REST API commands”
- Section 4.4, “Exporting and importing registry content using Service Registry REST API commands”

Prerequisites

- Chapter 1, *Introduction to Service Registry*

Additional resources

- Apicurio Registry REST API documentation

4.1. MANAGING SCHEMA AND API ARTIFACTS USING SERVICE REGISTRY REST API COMMANDS

This section shows a simple curl-based example of using the Service Registry core REST API to add and retrieve an Apache Avro schema artifact in Service Registry.

Prerequisites

- Service Registry is installed and running in your environment

Procedure

1. Add an artifact to the registry using the **/groups/{group}/artifacts** operation. The following example **curl** command adds a simple artifact for a share price application:

```
$ curl -X POST -H "Content-Type: application/json; artifactType=AVRO" \
  -H "X-Registry-ArtifactId: share-price" \
  -H "Authorization: Bearer $ACCESS_TOKEN" \
  --data '{"type":"record","name":"price","namespace":"com.example", \
   "fields":[{"name":"symbol","type":"string"},{"name":"price","type":"string"}]}' \
  MY-REGISTRY-URL/apis/registry/v2/groups/my-group/artifacts
```

   - This example adds an Avro schema artifact with an artifact ID of **share-price**. If you do not specify a unique artifact ID, Service Registry generates one automatically as a UUID.

- **MY-REGISTRY-URL** is the host name on which Service Registry is deployed. For example: **my-cluster-service-registry-myproject.example.com**.
- This example specifies a group ID of **my-group** in the API path. If you do not specify a unique group ID, you must specify **../groups/default** in the API path.

2. Verify that the response includes the expected JSON body to confirm that the artifact was added. For example:

```
{"createdBy":"","createdOn":"2021-04-16T09:07:51+0000","modifiedBy":"",
"modifiedOn":"2021-04-16T09:07:51+0000","id":"share-price","version":"1",
"type":"AVRO","globalId":2,"state":"ENABLED","groupId":"my-group","contentId":2}
```

- No version was specified when adding the artifact, so the default version **1** is created automatically.
- This was the second artifact added to the registry, so the global ID and content ID have a value of **2**.

3. Retrieve the artifact content from the registry using its artifact ID in the API path. In this example, the specified ID is **share-price**:

```
$ curl -H "Authorization: Bearer $ACCESS_TOKEN" \
 MY-REGISTRY-URL/apis/registry/v2/groups/my-group/artifacts/share-price \
 {"type":"record","name":"price","namespace":"com.example",
  "fields":[{"name":"symbol","type":"string"},{"name":"price","type":"string"}]}
```

Additional resources

- For more REST API sample requests, see the Apicurio Registry REST API documentation

4.2. MANAGING SCHEMA AND API ARTIFACT VERSIONS USING SERVICE REGISTRY REST API COMMANDS

If you do not specify an artifact version when adding schema and API artifacts to Service Registry using the v2 core REST API, Service Registry generates one automatically. The default version when creating a new artifact is **1**.

Service Registry also supports custom versioning where you can specify a version using the **X-Registry-Version** HTTP request header as a string. Specifying a custom version value overrides the default version normally assigned when creating or updating an artifact. You can then use this version value when executing REST API operations that require a version.

This section shows a simple curl-based example of using the registry v2 core REST API to add and retrieve a custom Apache Avro schema version in the registry. You can specify custom versions when using the REST API to add or update artifacts or to add artifact versions.

Prerequisites

- Service Registry is installed and running in your environment

Procedure

1. Add an artifact version in the registry using the **/groups/{group}/artifacts** operation. The following example **curl** command adds a simple artifact for a share price application:

```
$ curl -X POST -H "Content-Type: application/json; artifactType=AVRO" \
  -H "X-Registry-ArtifactId: my-share-price" -H "X-Registry-Version: 1.1.1" \
  -H "Authorization: Bearer $ACCESS_TOKEN" \
  --data '{"type":"record","name":" p","namespace":"com.example", \
   "fields":[{"name":"symbol","type":"string"},{"name":"price","type":"string"}]}' \
   MY-REGISTRY-URL/apis/registry/v2/groups/my-group/artifacts
```

   - This example adds an Avro schema artifact with an artifact ID of **my-share-price** and version of **1.1.1**. If you do not specify a version, Service Registry automatically generates a default version of **1**.
   - **MY-REGISTRY-URL** is the host name on which Service Registry is deployed. For example: **my-cluster-service-registry-myproject.example.com**.
   - This example specifies a group ID of **my-group** in the API path. If you do not specify a unique group ID, you must specify **../groups/default** in the API path.

2. Verify that the response includes the expected JSON body to confirm that the custom artifact version was added. For example:

```
{"createdBy":"","createdOn":"2021-04-16T10:51:43+0000","modifiedBy":"",
"modifiedOn":"2021-04-16T10:51:43+0000","id":"my-share-price","version":"1.1.1",
"type":"AVRO","globalId":3,"state":"ENABLED","groupId":"my-group","contentId":3}
```

   - A custom version of **1.1.1** was specified when adding the artifact.
   - This was the third artifact added to the registry, so the global ID and content ID have a value of **3**.

3. Retrieve the artifact content from the registry using its artifact ID and version in the API path. In this example, the specified ID is **my-share-price** and the version is **1.1.1**:

```
$ curl -H "Authorization: Bearer $ACCESS_TOKEN" \
MY-REGISTRY-URL/apis/registry/v2/groups/my-group/artifacts/my-share-
price/versions/1.1.1
{"type":"record","name":"price","namespace":"com.example",
  "fields":[{"name":"symbol","type":"string"},{"name":"price","type":"string"}]}
```

Additional resources

- For more REST API sample requests, see the Apicurio Registry REST API documentation

4.3. MANAGING ARTIFACT REFERENCES USING SERVICE REGISTRY REST API COMMANDS

Service Registry artifact types such as Apache Avro, Protobuf, and JSON Schema can include *artifact references* from one artifact file to another. You can create efficiencies by defining reusable schema and API artifacts, and then referencing them from multiple locations.

This section shows a simple curl-based example of using the Service Registry core REST API to add and retrieve an artifact reference to a simple Avro schema artifact in Service Registry.

This example first creates a schema artifact named **ItemId**:

ItemId schema

```
{
    "namespace":"com.example.common",
    "name":"ItemId",
    "type":"record",
    "fields":[
        {
            "name":"id",
            "type":"int"
        }
    ]
}
```

This example then creates a schema artifact named **Item**, which includes a reference to the nested **ItemId** artifact.

Item schema with nested ItemId schema

```
{
    "namespace":"com.example.common",
    "name":"Item",
    "type":"record",
    "fields":[
        {
            "name":"itemId",
            "type":"com.example.common.ItemId"
        },
    ]
}
```

Prerequisites

- Service Registry is installed and running in your environment

Procedure

1. Add the **ItemId** schema artifact that you want to create the nested artifact reference to using the /**groups**/**{group}**/**artifacts** operation:

```
$ curl -X POST MY-REGISTRY-URL/apis/registry/v2/groups/my-group/artifacts \
  -H "Content-Type: application/json; artifactType=AVRO" \
  -H "X-Registry-ArtifactId: ItemId" \
  -H "Authorization: Bearer $ACCESS_TOKEN" \
  --data '{"namespace": "com.example.common", "type": "record", "name": "ItemId", "fields":
[{"name":"id", "type":"int"}]}'
```

   - This example adds an Avro schema artifact with an artifact ID of **ItemId**. If you do not specify a unique artifact ID, Service Registry generates one automatically as a UUID.
   - **MY-REGISTRY-URL** is the host name on which Service Registry is deployed. For example: **my-cluster-service-registry-myproject.example.com**.

- This example specifies a group ID of **my-group** in the API path. If you do not specify a unique group ID, you must specify **../groups/default** in the API path.

2. Verify that the response includes the expected JSON body to confirm that the artifact was added. For example:

```
{"name":"ItemId","createdBy":"","createdOn":"2022-04-
14T10:50:09+0000","modifiedBy":"","modifiedOn":"2022-04-
14T10:50:09+0000","id":"ItemId","version":"1","type":"AVRO","globalId":1,"state":"ENABLED",
"groupId":"my-group","contentId":1,"references":[]}
```

3. Add the **Item** schema artifact that includes the artifact reference to the **ItemId** schema using the **/groups/{group}/artifacts** operation:

```
$ curl -X POST MY-REGISTRY-URL/apis/registry/v2/groups/my-group/artifacts \
-H 'Content-Type: application/create.extended+json' \
-H "X-Registry-ArtifactId: Item" \
-H 'X-Registry-ArtifactType: AVRO' \
-H "Authorization: Bearer $ACCESS_TOKEN" \
--data-raw '{
    "content": "{\r\n \"namespace\":\"com.example.common\",\r\n  \"name\":\"Item\",\r\n
\"type\":\"record\",\r\n  \"fields\":[\r\n   {\r\n  \"name\":\"itemId\",\r\n
\"type\":\"com.example.common.ItemId\"\r\n        }\r\n    ]\r\n}",
    "references": [
        {
            "groupId": "my-group",
            "artifactId": "ItemId",
            "name": "com.example.common.ItemId",
            "version": "1"
        }
    ]
}'
```

- For artifact references, you must specify the custom content type of **application/create.extended+json**, which extends the **application/json** content type.

4. Verify that the response includes the expected JSON body to confirm that the artifact was created with the reference. For example:

```
{"name":"Item","createdBy":"","createdOn":"2022-04-
14T11:52:15+0000","modifiedBy":"","modifiedOn":"2022-04-
14T11:52:15+0000","id":"Item","version":"1","type":"AVRO","globalId":2,"state":"ENABLED","g
roupId":"my-group","contentId":2,"references":[1]}
```

5. Retrieve the artifact reference from Service Registry by specifying the global ID of the artifact that includes the reference. In this example, the specified global ID is **2**:

```
$ curl MY-REGISTRY-URL/apis/registry/v2/ids/globalIds/2/references
```

6. Verify that the response includes the expected JSON body for this artifact reference. For example:

```
[{"groupId":"my-
group","artifactId":"ItemId","version":"1","name":"com.example.common.ItemId"}]
```

Additional resources

- For more details, see the Apicurio Registry REST API documentation

4.4. EXPORTING AND IMPORTING REGISTRY CONTENT USING SERVICE REGISTRY REST API COMMANDS

As an administrator, you can use the Service Registry REST API to export data from one Service Registry instance and import it into another Service Registry instance, so you can migrate data between different instances.

This section shows a simple curl-based example of using the core registry v2 REST API to export and import existing registry data in **.zip** format from one Service Registry instance to another. All of the artifact data contained in the Service Registry instance is exported in the **.zip** file.

NOTE

You can only import Service Registry data that has been exported from another Service Registry instance.

Prerequisites

- Service Registry is installed and running in your environment
- Service Registry instances have been created:
  - The source instance that you want to export data from contains at least one schema or API artifact
  - The target instance that you want to import data into is empty to perserve unique IDs

Procedure

1. Export the registry data from your existing source Service Registry instance:

```
$ curl MY-REGISTRY-URL/apis/registry/v2/admin/export \
  -H "Authorization: Bearer $ACCESS_TOKEN" \
  --output my-registry-data.zip
```

MY-REGISTRY-URL is the host name on which the source Service Registry is deployed. For example: **my-cluster-source-registry-myproject.example.com**.

2. Import the registry data into your target Service Registry instance:

```
$ curl -X POST "MY-REGISTRY-URL/apis/registry/v2/admin/import" \
  -H "Content-Type: application/zip" -H "Authorization: Bearer $ACCESS_TOKEN" \
  --data-binary @my-registry-data.zip
```

MY-REGISTRY-URL is the host name on which the target Service Registry is deployed. For example: **my-cluster-target-registry-myproject.example.com**.

Additional resources

- For more details, see the **admin** endpoint in the Apicurio Registry REST API documentation

- For details on export tools for migrating from Service Registry version 1.x to 2.x, see Apicurio Registry export utility for 1.x versions

CHAPTER 5. MANAGING SERVICE REGISTRY CONTENT USING THE MAVEN PLUG-IN

This chapter explains how to manage schema and API artifacts stored in the registry using the Service Registry Maven plug-in:

- Section 5.1, "Adding schema and API artifacts using the Maven plug-in"
- Section 5.2, "Downloading schema and API artifacts using the Maven plug-in"
- Section 5.3, "Adding artifact references using the Service Registry Maven plug-in"
- Section 5.4, "Testing schema and API artifacts using the Maven plug-in"

Prerequisites

- See Chapter 1, *Introduction to Service Registry*
- Service Registry must be installed and running in your environment
- Maven must be installed and configured in your environment

5.1. ADDING SCHEMA AND API ARTIFACTS USING THE MAVEN PLUG-IN

The most common use case for the Maven plug-in is adding artifacts during a build. You can accomplish this by using the **register** execution goal.

Prerequisites

- Service Registry is installed and running in your environment

Procedure

Update your Maven **pom.xml** file to use the **apicurio-registry-maven-plugin** to register an artifact. The following example shows registering Apache Avro and GraphQL schemas:

```
<plugin>
  <groupId>io.apicurio</groupId>
  <artifactId>apicurio-registry-maven-plugin</artifactId>
  <version>${apicurio.version}</version>
  <executions>
    <execution>
      <phase>generate-sources</phase>
      <goals>
        <goal>register</goal> (1)
      </goals>
      <configuration>
        <registryUrl>MY-REGISTRY-URL/apis/registry/v2</registryUrl> (2)
        <authServerUrl>MY-AUTH-SERVER</authServerUrl>
        <clientId>MY-CLIENT-ID</clientId>
        <clientSecret>MY-CLIENT-SECRET</clientSecret> (3)
        <artifacts>
          <artifact>
```

```
            <groupId>TestGroup</groupId> 4
            <artifactId>FullNameRecord</artifactId>
            <file>${project.basedir}/src/main/resources/schemas/record.avsc</file>
            <ifExists>FAIL</ifExists>
          </artifact>
          <artifact>
            <groupId>TestGroup</groupId>
            <artifactId>ExampleAPI</artifactId> 5
            <type>GRAPHQL</type>
            <file>${project.basedir}/src/main/resources/apis/example.graphql</file>
            <ifExists>RETURN_OR_UPDATE</ifExists>
            <canonicalize>true</canonicalize>
          </artifact>
        </artifacts>
      </configuration>
    </execution>
  </executions>
</plugin>
```

1. Specify **register** as the execution goal to upload the schema artifact to the registry.
2. Specify the Service Registry URL with the **../apis/registry/v2** endpoint.
3. If authentication is required, you can specify your authentication server and client credentials.
4. Specify the Service Registry artifact group ID. You can specify the **default** group if you do not want to use a unique group ID.
5. You can register multiple artifacts using the specified group ID, artifact ID, and location.

5.2. DOWNLOADING SCHEMA AND API ARTIFACTS USING THE MAVEN PLUG-IN

You can use the Maven plug-in to download artifacts from Service Registry. This is often useful, for example, when generating code from a registered schema.

Prerequisites

- Service Registry is installed and running in your environment

Procedure

Update your Maven **pom.xml** file to use the **apicurio-registry-maven-plugin** to download an artifact. The following example shows downloading Apache Avro and GraphQL schemas.

```
<plugin>
  <groupId>io.apicurio</groupId>
  <artifactId>apicurio-registry-maven-plugin</artifactId>
  <version>${apicurio.version}</version>
  <executions>
    <execution>
      <phase>generate-sources</phase>
      <goals>
        <goal>download</goal> 1
      </goals>
```

```
      <configuration>
        <registryUrl>MY-REGISTRY-URL/apis/registry/v2</registryUrl> 2
        <authServerUrl>MY-AUTH-SERVER</authServerUrl>
        <clientId>MY-CLIENT-ID</clientId>
        <clientSecret>MY-CLIENT-SECRET</clientSecret> 3
        <artifacts>
          <artifact>
            <groupId>TestGroup</groupId> 4
            <artifactId>FullNameRecord</artifactId> 5
            <file>${project.build.directory}/classes/record.avsc</file>
            <overwrite>true</overwrite>
          </artifact>
          <artifact>
            <groupId>TestGroup</groupId>
            <artifactId>ExampleAPI</artifactId>
            <version>1</version>
            <file>${project.build.directory}/classes/example.graphql</file>
            <overwrite>true</overwrite>
          </artifact>
        </artifacts>
      </configuration>
    </execution>
  </executions>
</plugin>
```

1. Specify **download** as the execution goal.
2. Specify the Service Registry URL with the **../apis/registry/v2** endpoint.
3. If authentication is required, you can specify your authentication server and client credentials.
4. Specify the Service Registry artifact group ID. You can specify the **default** group if you do not want to use a unique group.
5. You can download multiple artifacts to a specified directory using the artifact ID.

5.3. ADDING ARTIFACT REFERENCES USING THE SERVICE REGISTRY MAVEN PLUG-IN

Service Registry artifact types such as Apache Avro, Protobuf, and JSON Schema can include *artifact references* from one artifact file to another. You can create efficiencies by defining reusable schema and API artifacts, and then referencing them from multiple locations in artifact references.

This section shows a simple example of using the Service Registry Maven plug-in to register an artifact reference to a simple Avro schema artifact stored in Service Registry. This example assumes that the following **Exchange** schema artifact has already been created in Service Registry:

Exchange schema

```
{
  "namespace": "com.kubetrade.schema.common",
  "type": "enum",
  "name": "Exchange",
  "symbols" : ["GEMINI"]
}
```

This example then creates a **TradeKey** schema artifact, which includes a reference to the nested **Exchange** schema artifact:

TradeKey schema with nested Exchange schema

```
{
  "namespace": "com.kubetrade.schema.trade",
  "type": "record",
  "name": "TradeKey",
  "fields": [
    {
      "name": "exchange",
      "type": "com.kubetrade.schema.common.Exchange"
    },
    {
      "name": "key",
      "type": "string"
    }
  ]
}
```

Prerequisites

- Service Registry is installed and running in your environment
- The **Exchange** schema artifact is already created in Service Registry

Procedure

Update your Maven **pom.xml** file to use the **apicurio-registry-maven-plugin** to register the **TradeKey** schema, which includes a nested reference to the **Exchange** schema as follows:

```
<plugin>
    <groupId>io.apicurio</groupId>
    <artifactId>apicurio-registry-maven-plugin</artifactId>
    <version>${apicurio-registry.version}</version>
    <executions>
        <execution>
            <id>register-artifact</id>
            <goals>
                <goal>register</goal> (1)
            </goals>
            <configuration>
                <registryUrl>MY-REGISTRY-URL/apis/registry/v2</registryUrl> (2)
                <authServerUrl>MY-AUTH-SERVER</authServerUrl>
                <clientId>MY-CLIENT-ID</clientId>
                <clientSecret>MY-CLIENT-SECRET</clientSecret> (3)
                <artifacts>
                    <artifact>
                        <groupId>test-group</groupId> (4)
                        <artifactId>TradeKey</artifactId>
                        <version>2.0</version>
                        <type>AVRO</type>
                        <file>
```

```
                ${project.basedir}/src/main/resources/schemas/TradeKey.avsc
              </file>
              <ifExists>RETURN_OR_UPDATE</ifExists>
              <canonicalize>true</canonicalize>
              <references>
                <reference> 5
                  <name>com.kubetrade.schema.common.Exchange</name>
                  <groupId>test-group</groupId>
                  <artifactId>Exchange</artifactId>
                  <version>2.0</version>
                  <type>AVRO</type>
                  <file>
                    ${project.basedir}/src/main/resources/schemas/Exchange.avsc
                  </file>
                  <ifExists>RETURN_OR_UPDATE</ifExists>
                  <canonicalize>true</canonicalize>
                </reference>
              </references>
            </artifact>
          </artifacts>
        </configuration>
      </execution>
    </executions>
  </plugin>
```

1. Specify **register** as the execution goal to upload the schema artifact to the registry.
2. Specify the Service Registry URL with the **../apis/registry/v2** endpoint.
3. If authentication is required, you can specify your authentication server and client credentials.
4. Specify the Service Registry artifact group ID. You can specify the **default** group if you do not want to use a unique group ID.
5. Specify the Service Registry artifact reference using its group ID, artifact ID, version, type, and location. You can register multiple artifact references in this way.

5.4. TESTING SCHEMA AND API ARTIFACTS USING THE MAVEN PLUG-IN

You might want to verify that an artifact can be registered without actually making any changes. This is often useful when rules are configured in Service Registry. Testing the artifact results in a failure if the artifact content violates any of the configured rules.

NOTE

When testing artifacts using the Maven plug-in, even if the artifact passes the test, no content is added to Service Registry.

Prerequisites

- Service Registry must be installed and running in your environment

Procedure

Update your Maven **pom.xml** file to use the **apicurio-registry-maven-plugin** to test an artifact. The following example shows testing an Apache Avro schema:

```
<plugin>
  <groupId>io.apicurio</groupId>
  <artifactId>apicurio-registry-maven-plugin</artifactId>
  <version>${apicurio.version}</version>
  <executions>
    <execution>
      <phase>generate-sources</phase>
      <goals>
        <goal>test-update</goal> (1)
      </goals>
      <configuration>
        <registryUrl>MY-REGISTRY-URL/apis/registry/v2</registryUrl> (2)
        <authServerUrl>MY-AUTH-SERVER</authServerUrl>
        <clientId>MY-CLIENT-ID</clientId>
        <clientSecret>MY-CLIENT-SECRET</clientSecret> (3)
        <artifacts>
          <artifact>
            <groupId>TestGroup</groupId> (4)
            <artifactId>FullNameRecord</artifactId>
            <file>${project.basedir}/src/main/resources/schemas/record.avsc</file> (5)
          </artifact>
          <artifact>
            <groupId>TestGroup</groupId>
            <artifactId>ExampleAPI</artifactId>
            <type>GRAPHQL</type>
            <file>${project.basedir}/src/main/resources/apis/example.graphql</file>
          </artifact>
        </artifacts>
      </configuration>
    </execution>
  </executions>
</plugin>
```

1. Specify **test-update** as the execution goal to test the schema artifact.
2. Specify the Service Registry URL with the **../apis/registry/v2** endpoint.
3. If authentication is required, you can specify your authentication server and client credentials.
4. Specify the Service Registry artifact group ID. You can specify the **default** group if you do not want to use a unique group.
5. You can test multiple artifacts from a specified directory using the artifact ID.

CHAPTER 6. MANAGING SERVICE REGISTRY CONTENT USING A JAVA CLIENT

This chapter explains how to use the Service Registry Java client:

- Section 6.1, "Service Registry Java client"
- Section 6.2, "Writing Service Registry Java client applications"
- Section 6.3, "Service Registry Java client configuration"

6.1. SERVICE REGISTRY JAVA CLIENT

You can manage artifacts stored in Service Registry using a Java client application. You can create, read, update, or delete artifacts stored in the registry using the Service Registry Java client classes. You can also perform admin functions using the client, such as managing global rules or importing and exporting registry data.

You can access the Service Registry Java client by adding the correct dependency to your project. For more details, see Section 6.2, "Writing Service Registry Java client applications"

The Service Registry client is implemented using the HTTP client provided by the JDK. This gives you the ability to customize its use, for example, by adding custom headers or enabling options for Transport Layer Security (TLS) authentication. For more details, see Section 6.3, "Service Registry Java client configuration"

6.2. WRITING SERVICE REGISTRY JAVA CLIENT APPLICATIONS

This section explains how to manage artifacts stored in Service Registry using a Java client application.

Prerequisites

- Service Registry is installed and running in your environment

Procedure

1. Add the following dependency to your Maven project:

```
<dependency>
    <groupId>io.apicurio</groupId>
    <artifactId>apicurio-registry-client</artifactId>
    <version>${apicurio-registry.version}</version>
</dependency>
```

2. Create a registry client as follows:

```
public class ClientExample {

    private static final RegistryRestClient client;

    public static void main(String[] args) throws Exception {
        // Create a registry client
        String registryUrl = "https://my-registry.my-domain.com/apis/registry/v2";
```

```
        RegistryClient client = RegistryClientFactory.create(registryUrl);
    }
}
```

- If you specify an example registry URL of **https://my-registry.my-domain.com**, the client will automatically append /**apis/registry/v2**.
- For more options when creating a Service Registry client, see the Java client configuration in the next section.

When the client is created, you can use all the operations available in the Service Registry REST API in the client. For more details, see the Apicurio Registry REST API documentation .

Additional resources

- For an open source example of how to use and customize the Service Registry client, see the Registry REST client demonstration example
- For details on how to use the Service Registry Kafka client serializers/deserializers (SerDes) in producer and consumer applications, see Chapter 7, *Validating Kafka messages using serializers/deserializers in Java clients*

6.3. SERVICE REGISTRY JAVA CLIENT CONFIGURATION

The Service Registry Java client includes the following configuration options, based on the client factory:

Table 6.1. Service Registry Java client configuration options

Option	Description	Arguments
Plain client	Basic REST client used to interact with a running registry.	**baseUrl**
Client with custom configuration	Registry client using the configuration provided by the user.	**baseUrl**, **Map<String Object> configs**
Client with custom configuration and authentication	Registry client that accepts a map containing custom configuration. For example, this is useful to add custom headers to the calls. You must also provide an authentication server to authenticate the requests.	**baseUrl, Map<String Object> configs, Auth auth**

Custom header configuration

To configure custom headers, you must add the **apicurio.registry.request.headers** prefix to the **configs** map key. For example, a key of **apicurio.registry.request.headers.Authorization** with a value of **Basic: xxxxx** results in a header of **Authorization** with value of **Basic: xxxxx**.

TLS configuration options

You can configure Transport Layer Security (TLS) authentication for the Service Registry Java client using the following properties:

- **apicurio.registry.request.ssl.truststore.location**

- **apicurio.registry.request.ssl.truststore.password**
- **apicurio.registry.request.ssl.truststore.type**
- **apicurio.registry.request.ssl.keystore.location**
- **apicurio.registry.request.ssl.keystore.password**
- **apicurio.registry.request.ssl.keystore.type**
- **apicurio.registry.request.ssl.key.password**

Additional resources

- For details on how to configure authentication for Service Registry Kafka client serializers/deserializers (SerDes), see Chapter 7, *Validating Kafka messages using serializers/deserializers in Java clients*

CHAPTER 7. VALIDATING KAFKA MESSAGES USING SERIALIZERS/DESERIALIZERS IN JAVA CLIENTS

Service Registry provides client serializers/deserializers (SerDes) for Kafka producer and consumer applications written in Java. Kafka producer applications use serializers to encode messages that conform to a specific event schema. Kafka consumer applications use deserializers to validate that messages have been serialized using the correct schema, based on a specific schema ID. This ensures consistent schema use and helps to prevent data errors at runtime.

This chapter explains how to use Kafka client SerDes in your producer and consumer client applications:

- Section 7.1, “Kafka client applications and Service Registry”
- Section 7.2, “Strategies to look up a schema in Service Registry”
- Section 7.3, “Registering a schema in Service Registry”
- Section 7.4, “Using a schema from a Kafka consumer client”
- Section 7.5, “Using a schema from a Kafka producer client”
- Section 7.6, “Using a schema from a Kafka Streams application”

Prerequisites

- You have read Chapter 1, *Introduction to Service Registry*
- You have installed Service Registry
- You have created Kafka producer and consumer client applications
  For more details on Kafka client applications, see Deploying and Upgrading AMQ Streams on OpenShift.

7.1. KAFKA CLIENT APPLICATIONS AND SERVICE REGISTRY

Service Registry decouples schema management from client application configuration. You can enable a Java client application to use a schema from Service Registry by specifying its URL in your client code.

You can store the schemas in the registry to serialize and deserialize messages, which are referenced from your client applications to ensure that the messages that they send and receive are compatible with those schemas. Kafka client applications can push or pull their schemas from Service Registry at runtime.

Schemas can evolve, so you can define rules in Service Registry, for example, to ensure that schema changes are valid and do not break previous versions used by applications. Service Registry checks for compatibility by comparing a modified schema with previous schema versions.

Service Registry schema technologies
Service Registry provides schema registry support for schema technologies such as:

- Avro
- Protobuf
- JSON Schema

These schema technologies can be used by client applications through the Kafka client serializer/deserializer (SerDes) services provided by Service Registry. The maturity and usage of the SerDes classes provided by Service Registry might vary. The sections that follow provide more details about each schema type.

Producer schema configuration

A producer client application uses a serializer to put the messages that it sends to a specific broker topic into the correct data format.

To enable a producer to use Service Registry for serialization:

- Define and register your schema with Service Registry (if it does not already exist).
- Configure your producer client code with the following:
  - URL of Service Registry
  - Service Registry serializer to use with messages
  - Strategy to map the Kafka message to a schema artifact in Service Registry
  - Strategy to look up or register the schema used for serialization in Service Registry

After registering your schema, when you start Kafka and Service Registry, you can access the schema to format messages sent to the Kafka broker topic by the producer. Alternatively, depending on configuration, the producer can automatically register the schema on first use.

If a schema already exists, you can create a new version using the registry REST API based on compatibility rules defined in Service Registry. Versions are used for compatibility checking as a schema evolves. A group ID, artifact ID, and version represents a unique tuple that identifies a schema.

Consumer schema configuration

A consumer client application uses a deserializer to get the messages that it consumes from a specific broker topic into the correct data format.

To enable a consumer to use Service Registry for deserialization:

- Define and register your schema with Service Registry (if it does not already exist)
- Configure the consumer client code with the following:
  - URL of Service Registry
  - Service Registry deserializer to use with the messages
  - Input data stream for deserialization

Retrieve schemas using a global ID

By default, the schema is retrieved from Service Registry by the deserializer using a global ID, which is specified in the message being consumed. The schema global ID can be located in the message headers or in the message payload, depending on the configuration of the producer application.

When locating the global ID in the message payload, the format of the data begins with a magic byte, used as a signal to consumers, followed by the global ID, and the message data as normal. For example:

```
# ...
[MAGIC_BYTE]
```

```
[GLOBAL_ID]
[MESSAGE DATA]
```

Then when you start Kafka and Service Registry, you can access the schema to format messages received from the Kafka broker topic.

Retrieve schemas using a content ID

Alternatively, you can configure to retrieve schemas from Service Registry based on the content ID, which is the unique ID of the artifact content. While the global ID is the unique ID of an artifact version.

The content ID does not uniquely identify a version, but uniquely identifies the version content only. If multiple versions share the exact same content, they have a different global ID but the same content ID. Confluent Schema Registry uses content ID by default.

7.2. STRATEGIES TO LOOK UP A SCHEMA IN SERVICE REGISTRY

The Kafka client serializer uses *lookup strategies* to determine the artifact ID and global ID under which the message schema is registered in Service Registry. For a given topic and message, you can use different implementations of the **ArtifactReferenceResolverStrategy** Java interface to return a reference to an artifact in the registry.

The classes for each strategy are in the **io.apicurio.registry.serde.strategy** package. Specific strategy classes for Avro SerDes are in the **io.apicurio.registry.serde.avro.strategy package**. The default strategy is the **TopicIdStrategy**, which looks for Service Registry artifacts with the same name as the Kafka topic receiving messages.

Example

```
public ArtifactReference artifactReference(String topic, boolean isKey, T schema) {
    return ArtifactReference.builder()
            .groupId(null)
            .artifactId(String.format("%s-%s", topic, isKey ? "key" : "value"))
            .build();
```

- The **topic** parameter is the name of the Kafka topic receiving the message.
- The **isKey** parameter is **true** when the message key is serialized, and **false** when the message value is serialized.
- The **schema** parameter is the schema of the message serialized or deserialized.
- The **ArtifactReference** returned contains the artifact ID under which the schema is registered.

Which lookup strategy you use depends on how and where you store your schema. For example, you might use a strategy that uses a *record ID* if you have different Kafka topics with the same Avro message type.

Artifact resolver strategy

The artifact resolver strategy provides a way to map the Kafka topic and message information to an artifact in Service Registry. The common convention for the mapping is to combine the Kafka topic name with the **key** or **value**, depending on whether the serializer is used for the Kafka message key or value.

However, you can use alternative conventions for the mapping by using a strategy provided by Service Registry, or by creating a custom Java class that implements **io.apicurio.registry.serde.strategy.ArtifactReferenceResolverStrategy**.

Strategies to return a reference to an artifact

Service Registry provides the following strategies to return a reference to an artifact based on an implementation of **ArtifactReferenceResolverStrategy**:

RecordIdStrategy

Avro-specific strategy that uses the full name of the schema.

TopicRecordIdStrategy

Avro-specific strategy that uses the topic name and the full name of the schema.

TopicIdStrategy

Default strategy that uses the topic name and **key** or **value** suffix.

SimpleTopicIdStrategy

Simple strategy that only uses the topic name.

DefaultSchemaResolver interface

The default schema resolver locates and identifies the specific version of the schema registered under the artifact reference provided by the artifact resolver strategy. Every version of every artifact has a single globally unique identifier that can be used to retrieve the content of that artifact. This global ID is included in every Kafka message so that a deserializer can properly fetch the schema from Apicurio Registry.

The default schema resolver can look up an existing artifact version, or it can register one if not found, depending on which strategy is used. You can also provide your own strategy by creating a custom Java class that implements **io.apicurio.registry.resolver.SchemaResolver**. However, it is recommended to use the **DefaultSchemaResolver** and specify configuration properties instead.

Configuration for registry lookup options

When using the **DefaultSchemaResolver**, you can configure its behavior using application properties. The following table shows some commonly used examples:

Table 7.1. Service Registry lookup configuration options

Property	Type	Description	Default
apicurio.registry.find-latest	**boolean**	Specify whether the serializer tries to find the latest artifact in the registry for the corresponding group ID and artifact ID.	**false**
apicurio.registry.use-id	**String**	Instructs the serializer to write the specified ID to Kafka and instructs the deserializer to use this ID to find the schema.	None
apicurio.registry.auto-register	**boolean**	Specify whether the serializer tries to create an artifact in the registry. The JSON Schema serializer does not support this.	**false**

Property	Type	Description	Default
apicurio.registry.check-period-ms	**String**	Specify how long to cache the global ID in milliseconds. If not configured, the global ID is fetched every time.	None

7.3. REGISTERING A SCHEMA IN SERVICE REGISTRY

After you have defined a schema in the appropriate format, such as Apache Avro, you can add the schema to Service Registry.

You can add the schema using the following approaches:

- Service Registry web console
- curl command using the Service Registry REST API
- Maven plug-in supplied with Service Registry
- Schema configuration added to your client code

Client applications cannot use Service Registry until you have registered your schemas.

Service Registry web console

When Service Registry is installed, you can connect to the web console from the **ui** endpoint:

http://MY-REGISTRY-URL/ui

From the console, you can add, view and configure schemas. You can also create the rules that prevent invalid content being added to the registry.

Curl command example

```
curl -X POST -H "Content-type: application/json; artifactType=AVRO" \
  -H "X-Registry-ArtifactId: share-price" \ 1
  --data '{
    "type":"record",
    "name":"price",
    "namespace":"com.example",
    "fields":[{"name":"symbol","type":"string"},
    {"name":"price","type":"string"}]}'
  https://my-cluster-my-registry-my-project.example.com/apis/registry/v2/groups/my-group/artifacts -s
2
```

1. Simple Avro schema artifact.
2. OpenShift route name that exposes Service Registry.

Maven plug-in example

```
<plugin>
  <groupId>io.apicurio</groupId>
```

```
<artifactId>apicurio-registry-maven-plugin</artifactId>
<version>${apicurio.version}</version>
<executions>
  <execution>
    <phase>generate-sources</phase>
    <goals>
      <goal>register</goal> (1)
    </goals>
    <configuration>
      <registryUrl>http://REGISTRY-URL/apis/registry/v2</registryUrl> (2)
      <artifacts>
        <artifact>
          <groupId>TestGroup</groupId> (3)
          <artifactId>FullNameRecord</artifactId>
          <file>${project.basedir}/src/main/resources/schemas/record.avsc</file>
          <ifExists>FAIL</ifExists>
        </artifact>
        <artifact>
          <groupId>TestGroup</groupId>
          <artifactId>ExampleAPI</artifactId> (4)
          <type>GRAPHQL</type>
          <file>${project.basedir}/src/main/resources/apis/example.graphql</file>
          <ifExists>RETURN_OR_UPDATE</ifExists>
          <canonicalize>true</canonicalize>
        </artifact>
      </artifacts>
    </configuration>
  </execution>
</executions>
</plugin>
```

1. Specify **register** as the execution goal to upload the schema artifact to the registry.
2. Specify the Service Registry URL with the **../apis/registry/v2** endpoint.
3. Specify the Service Registry artifact group ID.
4. You can upload multiple artifacts using the specified group ID, artifact ID, and location.

Configuration using a producer client example

```
String registryUrl_node1 = PropertiesUtil.property(clientProperties, "registry.url.node1",
   "https://my-cluster-service-registry-myproject.example.com/apis/registry/v2"); (1)
try (RegistryService service = RegistryClient.create(registryUrl_node1)) {
   String artifactId = ApplicationImpl.INPUT_TOPIC + "-value";
   try {
      service.getArtifactMetaData(artifactId); (2)
   } catch (WebApplicationException e) {
      CompletionStage <ArtifactMetaData> csa = service.createArtifact(
         "AVRO",
         artifactId,
         new ByteArrayInputStream(LogInput.SCHEMA$.toString().getBytes())
      );
```

```
            csa.toCompletableFuture().get();
        }
    }
```

1. You can register properties against more than one URL node.
2. Check to see if the schema already exists based on the artifact ID.

7.4. USING A SCHEMA FROM A KAFKA CONSUMER CLIENT

This procedure describes how to configure a Kafka consumer client written in Java to use a schema from Service Registry.

Prerequisites

- Service Registry is installed
- The schema is registered with Service Registry

Procedure

1. Configure the client with the URL of Service Registry. For example:

```
String registryUrl = "https://registry.example.com/apis/registry/v2";
Properties props = new Properties();
props.putIfAbsent(SerdeConfig.REGISTRY_URL, registryUrl);
```

2. Configure the client with the Service Registry deserializer. For example:

```
// Configure Kafka settings
props.putIfAbsent(ProducerConfig.BOOTSTRAP_SERVERS_CONFIG, SERVERS);
props.putIfAbsent(ConsumerConfig.GROUP_ID_CONFIG, "Consumer-" + TOPIC_NAME);
props.putIfAbsent(ConsumerConfig.ENABLE_AUTO_COMMIT_CONFIG, "true");
props.putIfAbsent(ConsumerConfig.AUTO_COMMIT_INTERVAL_MS_CONFIG, "1000");
props.putIfAbsent(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG, "earliest");
// Configure deserializer settings
props.putIfAbsent(ConsumerConfig.KEY_DESERIALIZER_CLASS_CONFIG,
    AvroKafkaDeserializer.class.getName()); 1
props.putIfAbsent(ConsumerConfig.VALUE_DESERIALIZER_CLASS_CONFIG,
    AvroKafkaDeserializer.class.getName()); 2
```

- 1. The deserializer provided by Service Registry.
- 2. The deserialization is in Apache Avro JSON format.

7.5. USING A SCHEMA FROM A KAFKA PRODUCER CLIENT

This procedure describes how to configure a Kafka producer client written in Java to use a schema from Service Registry.

Prerequisites

- Service Registry is installed

- The schema is registered with Service Registry

Procedure

1. Configure the client with the URL of Service Registry. For example:

```
String registryUrl = "https://registry.example.com/apis/registry/v2";
Properties props = new Properties();
props.putIfAbsent(SerdeConfig.REGISTRY_URL, registryUrl);
```

2. Configure the client with the serializer, and the strategy to look up the schema in Service Registry. For example:

```
props.put(CommonClientConfigs.BOOTSTRAP_SERVERS_CONFIG, "my-cluster-kafka-bootstrap:9092");
props.put(ProducerConfig.KEY_SERIALIZER_CLASS_CONFIG,
AvroKafkaSerializer.class.getName()); 1
props.put(ProducerConfig.VALUE_SERIALIZER_CLASS_CONFIG,
AvroKafkaSerializer.class.getName()); 2
props.put(SerdeConfig.FIND_LATEST_ARTIFACT, Boolean.TRUE); 3
```

- 1. The serializer for the message key provided by Service Registry.
- 2. The serializer for the message value provided by Service Registry.
- 3. The lookup strategy to find the global ID for the schema.

7.6. USING A SCHEMA FROM A KAFKA STREAMS APPLICATION

This procedure describes how to configure a Kafka Streams client written in Java to use an Apache Avro schema from Service Registry.

Prerequisites

- Service Registry is installed
- The schema is registered with Service Registry

Procedure

1. Create and configure a Java client with the Service Registry URL:

```
String registryUrl = "https://registry.example.com/apis/registry/v2";

RegistryService client = RegistryClient.cached(registryUrl);
```

2. Configure the serializer and deserializer:

```
Serializer<LogInput> serializer = new AvroKafkaSerializer<LogInput>(); 1

Deserializer<LogInput> deserializer = new AvroKafkaDeserializer <LogInput>(); 2

Serde<LogInput> logSerde = Serdes.serdeFrom(
```

```
    serializer,
    deserializer
);

Map<String, Object> config = new HashMap<>();
config.put(SerdeConfig.REGISTRY_URL, registryUrl);
config.put(AvroKafkaSerdeConfig.USE_SPECIFIC_AVRO_READER, true);
logSerde.configure(config, false); 3
```

- 1. The Avro serializer provided by Service Registry.
- 2. The Avro deserializer provided by Service Registry.
- 3. Configures the Service Registry URL and the Avro reader for deserialization in Avro format.

3. Create the Kafka Streams client:

```
KStream<String, LogInput> input = builder.stream(
    INPUT_TOPIC,
    Consumed.with(Serdes.String(), logSerde)
);
```

CHAPTER 8. CONFIGURING KAFKA SERIALIZERS/DESERIALIZERS IN JAVA CLIENTS

This chapter provides detailed information on how to configure Kafka SerDes in your producer and consumer Java client applications:

- Section 8.1, "Service Registry serializer/deserializer configuration in client applications"
- Section 8.2, "Service Registry serializer/deserializer configuration properties"
- Section 8.3, "How to configure different client serializer/deserializer types"
- Section 8.3.1, "Configure Avro SerDes with Service Registry"
- Section 8.3.2, "Configure JSON Schema SerDes with Service Registry"
- Section 8.3.3, "Configure Protobuf SerDes with Service Registry"

Prerequisites

- You have read Chapter 7, *Validating Kafka messages using serializers/deserializers in Java clients*

8.1. SERVICE REGISTRY SERIALIZER/DESERIALIZER CONFIGURATION IN CLIENT APPLICATIONS

You can configure specific client serializer/deserializer (SerDe) services and schema lookup strategies directly in a client application using the example constants shown in this section. Alternatively, you can configure the corresponding Service Registry application properties in a file or an instance.

The following sections show examples of commonly used SerDe constants and configuration options.

Configuration for SerDe services

```
public class SerdeConfig {

  public static final String REGISTRY_URL = "apicurio.registry.url"; (1)
  public static final String ID_HANDLER = "apicurio.registry.id-handler"; (2)
  public static final String ENABLE_CONFLUENT_ID_HANDLER = "apicurio.registry.as-confluent";
(3)
```

1. The required URL of Service Registry.
2. Extends ID handling to support other ID formats and make them compatible with Service Registry SerDe services. For example, changing the default ID format from **Long** to **Integer** supports the Confluent ID format.
3. Simplifies the handling of Confluent IDs. If set to **true**, an **Integer** is used for the global ID lookup. The setting should not be used with the **ID_HANDLER** option.

Additional resources

- For more details on configuration options, see Section 8.2, "Service Registry serializer/deserializer configuration properties"

Configuration for SerDe lookup strategies

```
public class SerdeConfig {

  public static final String ARTIFACT_RESOLVER_STRATEGY = "apicurio.registry.artifact-resolver-strategy"; (1)
  public static final String SCHEMA_RESOLVER = "apicurio.registry.schema-resolver"; (2)
...
```

1. Java class that implements the artifact resolver strategy and maps between the Kafka SerDe and artifact ID. Defaults to the topic ID strategy. This is only used by the serializer class.
2. Java class that implements the schema resolver. Defaults to **DefaultSchemaResolver**. This is used by the serializer and deserializer classes.

Additional resources

- For more details on look up strategies, see Chapter 7, *Validating Kafka messages using serializers/deserializers in Java clients*
- For more details on configuration options, see Section 8.2, "Service Registry serializer/deserializer configuration properties"

Configuration for Kafka converters

```
public class SerdeBasedConverter<S, T> extends SchemaResolverConfigurer<S, T> implements Converter, Closeable {

  public static final String REGISTRY_CONVERTER_SERIALIZER_PARAM = "apicurio.registry.converter.serializer"; (1)
  public static final String REGISTRY_CONVERTER_DESERIALIZER_PARAM = "apicurio.registry.converter.deserializer"; (2)
```

1. The required serializer to use with the Service Registry Kafka converter.
2. The required deserializer to use with the Service Registry Kafka converter.

Additional resources

- For more details, see the SerdeBasedConverter Java class

Configuration for different schema types

For details on how to configure SerDe for different schema technologies, see the following:

- Section 8.3.1, "Configure Avro SerDes with Service Registry"
- Section 8.3.2, "Configure JSON Schema SerDes with Service Registry"
- Section 8.3.3, "Configure Protobuf SerDes with Service Registry"

8.2. SERVICE REGISTRY SERIALIZER/DESERIALIZER CONFIGURATION PROPERTIES

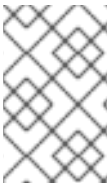
This section provides reference information on Java configuration properties for Service Registry Kafka serializers/deserializers (SerDes).

SchemaResolver interface

Service Registry SerDes are based on the **SchemaResolver** interface, which abstracts access to the registry and applies the same lookup logic for the SerDes classes of all supported formats.

Table 8.1. Configuration property for SchemaResolver interface

Constant	Property	Description	Type	Default
SCHEMA_RESOLVER	**apicurio.registry.schema-resolver**	Used by serializers and deserializers. Fully-qualified Java classname that implements **SchemaResolver**.	String	**io.apicurio.registry.resolver.DefaultSchemaResolver**



NOTE

The **DefaultSchemaResolver** is recommended and provides useful features for most use cases. For some advanced use cases, you might use a custom implementation of **SchemaResolver**.

DefaultSchemaResolver class

You can use the **DefaultSchemaResolver** to configure features such as:

- Access to the registry API
- How to look up artifacts in the registry
- How to write and read artifact information to and from Kafka
- Fall-back options for deserializers

Configuration for registry API access options

The **DefaultSchemaResolver** provides the following properties to configure access to the core registry API:

Table 8.2. Configuration properties for access to registry API

Constant	Property	Description	Type	Default
REGISTRY_URL	**apicurio.registry.url**	Used by serializers and deserializers. URL to access the registry API.	**String**	None

Constant	Property	Description	Type	Default
AUTH_SERVICE_URL	**apicurio.auth.service.url**	Used by serializers and deserializers. URL of the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	**String**	None
AUTH_REALM	**apicurio.auth.realm**	Used by serializers and deserializers. Realm to access the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	**String**	None
AUTH_CLIENT_ID	**apicurio.auth.client.id**	Used by serializers and deserializers. Client ID to access the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	**String**	None
AUTH_CLIENT_SECRET	**apicurio.auth.client.secret**	Used by serializers and deserializers. Client secret to access the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	**String**	None
AUTH_USERNAME	**apicurio.auth.username**	Used by serializers and deserializers. Username to access the registry. Required when accessing a secure registry using HTTP basic authentication.	**String**	None
AUTH_PASSWORD	**apicurio.auth.password**	Used by serializers and deserializers. Password to access the registry. Required when accessing a secure registry using HTTP basic authentication.	**String**	None

Configuration for registry lookup options

The **DefaultSchemaResolver** uses the following properties to configure how to look up artifacts in Service Registry.

Table 8.3. Configuration properties for registry artifact lookup

Constant	Property	Description	Type	Default
ARTIFACT_RESOLVER_STRATEGY	**apicurio.registry.artifact-resolver-strategy**	Used by serializers only. Fully-qualified Java classname that implements **ArtifactReferenceResolverStrategy** and maps each Kafka message to an **ArtifactReference** (**groupId**, **artifactId**, and version). For example, the default strategy uses the topic name as the schema **artifactId**.	**String**	**io.apicurio.registry.serde.strategy.TopicIdStrategy**
EXPLICIT_ARTIFACT_GROUP_ID	**apicurio.registry.artifact.group-id**	Used by serializers only. Sets the **groupId** used for querying or creating an artifact. Overrides the **groupId** returned by the **ArtifactResolverStrategy**.	**String**	None
EXPLICIT_ARTIFACT_ID	**apicurio.registry.artifact.artifact-id**	Used by serializers only. Sets the **artifactId** used for querying or creating an artifact. Overrides the **artifactId** returned by the **ArtifactResolverStrategy**.	**String**	None
EXPLICIT_ARTIFACT_VERSION	**apicurio.registry.artifact.version**	Used by serializers only. Sets the artifact version used for querying or creating an artifact. Overrides the version returned by the **ArtifactResolverStrategy**.	**String**	None

Constant	Property	Description	Type	Default
FIND_LATEST_ARTIFACT	**apicurio.registry.find-latest**	Used by serializers only. Specifies whether the serializer tries to find the latest artifact in the registry for the corresponding group ID and artifact ID.	**boolean**	**false**
AUTO_REGISTER_ARTIFACT	**apicurio.registry.auto-register**	Used by serializers only. Specifies whether the serializer tries to create an artifact in the registry. The JSON Schema serializer does not support this feature.	**boolean**	**false**
AUTO_REGISTER_ARTIFACT_IF_EXISTS	**apicurio.registry.auto-register.if-exists**	Used by serializers only. Configures the behavior of the client when there is a conflict creating an artifact because the artifact already exists. Available values are **FAIL**, **UPDATE**, **RETURN**, or **RETURN_OR_UPDATE**.	**String**	**RETURN_OR_UPDATE**
CHECK_PERIOD_MS	**apicurio.registry.check-period-ms**	Used by serializers and deserializers. Specifies how long to cache artifacts before auto-eviction. If not set, artifacts are fetched every time.	**String**	None

Constant	Property	Description	Type	Default
USE_ID	**apicurio.registry.use-id**	Used by serializers and deserializers. Configures to use the specified **IdOption** as the identifier for artifacts. Options are **globalId** and **contentId**. Instructs the serializer to write the specified ID to Kafka, and instructs the deserializer to use this ID to find the schema.	**String**	**globalId**

Configuration to read/write registry artifacts in Kafka

The **DefaultSchemaResolver** uses the following properties to configure how artifact information is written to and read from Kafka.

Table 8.4. Configuration properties to read/write artifact information in Kafka

Constant	Property	Description	Type	Default
ENABLE_HEADERS	**apicurio.registry.headers.enabled**	Used by serializers and deserializers. Configures to read/write the artifact identifier to Kafka message headers instead of in the message payload.	**boolean**	**true**
HEADERS_HANDLER	**apicurio.registry.headers.handler**	Used by serializers and deserializers. Fully-qualified Java classname that implements **HeadersHandler** and writes/reads the artifact identifier to/from the Kafka message headers.	**String**	**io.apicurio.registry.serde.headers.DefaultHeadersHandler**

Constant	Property	Description	Type	Default
ID_HANDLER	**apicurio.registry.id-handler**	Used by serializers and deserializers. Fully-qualified Java classname of a class that implements **IdHandler** and writes/reads the artifact identifier to/from the message payload. Only used if **apicurio.registry.headers.enabled** is set to **false**.	**String**	**io.apicurio.registry.serde.DefaultIdHandler**
ENABLE_CONFLUENT_ID_HANDLER	**apicurio.registry.as-confluent**	Used by serializers and deserializers. Shortcut for enabling the legacy Confluent-compatible implementation of **IdHandler**. Only used if **apicurio.registry.headers.enabled** is set to **false**.	**boolean**	**true**

Configuration for deserializer fall-back options

The **DefaultSchemaResolver** uses the following property to configure a fall-back provider for all deserializers.

Table 8.5. Configuration property for deserializer fall-back provider

Constant	Property	Description	Type	Default
FALLBACK_ARTIFACT_PROVIDER	**apicurio.registry.fallback.provider**	Only used by deserializers. Sets a custom implementation of **FallbackArtifactProvider** for resolving the artifact used for deserialization. **FallbackArtifactProvider** configures a fallback artifact to fetch from the registry in case the lookup fails.	**String**	**io.apicurio.registry.serde.fallback.DefaultFallbackArtifactProvider**

The **DefaultFallbackArtifactProvider** uses the following properties to configure deserializer fall-back options:

Table 8.6. Configuration properties for deserializer fall-back options

Constant	Property	Description	Type	Default
FALLBACK_ARTIFACT_ID	**apicurio.registry.fallback.artifact-id**	Used by deserializers only. Sets the **artifactId** used as fallback for resolving the artifact used for deserialization.	**String**	None
FALLBACK_ARTIFACT_GROUP_ID	**apicurio.registry.fallback.group-id**	Used by deserializers only. Sets the **groupId** used as fallback for resolving the group used for deserialization.	**String**	None
FALLBACK_ARTIFACT_VERSION	**apicurio.registry.fallback.version**	Used by deserializers only. Sets the version used as fallback for resolving the artifact used for deserialization.	**String**	None

Additional resources

- For more details, see the SerdeConfig Java class
- You can configure application properties as Java system properties or include them in the Quarkus **application.properties** file. For more details, see the Quarkus documentation.

8.3. HOW TO CONFIGURE DIFFERENT CLIENT SERIALIZER/DESERIALIZER TYPES

When using schemas in your Kafka client applications, you must choose which specific schema type to use, depending on your use case. Service Registry provides SerDe Java classes for Apache Avro, JSON Schema, and Google Protobuf. The following sections explain how to configure Kafka applications to use each type.

You can also use Kafka to implement custom serializer and deserializer classes, and leverage Service Registry functionality using the Service Registry REST Java client.

Kafka application configuration for serializers/deserializers

Using the SerDe classes provided by Service Registry in your Kafka application involves setting the correct configuration properties. The following simple Avro examples show how to configure a serializer in a Kafka producer application and how to configure a deserializer in a Kafka consumer application.

Example serializer configuration in a Kafka producer

```
// Create the Kafka producer
private static Producer<Object, Object> createKafkaProducer() {
```

```
    Properties props = new Properties();

    // Configure standard Kafka settings
    props.putIfAbsent(ProducerConfig.BOOTSTRAP_SERVERS_CONFIG, SERVERS);
    props.putIfAbsent(ProducerConfig.CLIENT_ID_CONFIG, "Producer-" + TOPIC_NAME);
    props.putIfAbsent(ProducerConfig.ACKS_CONFIG, "all");

    // Use Service Registry-provided Kafka serializer for Avro
    props.putIfAbsent(ProducerConfig.KEY_SERIALIZER_CLASS_CONFIG,
StringSerializer.class.getName());
    props.putIfAbsent(ProducerConfig.VALUE_SERIALIZER_CLASS_CONFIG,
AvroKafkaSerializer.class.getName());

    // Configure the Service Registry location
    props.putIfAbsent(SerdeConfig.REGISTRY_URL, REGISTRY_URL);

    // Register the schema artifact if not found in the registry.
    props.putIfAbsent(SerdeConfig.AUTO_REGISTER_ARTIFACT, Boolean.TRUE);

    // Create the Kafka producer
    Producer<Object, Object> producer = new KafkaProducer<>(props);
    return producer;
}
```

Example deserializer configuration in a Kafka consumer

```
// Create the Kafka consumer
private static KafkaConsumer<Long, GenericRecord> createKafkaConsumer() {
    Properties props = new Properties();

    // Configure standard Kafka settings
    props.putIfAbsent(ProducerConfig.BOOTSTRAP_SERVERS_CONFIG, SERVERS);
    props.putIfAbsent(ConsumerConfig.GROUP_ID_CONFIG, "Consumer-" + TOPIC_NAME);
    props.putIfAbsent(ConsumerConfig.ENABLE_AUTO_COMMIT_CONFIG, "true");
    props.putIfAbsent(ConsumerConfig.AUTO_COMMIT_INTERVAL_MS_CONFIG, "1000");
    props.putIfAbsent(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG, "earliest");

    // Use Service Registry-provided Kafka deserializer for Avro
    props.putIfAbsent(ConsumerConfig.KEY_DESERIALIZER_CLASS_CONFIG,
StringDeserializer.class.getName());
    props.putIfAbsent(ConsumerConfig.VALUE_DESERIALIZER_CLASS_CONFIG,
AvroKafkaDeserializer.class.getName());

    // Configure the Service Registry location
    props.putIfAbsent(SerdeConfig.REGISTRY_URL, REGISTRY_URL);

    // No other configuration needed because the schema globalId the deserializer uses is sent
    // in the payload. The deserializer extracts the globalId and uses it to look up the schema
    // from the registry.

    // Create the Kafka consumer
    KafkaConsumer<Long, GenericRecord> consumer = new KafkaConsumer<>(props);
    return consumer;
}
```

Additional resources

- For an example application, see the Simple Avro example

8.3.1. Configure Avro SerDes with Service Registry

This topic explains how to use the Kafka client serializer and deserializer (SerDes) classes for Apache Avro.

Service Registry provides the following Kafka client SerDes classes for Avro:

- **io.apicurio.registry.serde.avro.AvroKafkaSerializer**
- **io.apicurio.registry.serde.avro.AvroKafkaDeserializer**

Configure the Avro serializer

You can configure the Avro serializer class with the following:

- Service Registry URL
- Artifact resolver strategy
- ID location
- ID encoding
- Avro datum provider
- Avro encoding

ID location

The serializer passes the unique ID of the schema as part of the Kafka message so that consumers can use the correct schema for deserialization. The ID can be in the message payload or in the message headers. The default location is the message payload. To send the ID in the message headers, set the following configuration property:

```
props.putIfAbsent(SerdeConfig.ENABLE_HEADERS, "true")
```

The property name is **apicurio.registry.headers.enabled**.

ID encoding

You can customize how the schema ID is encoded when passing it in the Kafka message body. Set the **apicurio.registry.id-handler** configuration property to a class that implements the **io.apicurio.registry.serde.IdHandler** interface. Service Registry provides the following implementations:

- **io.apicurio.registry.serde.DefaultIdHandler**: Stores the ID as an 8-byte long
- **io.apicurio.registry.serde.Legacy4ByteIdHandler**: Stores the ID as an 4-byte integer

Service Registry represents the schema ID as a long, but for legacy reasons, or for compatibility with other registries or SerDe classes, you might want to use 4 bytes when sending the ID.

Avro datum provider

Avro provides different datum writers and readers to write and read data. Service Registry supports three different types:

- Generic
- Specific
- Reflect

The Service Registry **AvroDatumProvider** is the abstraction of which type is used, where **DefaultAvroDatumProvider** is used by default.

You can set the following configuration options:

- **apicurio.registry.avro-datum-provider**: Specifies a fully-qualified Java class name of the **AvroDatumProvider** implementation, for example **io.apicurio.registry.serde.avro.ReflectAvroDatumProvider**
- **apicurio.registry.use-specific-avro-reader**: Set to **true** to use a specific type when using **DefaultAvroDatumProvider**

Avro encoding

When using Avro to serialize data, you can use the Avro binary encoding format to ensure the data is encoded in as efficient a format as possible. Avro also supports encoding the data as JSON, which makes it easier to inspect the payload of each message, for example, for logging or debugging.

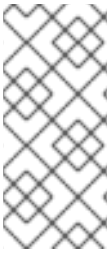
You can set the Avro encoding by configuring the **apicurio.registry.avro.encoding** property with a value of **JSON** or **BINARY**. The default is **BINARY**.

Configure the Avro deserializer

You must configure the Avro deserializer class to match the following configuration settings of the serializer:

- Service Registry URL
- ID encoding
- Avro datum provider
- Avro encoding

See the serializer section for these configuration options. The property names and values are the same.



NOTE

The following options are not required when configuring the deserializer:

- Artifact resolver strategy
- ID location

The deserializer class can determine the values for these options from the message. The strategy is not required because the serializer is responsible for sending the ID as part of the message.

The ID location is determined by checking for the magic byte at the start of the message payload. If that byte is found, the ID is read from the message payload using the configured handler. If the magic byte is not found, the ID is read from the message headers.

Avro SerDes and artifact references

When working with Avro messages and a schema with nested records, a new artifact is registered per nested record. For example, the following **TradeKey** schema includes a nested **Exchange** schema:

TradeKey schema with nested Exchange schema

```
{
  "namespace": "com.kubetrade.schema.trade",
  "type": "record",
  "name": "TradeKey",
  "fields": [
    {
      "name": "exchange",
      "type": "com.kubetrade.schema.common.Exchange"
    },
    {
      "name": "key",
      "type": "string"
    }
  ]
}
```

Exchange schema

```
{
  "namespace": "com.kubetrade.schema.common",
  "type": "enum",
  "name": "Exchange",
  "symbols" : ["GEMINI"]
}
```

When using these schemas with Avro SerDes, two artifacts are created in Service Registry, one for the **TradeKey** schema and one for the **Exchange** schema. Whenever a message using the **TradeKey** schema is serialized or deserialized, both schemas are retrieved, allowing you to split your definitions into different files.

Additional resources

- For more details on Avro configuration, see the AvroKafkaSerdeConfig Java class
- For Java example applications, see:
  - Simple Avro example
  - SerDes with references example

8.3.2. Configure JSON Schema SerDes with Service Registry

This topic explains how to use the Kafka client serializer and deserializer (SerDes) classes for JSON Schema.

Service Registry provides the following Kafka client SerDes classes for JSON Schema:

- **io.apicurio.registry.serde.jsonschema.JsonSchemaKafkaSerializer**
- **io.apicurio.registry.serde.jsonschema.JsonSchemaKafkaDeserializer**

Unlike Apache Avro, JSON Schema is not a serialization technology, but is instead a validation technology. As a result, configuration options for JSON Schema are quite different. For example, there is no encoding option, because data is always encoded as JSON.

Configure the JSON Schema serializer

You can configure the JSON Schema serializer class as follows:

- Service Registry URL
- Artifact resolver strategy
- Schema validation

The only non-standard configuration property is JSON Schema validation, which is enabled by default. You can disable this by setting **apicurio.registry.serde.validation-enabled** to **"false"**. For example:

```
props.putIfAbsent(SerdeConfig.VALIDATION_ENABLED, Boolean.FALSE)
```

Configure the JSON Schema deserializer

You can configure the JSON Schema deserializer class as follows:

- Service Registry URL
- Schema validation
- Class for deserializing data

You must provide the location of Service Registry so that the schema can be loaded. The other configuration is optional.

NOTE

Deserializer validation only works if the serializer passes the global ID in the Kafka message, which will only happen when validation is enabled in the serializer.

JSON Schema SerDes and artifact references

The JSON Schema SerDes cannot discover the schema from the message payload, so the schema artifact must be registered beforehand, and this also applies artifact references.

Depending on the content of the schema, if the **$ref** value is a URL, the SerDes try to resolve the referenced schema using that URL, and then validation works as usual, validating the data against the main schema, and validating the nested value against the nested schema. Support for referencing artifacts in Service Registry has also been implemented.

For example, the following **citizen.json** schema references the **city.json** schema:

citizen.json schema with reference to city.json schema

```
{
 "$id": "https://example.com/citizen.schema.json",
 "$schema": "http://json-schema.org/draft-07/schema#",
 "title": "Citizen",
 "type": "object",
 "properties": {
  "firstName": {
    "type": "string",
    "description": "The citizen's first name."
  },
  "lastName": {
    "type": "string",
    "description": "The citizen's last name."
  },
  "age": {
    "description": "Age in years which must be equal to or greater than zero.",
    "type": "integer",
    "minimum": 0
  },
  "city": {
    "$ref": "city.json"
  }
 }
}
```

city.json schema

```
{
 "$id": "https://example.com/city.schema.json",
 "$schema": "http://json-schema.org/draft-07/schema#",
 "title": "City",
 "type": "object",
 "properties": {
  "name": {
    "type": "string",
    "description": "The city's name."
  },
  "zipCode": {
    "type": "integer",
    "description": "The zip code.",
    "minimum": 0
  }
 }
}
```

In this example, a given citizen has a city. In Service Registry, a citizen artifact with a reference to the city artifact is created using the name **city.json**. In the SerDes, when the citizen schema is fetched, the city schema is also fetched because it is referenced from the citizen schema. When serializing/deserializing data, the reference name is used to resolve the nested schema, allowing validation against the citizen schema and the nested city schema.

Additional resources

- For more details, see the JsonSchemaKafkaDeserializerConfig Java class

- For Java example applications, see:
  - Simple JSON Schema example
  - SerDes with references example

8.3.3. Configure Protobuf SerDes with Service Registry

This topic explains how to use the Kafka client serializer and deserializer (SerDes) classes for Google Protobuf.

Service Registry provides the following Kafka client SerDes classes for Protobuf:

- **io.apicurio.registry.serde.protobuf.ProtobufKafkaSerializer**
- **io.apicurio.registry.serde.protobuf.ProtobufKafkaDeserializer**

Configure the Protobuf serializer

You can configure the Protobuf serializer class as follows:

- Service Registry URL
- Artifact resolver strategy
- ID location
- ID encoding
- Schema validation

For details on these configuration options, see the following sections:

- Section 8.1, "Service Registry serializer/deserializer configuration in client applications"
- Section 8.3.1, "Configure Avro SerDes with Service Registry"

Configure the Protobuf deserializer

You must configure the Protobuf deserializer class to match the following configuration settings in the serializer:

- Service Registry URL
- ID encoding

The configuration property names and values are the same as for the serializer.

NOTE

The following options are not required when configuring the deserializer:

- Artifact resolver strategy
- ID location

The deserializer class can determine the values for these options from the message. The strategy is not required because the serializer is responsible for sending the ID as part of the message.

The ID location is determined by checking for the magic byte at the start of the message payload. If that byte is found, the ID is read from the message payload using the configured handler. If the magic byte is not found, the ID is read from the message headers.

NOTE

The Protobuf deserializer does not deserialize to your exact Protobuf Message implementation, but rather to a **DynamicMessage** instance. There is no appropriate API to do otherwise.

Protobuf SerDes and artifact references

When a complex Protobuf message with an **import** statement is used, the imported Protobuf messages are stored in Service Registry as separate artifacts. Then when Service Registry gets the main schema to check a Protobuf message, the referenced schemes are also retrieved so the full message schema can be checked and serialized.

For example, the following **table_info.proto** schema file includes the imported **mode.proto** schema file:

table_info.proto file with imported .mode.proto file

```
syntax = "proto3";
package sample;
option java_package = "io.api.sample";
option java_multiple_files = true;

import "sample/mode.proto";

message TableInfo {

 int32 winIndex = 1;
 Mode mode = 2;
 int32 min = 3;
 int32 max = 4;
 string id = 5;
 string dataAdapter = 6;
 string schema = 7;
 string selector = 8;
 string subscription_id = 9;
}
```

mode.proto file

```
syntax = "proto3";
package sample;
option java_package = "io.api.sample";
option java_multiple_files = true;

enum Mode {

MODE_UNKNOWN = 0;
RAW = 1;
```

```
MERGE = 2;
DISTINCT = 3;
COMMAND = 4;
}
```

In this example, two Protobuf artifacts are stored in Service Registry, one for **TableInfo** and one for **Mode**. However, because **Mode** is part of **TableInfo**, whenever **TableInfo** is fetched to check a message in the SerDes, **Mode** is also returned as an artifact referenced by **TableInfo**.

Additional resources

- For Java example applications, see:
  - Protobuf Bean and Protobuf Find Latest examples
  - SerDes with references example

CHAPTER 9. SERVICE REGISTRY ARTIFACT REFERENCE

This chapter provides details on the supported artifact types, states, metadata, and content rules that are stored in Service Registry.

Additional resources

- For more detailed information, see the Apicurio Registry REST API documentation

9.1. SERVICE REGISTRY ARTIFACT TYPES

You can store and manage a wide range of schema and API artifact types in Service Registry.

Table 9.1. Service Registry artifact types

Type	Description
ASYNCAPI	AsyncAPI specification
AVRO	Apache Avro schema
GRAPHQL	GraphQL schema
JSON	JSON Schema
KCONNECT	Apache Kafka Connect schema
OPENAPI	OpenAPI specification
PROTOBUF	Google protocol buffers schema
WSDL	Web Services Definition Language
XSD	XML Schema Definition

9.2. SERVICE REGISTRY ARTIFACT STATES

The valid artifact states in Service Registry are **ENABLED**, **DISABLED**, and **DEPRECATED**.

Table 9.2. Service Registry artifact states

State	Description
ENABLED	Basic state, all the operations are available.
DISABLED	The artifact and its metadata is viewable and searchable using the Service Registry web console, but its content cannot be fetched by any client.
DEPRECATED	The artifact is fully usable but a header is added to the REST API response whenever the artifact content is fetched. The Service Registry Rest Client will also log a warning whenever it sees deprecated content.

9.3. SERVICE REGISTRY ARTIFACT METADATA

When an artifact is added to Service Registry, a set of metadata properties is stored along with the artifact content. This metadata consists of a set of generated read-only properties, along with some properties that you can set.

Table 9.3. Service Registry metadata properties

Property	Type	Editable
id	string	false
type	ArtifactType	false
state	ArtifactState	true
version	integer	false
createdBy	string	false
createdOn	date	false
modifiedBy	string	false
modifiedOn	date	false
name	string	true
description	string	true
labels	array of string	true
properties	map	true

Property	Type	Editable

Updating artifact metadata

- You can use the Service Registry REST API to update the set of editable properties using the metadata endpoints.
- You can edit the **state** property only by using the state transition API. For example, you can mark an artifact as **deprecated** or **disabled**.

Additional resources

For more details, see the **/artifacts/{artifactId}/meta** sections in the Apicurio Registry REST API documentation.

9.4. SERVICE REGISTRY CONTENT RULE TYPES

You can specify **VALIDITY** and **COMPATIBILITY** rule types to govern content evolution in Service Registry.

Table 9.4. Service Registry content rule types

Type	Description
VALIDITY	Validate data before adding it to the registry. The possible configuration values for this rule are: • **FULL**: The validation is both syntax and semantic. • **SYNTAX_ONLY**: The validation is syntax only. • **NONE**: All validation checks are disabled.

Type	Description
COMPATIBILITY	Ensure that newly added artifacts are compatible with previously added versions. The possible configuration values for this rule are: • **FULL**: The new artifact is forward and backward compatible with the most recently added artifact. • **FULL_TRANSITIVE**: The new artifact is forward and backward compatible with all previously added artifacts. • **BACKWARD**: Clients using the new artifact can read data written using the most recently added artifact. • **BACKWARD_TRANSITIVE**: Clients using the new artifact can read data written using all previously added artifacts. • **FORWARD**: Clients using the most recently added artifact can read data written using the new artifact. • **FORWARD_TRANSITIVE**: Clients using all previously added artifacts can read data written using the new artifact. • **NONE**: All backward and forward compatibility checks are disabled.

9.5. SERVICE REGISTRY CONTENT RULE MATURITY

Not all content rules are fully implemented for every artifact type supported by Service Registry. The following table shows the current maturity level for each rule and artifact type:

Table 9.5. Service Registry content rule maturity matrix

Artifact type	Validity rule	Compatibility rule
Avro	Full	Full
Protobuf	Full	Full
JSON Schema	Full	Full
OpenAPI	Full	None
AsyncAPI	Syntax Only	None
GraphQL	Syntax Only	None

Artifact type	Validity rule	Compatibility rule
Kafka Connect	Syntax Only	None
WSDL	Syntax Only	None
XSD	Syntax Only	None

9.6. SERVICE REGISTRY CONTENT RULE PRECEDENCE

When you add or update an artifact, Service Registry applies rules to check the validity and compatibility of the artifact content. Configured artifact rules override the equivalent configured global rules, as shown in the following table.

Table 9.6. Service Registry content rule precedence

Artifact rule	Global rule	Rule applied to this artifact	Global rule available for other artifacts?
Enabled	Enabled	Artifact	Yes
Disabled	Enabled	Global	Yes
Disabled	Disabled	None	No
Enabled, set to None	Enabled	None	Yes
Disabled	Enabled, set to None	None	No

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 .