



# Red Hat build of Apicurio Registry 2.5

## Apicurio Registry User Guide

Manage schemas and APIs in Apicurio Registry 2.5





## Legal Notice

Copyright © 2024 Red Hat, Inc.

The text of and illustrations in this document are licensed by Red Hat under a Creative Commons Attribution–Share Alike 3.0 Unported license ("CC-BY-SA"). An explanation of CC-BY-SA is available at

<http://creativecommons.org/licenses/by-sa/3.0/>

. In accordance with CC-BY-SA, if you distribute this document or an adaptation of it, you must provide the URL for the original version.

Red Hat, as the licensor of this document, waives the right to enforce, and agrees not to assert, Section 4d of CC-BY-SA to the fullest extent permitted by applicable law.

Red Hat, Red Hat Enterprise Linux, the Shadowman logo, the Red Hat logo, JBoss, OpenShift, Fedora, the Infinity logo, and RHCE are trademarks of Red Hat, Inc., registered in the United States and other countries.

Linux<sup>®</sup> is the registered trademark of Linus Torvalds in the United States and other countries.

Java<sup>®</sup> is a registered trademark of Oracle and/or its affiliates.

XFS<sup>®</sup> is a trademark of Silicon Graphics International Corp. or its subsidiaries in the United States and/or other countries.

MySQL<sup>®</sup> is a registered trademark of MySQL AB in the United States, the European Union and other countries.

Node.js<sup>®</sup> is an official trademark of Joyent. Red Hat is not formally related to or endorsed by the official Joyent Node.js open source or commercial project.

The OpenStack<sup>®</sup> Word Mark and OpenStack logo are either registered trademarks/service marks or trademarks/service marks of the OpenStack Foundation, in the United States and other countries and are used with the OpenStack Foundation's permission. We are not affiliated with, endorsed or sponsored by the OpenStack Foundation, or the OpenStack community.

All other trademarks are the property of their respective owners.

## Abstract

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

# Table of Contents

<b>PREFACE</b> .....	<b>5</b>
MAKING OPEN SOURCE MORE INCLUSIVE	5
PROVIDING FEEDBACK ON RED HAT DOCUMENTATION	5
<b>CHAPTER 1. INTRODUCTION TO APICURIO REGISTRY</b> .....	<b>6</b>
1.1. WHAT IS APICURIO REGISTRY?	6
Apicurio Registry capabilities	6
1.2. SCHEMA AND API ARTIFACTS IN APICURIO REGISTRY	7
Groups of schemas and APIs	7
References to other schemas and APIs	8
Supported artifact types	9
1.3. MANAGE CONTENT USING THE APICURIO REGISTRY WEB CONSOLE	10
1.4. APICURIO REGISTRY REST API FOR CLIENTS	10
Compatibility with other schema registry REST APIs	11
1.5. APICURIO REGISTRY STORAGE OPTIONS	12
1.6. VALIDATE KAFKA MESSAGES USING SCHEMAS AND JAVA CLIENT SERIALIZERS/DESERIALIZERS	12
1.7. STREAM DATA TO EXTERNAL SYSTEMS WITH KAFKA CONNECT CONVERTERS	13
1.8. APICURIO REGISTRY DEMONSTRATION EXAMPLES	14
1.9. APICURIO REGISTRY AVAILABLE DISTRIBUTIONS	15
<b>CHAPTER 2. APICURIO REGISTRY CONTENT RULES</b> .....	<b>16</b>
2.1. GOVERN APICURIO REGISTRY CONTENT USING RULES	16
2.1.1. When rules are applied	16
2.1.2. Order of precedence of rules	16
2.1.3. How rules work	17
2.1.4. Content rule configuration	17
Configure artifact rules	17
Configure global rules	17
<b>CHAPTER 3. MANAGING APICURIO REGISTRY CONTENT USING THE WEB CONSOLE</b> .....	<b>19</b>
3.1. VIEWING ARTIFACTS USING THE APICURIO REGISTRY WEB CONSOLE	19
3.2. ADDING ARTIFACTS USING THE APICURIO REGISTRY WEB CONSOLE	21
3.3. CONFIGURING CONTENT RULES USING THE APICURIO REGISTRY WEB CONSOLE	23
3.4. GENERATING CLIENT SDKS FOR OPENAPI ARTIFACTS USING THE APICURIO REGISTRY WEB CONSOLE	24
3.5. CHANGING AN ARTIFACT OWNER USING THE APICURIO REGISTRY WEB CONSOLE	26
3.6. CONFIGURING APICURIO REGISTRY INSTANCE SETTINGS USING THE WEB CONSOLE	27
3.7. EXPORTING AND IMPORTING DATA USING THE APICURIO REGISTRY WEB CONSOLE	29
<b>CHAPTER 4. MANAGING APICURIO REGISTRY CONTENT USING THE REST API</b> .....	<b>31</b>
4.1. MANAGING SCHEMA AND API ARTIFACTS USING APICURIO REGISTRY REST API COMMANDS	31
4.2. MANAGING SCHEMA AND API ARTIFACT VERSIONS USING APICURIO REGISTRY REST API COMMANDS	32
4.3. MANAGING SCHEMA AND API ARTIFACT REFERENCES USING APICURIO REGISTRY REST API COMMANDS	33
4.4. EXPORTING AND IMPORTING REGISTRY DATA USING APICURIO REGISTRY REST API COMMANDS	36
<b>CHAPTER 5. MANAGING APICURIO REGISTRY CONTENT USING THE MAVEN PLUG-IN</b> .....	<b>38</b>
5.1. ADDING SCHEMA AND API ARTIFACTS USING THE MAVEN PLUG-IN	38
5.2. DOWNLOADING SCHEMA AND API ARTIFACTS USING THE MAVEN PLUG-IN	39
5.3. TESTING SCHEMA AND API ARTIFACTS USING THE MAVEN PLUG-IN	41
5.4. ADDING ARTIFACT REFERENCES MANUALLY USING THE APICURIO REGISTRY MAVEN PLUG-IN	42
5.5. ADDING ARTIFACT REFERENCES AUTOMATICALLY USING THE APICURIO REGISTRY MAVEN PLUG-IN	

	45
<b>CHAPTER 6. MANAGING APICURIO REGISTRY CONTENT USING A JAVA CLIENT</b> .....	<b>48</b>
6.1. APICURIO REGISTRY JAVA CLIENT	48
6.2. WRITING APICURIO REGISTRY JAVA CLIENT APPLICATIONS	48
6.3. APICURIO REGISTRY JAVA CLIENT CONFIGURATION	49
Custom header configuration	49
TLS configuration options	50
<b>CHAPTER 7. VALIDATING KAFKA MESSAGES USING SERIALIZERS/DESERIALIZERS IN JAVA CLIENTS</b>	<b>51</b>
7.1. KAFKA CLIENT APPLICATIONS AND APICURIO REGISTRY	51
Apicurio Registry schema technologies	51
Producer schema configuration	52
Consumer schema configuration	52
7.2. STRATEGIES TO LOOK UP A SCHEMA IN APICURIO REGISTRY	53
Artifact resolver strategy	53
Strategies to return a reference to an artifact	54
DefaultSchemaResolver interface	54
Configuration for registry lookup options	54
7.3. REGISTERING A SCHEMA IN APICURIO REGISTRY	55
Apicurio Registry web console	55
Curl command example	55
Maven plug-in example	55
Configuration using a producer client example	56
7.4. USING A SCHEMA FROM A KAFKA CONSUMER CLIENT	57
7.5. USING A SCHEMA FROM A KAFKA PRODUCER CLIENT	57
7.6. USING A SCHEMA FROM A KAFKA STREAMS APPLICATION	58
<b>CHAPTER 8. CONFIGURING KAFKA SERIALIZERS/DESERIALIZERS IN JAVA CLIENTS</b> .....	<b>60</b>
8.1. APICURIO REGISTRY SERIALIZER/DESERIALIZER CONFIGURATION IN CLIENT APPLICATIONS	60
Configuration for SerDes services	60
Configuration for SerDes lookup strategies	61
Configuration for Kafka converters	61
Configuration for different schema types	61
8.2. APICURIO REGISTRY SERIALIZER/DESERIALIZER CONFIGURATION PROPERTIES	61
SchemaResolver interface	62
DefaultSchemaResolver class	62
Configuration for registry API access options	62
Configuration for registry lookup options	64
Configuration to read/write registry artifacts in Kafka	66
Configuration for deserializer fall-back options	67
8.3. HOW TO CONFIGURE DIFFERENT CLIENT SERIALIZER/DESERIALIZER TYPES	69
Kafka application configuration for serializers/deserializers	69
8.3.1. Configure Avro SerDes with Apicurio Registry	70
8.3.2. Configure JSON Schema SerDes with Apicurio Registry	73
8.3.3. Configure Protobuf SerDes with Apicurio Registry	75
<b>CHAPTER 9. APICURIO REGISTRY ARTIFACT REFERENCE</b> .....	<b>78</b>
9.1. APICURIO REGISTRY ARTIFACT TYPES	78
9.2. APICURIO REGISTRY ARTIFACT STATES	78
9.3. APICURIO REGISTRY ARTIFACT METADATA	79
<b>CHAPTER 10. APICURIO REGISTRY CONTENT RULE REFERENCE</b> .....	<b>82</b>
10.1. APICURIO REGISTRY CONTENT RULE TYPES	82

10.2. APICURIO REGISTRY CONTENT RULE MATURITY	84
10.3. APICURIO REGISTRY CONTENT RULE PRECEDENCE	84
<b>APPENDIX A. USING YOUR SUBSCRIPTION</b> .....	<b>86</b>
Accessing your account	86
Activating a subscription	86
Downloading ZIP and TAR files	86





## 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](#).

### PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

We appreciate your feedback on our documentation.

To propose improvements, open a Jira issue and describe your suggested changes. Provide as much detail as possible to enable us to address your request quickly.

#### Prerequisite

- You have a Red Hat Customer Portal account. This account enables you to log in to the Red Hat Jira Software instance.  
If you do not have an account, you will be prompted to create one.

#### Procedure

1. Click the following link: [Create issue](#).
2. In the **Summary** text box, enter a brief description of the issue.
3. In the **Description** text box, provide the following information:
  - The URL of the page where you found the issue.
  - A detailed description of the issue.  
You can leave the information in any other fields at their default values.
4. Click **Create** to submit the Jira issue to the documentation team.

Thank you for taking the time to provide feedback.

# CHAPTER 1. INTRODUCTION TO APICURIO REGISTRY

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

- [Section 1.1, "What is Apicurio Registry?"](#)
- [Section 1.2, "Schema and API artifacts in Apicurio Registry"](#)
- [Section 1.3, "Manage content using the Apicurio Registry web console"](#)
- [Section 1.4, "Apicurio Registry REST API for clients"](#)
- [Section 1.5, "Apicurio Registry storage options"](#)
- [Section 1.6, "Validate Kafka messages using schemas and Java client serializers/deserializers"](#)
- [Section 1.7, "Stream data to external systems with Kafka Connect converters"](#)
- [Section 1.8, "Apicurio Registry demonstration examples"](#)
- [Section 1.9, "Apicurio Registry available distributions"](#)

## 1.1. WHAT IS APICURIO REGISTRY?

Apicurio Registry is a datastore for sharing standard event schemas and API designs across event-driven and API architectures. You can use Apicurio 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.

Client applications can dynamically push or pull the latest schema updates to or from Apicurio Registry at runtime without needing to redeploy. Developer teams can query Apicurio 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 Apicurio Registry by specifying the Apicurio Registry URL in your client application code. Apicurio Registry can store schemas used 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.

Using Apicurio 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. Apicurio Registry provides a web console to make it easy for developers and administrators to manage registry content.

You can configure optional rules to govern the evolution of your Apicurio Registry content. These include rules to ensure that uploaded content is valid, or is compatible with other versions. Any configured rules must pass before new versions can be uploaded to Apicurio Registry, which ensures that time is not wasted on invalid or incompatible schemas or API designs.

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

### Apicurio Registry capabilities

- Multiple payload formats for standard event schema and API specifications such as Apache Avro, JSON Schema, Google Protobuf, AsyncAPI, OpenAPI, and more.
- Pluggable Apicurio Registry storage options in AMQ Streams or PostgreSQL database.
- Rules for content validation, compatibility, and integrity to govern how Apicurio Registry content evolves over time.
- Apicurio 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 schema registry client applications.
- Cloud-native Quarkus Java runtime for low memory footprint and fast deployment times.
- Operator-based installation of Apicurio Registry on OpenShift.
- OpenID Connect (OIDC) authentication using Red Hat Single Sign-On.

## 1.2. SCHEMA AND API ARTIFACTS IN APICURIO REGISTRY

The items stored in Apicurio 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 Apicurio 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.

### 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 Apicurio 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 Apicurio Registry web console, REST API, command line, Maven plug-in, or Java client application. The following simple example shows using the Core Registry 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 Apicurio Registry web console, and a **default** group is created automatically. 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 information on supported artifact types, see [Chapter 9, Apicurio Registry artifact reference](#).
- For information on the Core Registry API, see the [Apicurio Registry REST API documentation](#).

#### References to other schemas and APIs

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

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

You can manage artifact references using the Apicurio Registry core REST API, Maven plug-in, and Java serializers/deserializers (SerDes). Apicurio Registry stores the artifact references along with the artifact content. Apicurio 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

Apicurio Registry currently supports artifact references for the following artifact types only:

- Avro
- Protobuf
- JSON Schema
- OpenAPI
- AsyncAPI

## Additional resources

- For details on managing artifact references, see:
  - [Chapter 4, Managing Apicurio Registry content using the REST API](#) .
  - [Chapter 5, Managing Apicurio Registry content using the Maven plug-in](#) .
- For a Java example, see the [Apicurio Registry SerDes with references demonstration](#) .

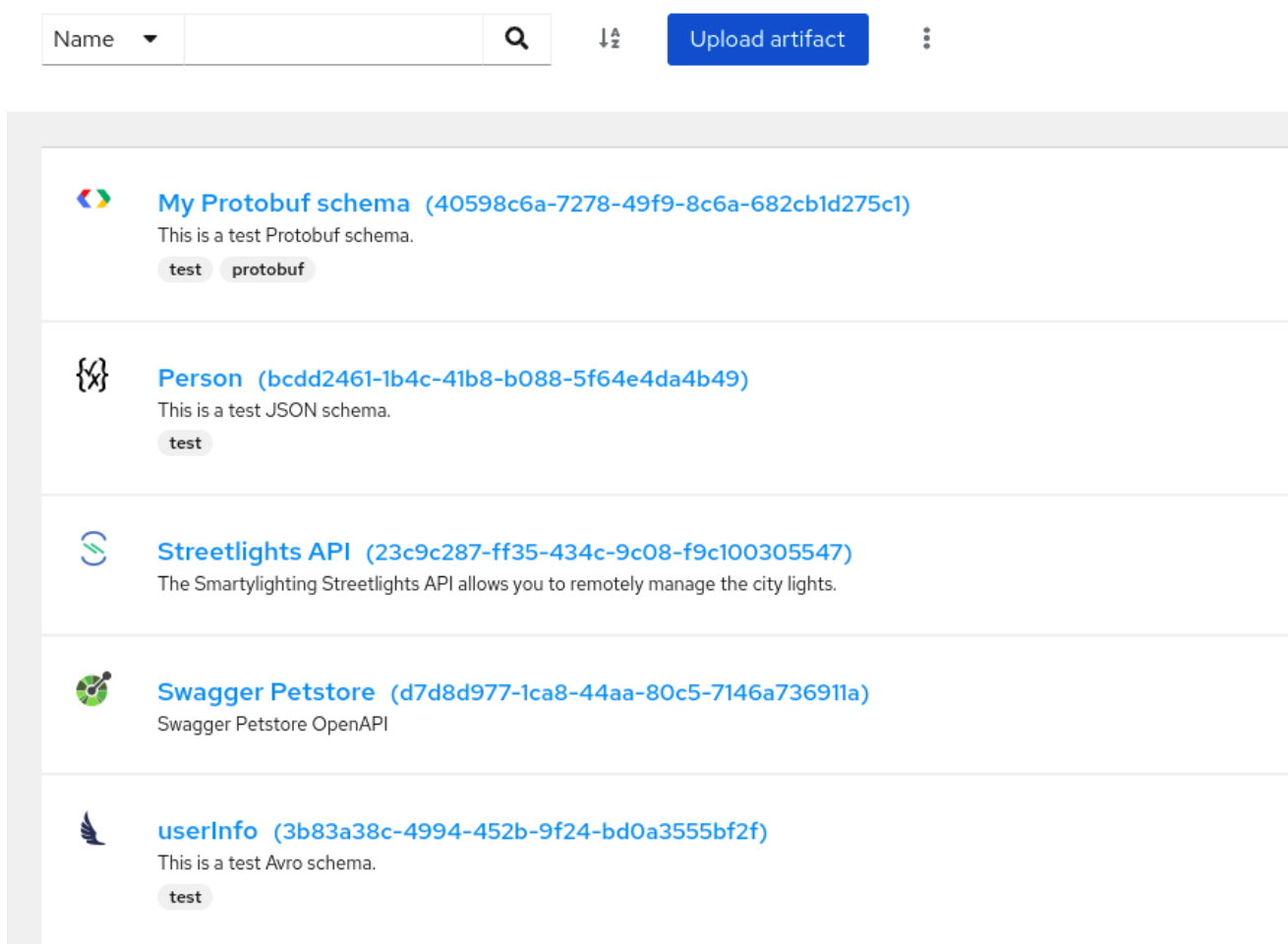
## 1.3. MANAGE CONTENT USING THE APICURIO REGISTRY WEB CONSOLE

You can use the Apicurio 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 10, Apicurio Registry content rule reference](#).

Figure 1.1. Apicurio Registry web console



The Apicurio Registry web console is available from [http://MY\\_REGISTRY\\_URL/ui](http://MY_REGISTRY_URL/ui).

### Additional resources

- [Chapter 3, Managing Apicurio Registry content using the web console](#)

## 1.4. APICURIO REGISTRY REST API FOR CLIENTS

Client applications can use the Core Registry API v2 to manage the schema and API artifacts in Apicurio Registry. This API provides operations for the following features:

## Admin

Export or import Apicurio Registry data in a **.zip** file, and manage logging levels for the Apicurio Registry instance at runtime.

## Artifacts

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

## Artifact metadata

Manage details about a schema or API artifact. You can edit details such as artifact name, description, or labels. Details such as 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 Apicurio Registry. Artifact rules override any global rules configured.

## 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.

## 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 Apicurio 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.

## System

Get the Apicurio Registry version and the limits on resources for the Apicurio Registry instance.

## Users

Get the current Apicurio Registry user.

## Compatibility with other schema registry REST APIs

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

- Apicurio Registry Core Registry API v1
- Confluent Schema Registry API v6
- Confluent Schema Registry API v7
- CNCF CloudEvents Schema Registry API v0

Applications using Confluent client libraries can use Apicurio Registry as a drop-in replacement. For more details, see [Replacing Confluent Schema Registry](#).

## Additional resources

- For more information on the Core Registry API v2, see the [Apicurio Registry REST API documentation](#).

- For API documentation on the Core Registry API v2 and all compatible APIs, browse to the `/apis` endpoint of your Apicurio Registry instance, for example, <http://MY-REGISTRY-URL/apis>.

## 1.5. APICURIO REGISTRY STORAGE OPTIONS

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

**Table 1.1. Apicurio Registry data storage options**

Storage option	Description
PostgreSQL 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	Kafka storage is provided for production environments where database management expertise is not available, or where storage in Kafka is a specific requirement.

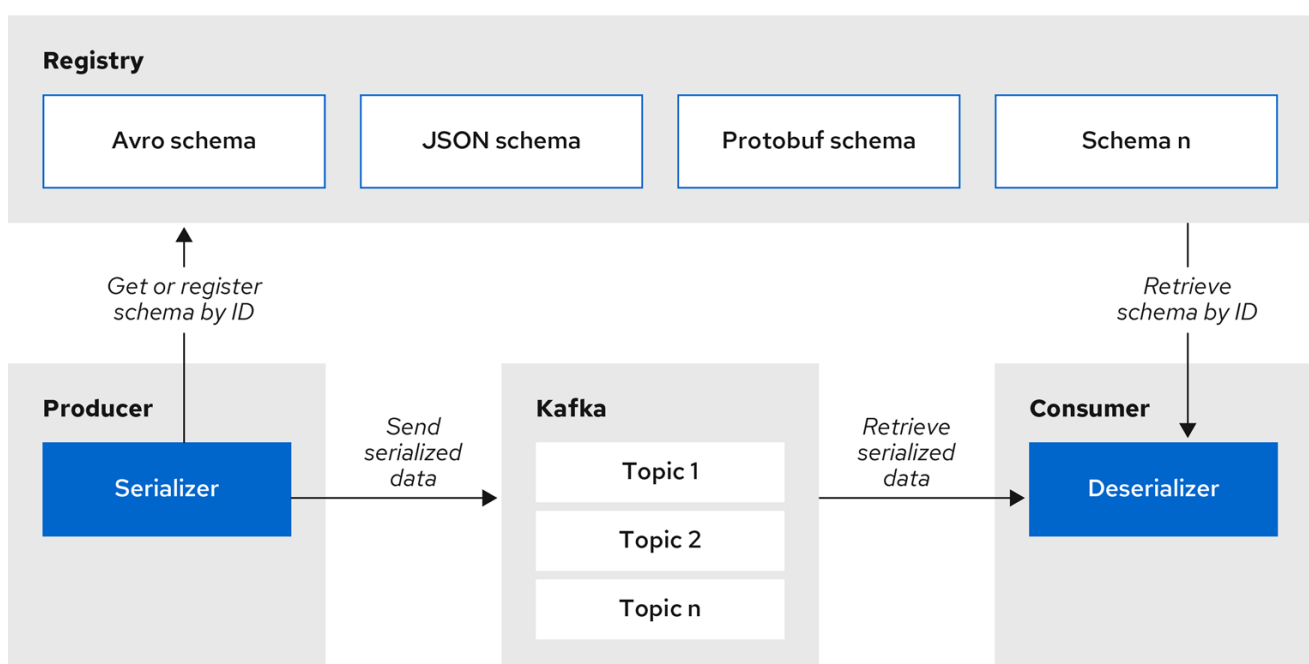
### Additional resources

- For more details on storage options, see [Installing and deploying Red Hat build of Apicurio 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. Apicurio Registry and Kafka client SerDes architecture**



101\_RHL\_0620



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

- Apache Avro
- Google Protobuf
- JSON Schema

The Apicurio 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 Apicurio 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 Apicurio Registry at runtime for validation.

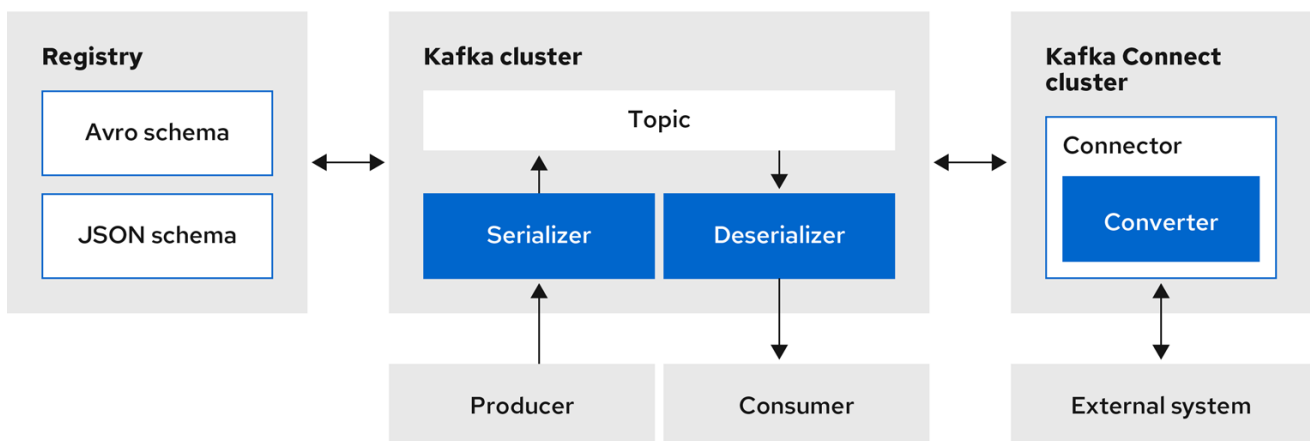
### Additional resources

- [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 Apicurio 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. Apicurio Registry and Kafka Connect architecture



101\_RHL\_0620

Apicurio Registry provides the following features for Kafka Connect:

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

You can use the Avro and JSON Schema converters to map Kafka Connect schemas into Avro or JSON schemas. These schemas can then serialize message keys and values into the compact Avro binary

format or human-readable JSON format. The converted JSON is less verbose because the messages do not contain the schema information, only the schema ID.

Apicurio Registry can manage and track the Avro and JSON schemas used in the Kafka topics. Because the schemas are stored in Apicurio 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 Apicurio Registry are 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 events. You can install the Apicurio Registry SerDes in any Kafka-based system and use them along with Kafka Connect, or with a Kafka Connect-based system such as Debezium.

### Additional resources

- [Configuring Debezium to use Avro serialization and Apicurio Registry](#)
- [Example of using Debezium to monitor the PostgreSQL database used by Apicurio Registry](#)
- [Apache Kafka Connect documentation](#)

## 1.8. APICURIO REGISTRY DEMONSTRATION EXAMPLES

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

These applications demonstrate use cases such as the following examples:

- Apache Avro Kafka SerDes
- Apache Avro Maven plug-in
- Apache Camel Quarkus and Kafka
- CloudEvents
- Confluent Kafka SerDes
- Custom ID strategy
- Event-driven architecture with Debezium
- Google Protobuf Kafka SerDes
- JSON Schema Kafka SerDes
- REST clients

### Additional resources

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

## 1.9. APICURIO REGISTRY AVAILABLE DISTRIBUTIONS

Apicurio Registry provides the following distribution options.

**Table 1.2. Apicurio Registry Operator and images**

Distribution	Location	Release category
Apicurio Registry Operator	OpenShift web console under <b>Operators → OperatorHub</b>	General Availability
Container image for Apicurio Registry Operator	<a href="#">Red Hat Ecosystem Catalog</a>	General Availability
Container image for Kafka storage in AMQ Streams	<a href="#">Red Hat Ecosystem Catalog</a>	General Availability
Container image for database storage in PostgreSQL	<a href="#">Red Hat Ecosystem Catalog</a>	General Availability

**Table 1.3. Apicurio Registry zip downloads**

Distribution	Location	Release category
Example custom resource definitions for installation	<a href="#">Red Hat Software Downloads</a>	General Availability
Apicurio Registry v1 to v2 migration tool	<a href="#">Red Hat Software Downloads</a>	General Availability
Maven repository	<a href="#">Red Hat Software Downloads</a>	General Availability
Source code	<a href="#">Red Hat Software Downloads</a>	General Availability
Kafka Connect converters	<a href="#">Red Hat Software Downloads</a>	General Availability



### NOTE

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

## CHAPTER 2. APICURIO REGISTRY CONTENT RULES

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

- [Section 2.1, “Govern Apicurio Registry content using rules”](#)
- [Section 2.1.1, “When rules are applied”](#)
- [Section 2.1.2, “Order of precedence of rules”](#)
- [Section 2.1.3, “How rules work”](#)
- [Section 2.1.4, “Content rule configuration”](#)

### 2.1. GOVERN APICURIO REGISTRY CONTENT USING RULES

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

The goal of these rules is to prevent invalid content from being added to Apicurio 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.
- Artifact reference integrity, for example, a duplicate or non-existent artifact reference mapping.

You can enable optional content rules using the Apicurio 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 Apicurio Registry. This includes the following REST operations:

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

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

#### 2.1.2. Order of precedence of rules

The order of precedence for artifact-specific and global rules is as follows:

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

- If you disable an artifact-specific rule, and the equivalent global rule is enabled, the global rule applies.
- If you disable an artifact-specific rule, and the equivalent global rule is disabled, the rule is disabled 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 of **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. Apicurio 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, Apicurio 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 10, Apicurio Registry content rule reference](#) .

### 2.1.4. Content rule configuration

Administrators can configure Apicurio Registry global rules and artifact-specific rules. Developers can configure artifact-specific rules only.

Apicurio Registry applies the rules configured for the specific artifact. If no rules are configured at that level, Apicurio 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 Apicurio Registry web console or REST API. For details, see the following:

- [Chapter 3, Managing Apicurio Registry content using the web console](#)
- [Apicurio Registry REST API documentation](#)

#### Configure global rules

Administrators can configure global rules in several ways:

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

#### Configure default global rules

Administrators can configure Apicurio 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**
- **integrity**

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 APICURIO REGISTRY CONTENT USING THE WEB CONSOLE

You can manage schema and API artifacts stored in Apicurio Registry by using the Apicurio Registry web console. This includes uploading and browsing Apicurio Registry content, configuring optional rules for content, and generating client sdk code:

- [Section 3.1, "Viewing artifacts using the Apicurio Registry web console"](#)
- [Section 3.2, "Adding artifacts using the Apicurio Registry web console"](#)
- [Section 3.3, "Configuring content rules using the Apicurio Registry web console"](#)
- [Section 3.4, "Generating client SDKs for OpenAPI artifacts using the Apicurio Registry web console"](#)
- [Section 3.5, "Changing an artifact owner using the Apicurio Registry web console"](#)
- [Section 3.6, "Configuring Apicurio Registry instance settings using the web console"](#)
- [Section 3.7, "Exporting and importing data using the Apicurio Registry web console"](#)

### 3.1. VIEWING ARTIFACTS USING THE APICURIO REGISTRY WEB CONSOLE

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

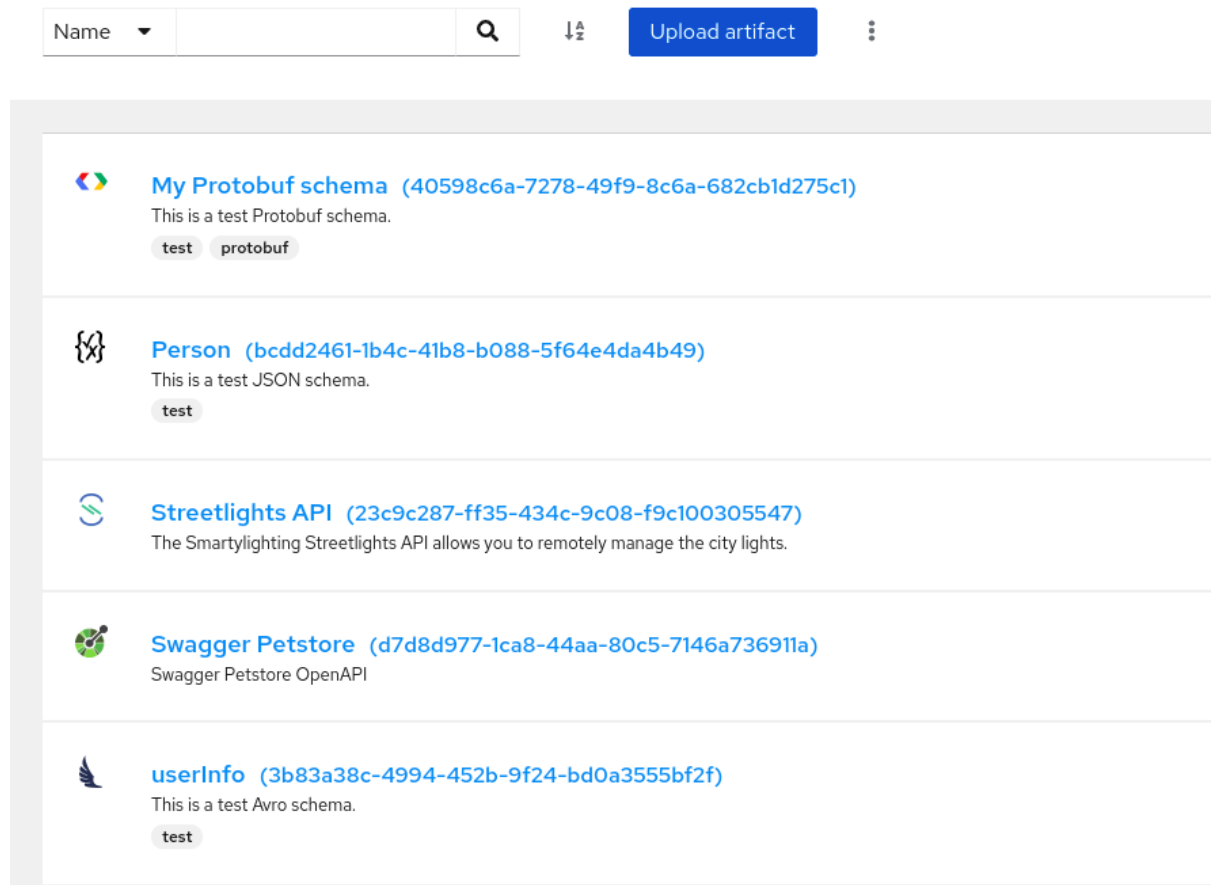
#### Prerequisites

- Apicurio Registry is installed and running in your environment.
- You are logged in to the Apicurio Registry web console:  
**`http://MY_REGISTRY_URL/ui`**
- Artifacts have been added to Apicurio 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 Apicurio 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 Apicurio Registry web console



- Click an artifact to view the following details:
  - Overview:** Displays artifact version metadata such as artifact name, artifact ID, global ID, content ID, labels, properties, and so on. 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.
  - References:** Displays a read-only view of all artifacts referenced by this artifact. You can also click **View artifacts that reference this artifact**
- If additional versions of this artifact have been added, you can select them from the **Version** list in page header.
- To save the artifact contents to a local file, for example, **my-openapi.json** or **my-protobuf-schema.proto**, and click **Download** at the end of the page.

#### Additional resources

- Section 3.2, "Adding artifacts using the Apicurio Registry web console"
- Section 3.3, "Configuring content rules using the Apicurio Registry web console"
- Chapter 10, *Apicurio Registry content rule reference*



## 3.2. ADDING ARTIFACTS USING THE APICURIO REGISTRY WEB CONSOLE

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

### Prerequisites

- Apicurio Registry is installed and running in your environment.
- You are logged in to the Apicurio 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**. You must manually select the **Kafka Connect Schema** artifact type, which cannot be automatically detected.
  - **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**. Alternatively, you can enter the file contents in the text box.
    - **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 artifact version metadata such as artifact name, artifact ID, global ID, content ID, labels, properties, and so on. 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.
  - **References:** Displays a read-only view of all artifacts referenced by this artifact. You can also click **View artifacts that reference this artifact**. You can add artifact references using the Apicurio Registry Maven plug-in or REST API only.  
The following example shows an example OpenAPI artifact:

Figure 3.2. Artifact details in Apicurio Registry web console

Overview Documentation Content References

---

 **Version metadata** [Generate client SDK](#) [Edit](#)

---

**Name**  
Swagger Petstore

**ID**  
aeb0159f-af9c-43ac-980e-2812e0b56383

**Description**  
No description

**Status**  
ENABLED

**Created**  
7 minutes ago

**Modified**  
7 minutes ago

**Global ID**  
1

**Content ID**  
1

**Labels**  
test openapi

**Properties**  
my-key=my-value

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** or **my-openapi.json**, 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.

#### Additional resources

- [Section 3.1, “Viewing artifacts using the Apicurio Registry web console”](#)
- [Section 3.3, “Configuring content rules using the Apicurio Registry web console”](#)
- [Chapter 10, \*Apicurio Registry content rule reference\*](#)

## 3.3. CONFIGURING CONTENT RULES USING THE APICURIO REGISTRY WEB CONSOLE

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

#### Prerequisites

- Apicurio Registry is installed and running in your environment.
- You are logged in to the Apicurio Registry web console:  
**http://MY\_REGISTRY\_URL/ui**
- Artifacts have been added to Apicurio Registry using the web console, command line, Maven plug-in, or a Java client application.
- When role-based authorization is enabled, you have administrator access for global rules and artifact-specific rules, or developer access for artifact-specific rules only.

#### Procedure


1. On the **Artifacts** tab, browse the list of artifacts in Apicurio 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.

- In **Artifact-specific rules**, click **Enable** to configure a validity, compatibility, or integrity rule for artifact content, and select the appropriate rule configuration from the list. For example, for **Validity rule**, select **Full**.

Figure 3.3. Artifact content rules in Apicurio Registry web console

### Artifact-specific rules

Manage the content rules for this artifact. Each artifact-specific rule can be individually enabled, configured, and disabled. Artifact-specific rules override the equivalent global rules.

<input checked="" type="checkbox"/> Validity rule	Ensure that content is <i>valid</i> when updating this artifact.	Full ▼	
<input type="checkbox"/> Compatibility rule	Enforce a compatibility level when updating this artifact (for example, select Backward for backwards compatibility).	<input type="button" value="Enable"/>	
<input checked="" type="checkbox"/> Integrity rule	Enforce artifact reference integrity when creating or updating artifacts. Enable and configure this rule to ensure that artifact references provided are correct.	<input type="button" value="Enable"/>	

- To access global rules, click the **Global rules** tab. Click **Enable** to configure global validity, compatibility, or integrity rules for all artifact content, and select the appropriate rule configuration from the list.
- 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 Apicurio Registry web console”](#)
- [Chapter 10, Apicurio Registry content rule reference](#)

## 3.4. GENERATING CLIENT SDKS FOR OPENAPI ARTIFACTS USING THE APICURIO REGISTRY WEB CONSOLE

You can use the Apicurio Registry web console to configure, generate, and download client software development kits (SDKs) for OpenAPI artifacts. You can then use the generated client SDKs to build your client applications for specific platforms based on the OpenAPI.

Apicurio Registry generates client SDKs for the following programming languages:

- C#
- Go

- Java
- PHP
- Python
- Ruby
- Swift
- TypeScript



## NOTE

Client SDK generation for OpenAPI artifacts runs in your browser only, and cannot be automated by using an API. You must regenerate the client SDK each time a new artifact version is added in Apicurio Registry.

## Prerequisites

- Apicurio Registry is installed and running in your environment.
- You are logged in to the Apicurio Registry web console:  
**`http://MY_REGISTRY_URL/ui`**
- An OpenAPI artifact has been added to Apicurio 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 Apicurio Registry, or enter a search string to find a specific OpenAPI artifact. You can select from the list to search by criteria such as name, group, labels, or global ID.
2. Click the OpenAPI artifact in the list to view its details.
3. In the **Version metadata** section, click **Generate client SDK**, and configure the following settings in the dialog:
  - **Language:** Select the programming language in which to generate the client SDK, for example, **Java**.
  - **Generated client class name:** Enter the class name for the client SDK, for example, **MyJavaClientSDK**.
  - **Generated client package name:** Enter the package name for the client SDK, for example, **io.my.example.sdk**
4. Click **Show advanced settings** to configure optional comma-separated lists of path patterns to include or exclude:
  - **Include path patterns:** Enter specific paths to include when generating the client SDK, for example, **\*\*/\*.\*, \*\*/my-path/\***. If this field is empty, all paths are included.
  - **Exclude path patterns:** Enter specific paths to exclude when generating the client SDK, for example, **\*\*/my-other-path/\***. If this field is empty, no paths are excluded.

Figure 3.4. Generate a Java client SDK in Apicurio Registry web console

## Generate client SDK ✕

Configure your client SDK before you generate and download it. You must manually regenerate the client SDK each time a new version of the artifact is registered.

**Language** \*

Java ▼

<b>Generated client class name</b>	<b>Generated client package name</b>
MySdkClient	io.example.sdk

▼ [Hide advanced options](#)

**Include paths**  
Enter a comma-separated list of patterns to specify the paths used to generate the client SDK (for example, /., \*\*/my-path/).

**Include path patterns**

Enter path1, path2, ...

If this field is empty, all paths are included

**Exclude path patterns**

Enter path1, path2, ...

If this field is empty, no paths are excluded

Generate and download
Cancel

5. When you have configured the settings in the dialog, click **Generate and download**.
6. Enter a file name for the client SDK in the dialog, for example, **my-client-java.zip**, and click **Save** to download.

### Additional resources

- Apicurio Registry uses Kiota from Microsoft to generate the client SDKs. For more information, see the [Kiota project in GitHub](#).
- For more details and examples of using the generated SDKs to build client applications, see the [Kiota documentation](#).

## 3.5. CHANGING AN ARTIFACT OWNER USING THE APICURIO REGISTRY WEB CONSOLE

As an administrator or as an owner of a schema or API artifact, you can use the Apicurio 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 Apicurio 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 Apicurio Registry instance was deployed. For more details, see [Installing and deploying Red Hat build of Apicurio Registry on OpenShift](#).

**Prerequisites**

- The Apicurio Registry instance is deployed and the artifact is created.
- You are logged in to the Apicurio 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 Apicurio 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 Red Hat build of Apicurio Registry on OpenShift](#)

## 3.6. CONFIGURING APICURIO REGISTRY INSTANCE SETTINGS USING THE WEB CONSOLE

As an administrator, you can use the Apicurio Registry web console to configure dynamic settings for Apicurio 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 Apicurio Registry instance was deployed. For more details, see the [Installing and deploying Red Hat build of Apicurio Registry on OpenShift](#).

**Prerequisites**

- The Apicurio Registry instance is already deployed.
- You are logged in to the Apicurio Registry web console with administrator access:

**http://MY\_REGISTRY\_URL/ui**

**Procedure**

**Procedure**

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

**Table 3.1. Authentication settings**

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

**Table 3.2. Authorization settings**

Setting	Description
<b>Anonymous read access</b>	Displayed only when authentication is already selected. When selected, Apicurio 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.
<b>Artifact owner-only authorization</b>	Displayed only when authentication is already enabled. When selected, only the user who created an artifact can modify that artifact. Not selected by default.
<b>Artifact group owner-only authorization</b>	Displayed only when authentication is already enabled and <b>Artifact owner-only authorization</b> 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.
<b>Authenticated read access</b>	Displayed only when authentication is already enabled. When selected, Apicurio 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
<b>Legacy ID mode (compatibility API)</b>	When selected, the Confluent Schema Registry compatibility API uses <b>globalId</b> instead of <b>contentId</b> as an artifact identifier. This setting is useful when migrating from legacy Apicurio Registry instances based on the v1 Core Registry API. Not selected by default.

**Table 3.4. Web console settings**



Setting	Description
<b>Download link expiry</b>	The number of seconds that a generated link to a <b>.zip</b> download file is active before expiring for security reasons, for example, when exporting artifact data from the instance. Defaults to 30 seconds.
<b>UI read-only mode</b>	When selected, the Apicurio 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.

Table 3.5. Additional properties

Setting	Description
<b>Delete artifact version</b>	When selected, users are permitted to delete artifact versions in this instance by using the Core Registry API. Not selected by default.

#### Additional resources

- [Installing and deploying Red Hat build of Apicurio Registry on OpenShift](#)

## 3.7. EXPORTING AND IMPORTING DATA USING THE APICURIO REGISTRY WEB CONSOLE

As an administrator, you can use the Apicurio Registry web console to export data from one Apicurio Registry instance, and import this data into another Apicurio 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 Apicurio Registry instance to another instance. All of the artifact data contained in the Apicurio Registry instance is exported in the **.zip** file.



#### NOTE

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

#### Prerequisites

- Apicurio 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 Apicurio Registry web console with administrator access: **http://MY\_REGISTRY\_URL/ui**

## Procedure

1. In the web console for the source Apicurio 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 data for this Apicurio Registry instance to a **.zip** download file.
3. In the the web console for the target Apicurio 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 APICURIO REGISTRY CONTENT USING THE REST API

Client applications can use Apicurio Registry REST API operations to manage schema and API artifacts in Apicurio Registry, for example, in a CI/CD pipeline deployed in production. The Core Registry API v2 provides operations for artifacts, versions, metadata, and rules stored in Apicurio Registry. For detailed information, see the [Apicurio Registry REST API documentation](#).

This chapter shows examples of how to use the Core Registry API v2 to perform the following tasks:

- [Section 4.1, “Managing schema and API artifacts using Apicurio Registry REST API commands”](#)
- [Section 4.2, “Managing schema and API artifact versions using Apicurio Registry REST API commands”](#)
- [Section 4.3, “Managing schema and API artifact references using Apicurio Registry REST API commands”](#)
- [Section 4.4, “Exporting and importing registry data using Apicurio Registry REST API commands”](#)

### Prerequisites

- [Chapter 1, Introduction to Apicurio Registry](#)

### Additional resources

- [Apicurio Registry REST API documentation](#)

## 4.1. MANAGING SCHEMA AND API ARTIFACTS USING APICURIO REGISTRY REST API COMMANDS

This section shows a simple curl-based example of using the Core Registry API v2 to add and retrieve a simple schema artifact in Apicurio Registry.

### Prerequisites

- Apicurio Registry is installed and running in your environment.

### Procedure

1. Add an artifact to Apicurio Registry using the `/groups/{group}/artifacts` operation. The following example **curl** command adds a simple schema 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 Apache Avro schema artifact with an artifact ID of **share-price**. If you do not specify a unique artifact ID, Apicurio Registry generates one automatically as a UUID.

- **MY-REGISTRY-URL** is the host name on which Apicurio 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 Apicurio Registry, so the global ID and content ID have a value of **2**.
3. Retrieve the artifact content from Apicurio 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 details, see the [Apicurio Registry REST API documentation](#).

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

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

Apicurio 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 Core Registry API v2 to add and retrieve a custom Apache Avro schema version in Apicurio Registry. You can specify custom versions to add or update artifacts, or to add artifact versions.

### Prerequisites

- Apicurio 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, Apicurio Registry automatically generates a default version of **1**.
  - **MY-REGISTRY-URL** is the host name on which Apicurio 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 details, see the [Apicurio Registry REST API documentation](#).

### 4.3. MANAGING SCHEMA AND API ARTIFACT REFERENCES USING APICURIO REGISTRY REST API COMMANDS

Some Apicurio Registry artifact types can include *artifact references* from one artifact file to another. You can create efficiencies by defining reusable schema or API artifacts, and then referencing them from multiple locations in artifact references.

The following artifact types support artifact references:

- Apache Avro

- Google Protobuf
- JSON Schema
- OpenAPI
- AsyncAPI

This section shows a simple curl-based example of using the Core Registry API v2 to add and retrieve an artifact reference to a simple Avro schema artifact in Apicurio 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

- Apicurio 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, Apicurio Registry generates one automatically as a UUID.
  - **MY-REGISTRY-URL** is the host name on which Apicurio 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", "groupId": "my-group", "contentId": 2, "references": [{"artifactId": "ItemId", "groupId": "my-group", "name": "ItemId", "version": "1"}] }
```

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

```
$ curl -H "Authorization: Bearer $ACCESS_TOKEN" MY-REGISTRY-URL/apis/registry/v2/ids/globalIds/2/references
```

- 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"}}
```

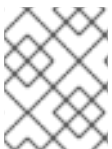
#### Additional resources

- For more details, see the [Apicurio Registry REST API documentation](#).
- For more examples of artifact references, see the section on configuring each artifact type in [Chapter 8, Configuring Kafka serializers/deserializers in Java clients](#).

## 4.4. EXPORTING AND IMPORTING REGISTRY DATA USING APICURIO REGISTRY REST API COMMANDS

As an administrator, you can use the Core Registry API v2 to export data from one Apicurio Registry instance and import into another Apicurio Registry instance, so you can migrate data between different instances.

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



#### NOTE

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

#### Prerequisites

- Apicurio Registry is installed and running in your environment.
- Apicurio 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 preserve unique IDs.

#### Procedure

- Export the Apicurio Registry data from your existing source Apicurio 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 Apicurio Registry is deployed. For example: **my-cluster-source-registry-myproject.example.com**.

2. Import the registry data into your target Apicurio 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 Apicurio 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 Apicurio Registry version 1.x to 2.x, see [Apicurio Registry export utility for 1.x versions](#).

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

When developing client applications, you can use the Apicurio Registry Maven plug-in to manage schema and API artifacts stored in Apicurio Registry:

- [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, “Testing schema and API artifacts using the Maven plug-in”](#)
- [Section 5.4, “Adding artifact references manually using the Apicurio Registry Maven plug-in”](#)
- [Section 5.5, “Adding artifact references automatically using the Apicurio Registry Maven plug-in”](#)

### Prerequisites

- Apicurio Registry is installed and running in your environment.
- Apache Maven is 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 of your client application. You can accomplish this by using the **register** execution goal.

### Prerequisites

- You have created a Maven project for your client application. For more details, see the [Apache Maven documentation](#).

### Procedure

1. 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
      </configuration>
    </execution>
  </executions>
</plugin>
```

```

<clientScope>MY-CLIENT-SCOPE</clientScope>
<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 Apicurio Registry.
- 2** Specify the Apicurio 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 Apicurio 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.

2. Build your Maven project, for example, by using the **mvn package** command.

### Additional resources

- For more details on using Apache Maven, see the [Apache Maven documentation](#).
- For open source examples of using the Apicurio Registry Maven plug-in, see the [Apicurio Registry demonstration examples](#).

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

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

### Prerequisites

- You have created a Maven project for your client application. For more details, see the [Apache Maven documentation](#).

## Procedure

1. 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>${apicurio.version}</version>
  <executions>
    <execution>
      <phase>generate-sources</phase>
      <goals>
        <goal>download</goal> 1
      </goals>
      <configuration>
        <registryUrl>MY-REGISTRY-URL/apis/registry/v2</registryUrl> 2
        <authServerUrl>MY-AUTH-SERVER</authServerUrl>
        <clientId>MY-CLIENT-ID</clientId>
        <clientSecret>MY-CLIENT-SECRET</clientSecret> 3
        <clientScope>MY-CLIENT-SCOPE</clientScope>
        <artifacts>
          <artifact>
            <groupId>TestGroup</groupId> 4
            <artifactId>FullNameRecord</artifactId> 5
            <file>${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 Apicurio 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 Apicurio 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.

2. Build your Maven project, for example, by using the **mvn package** command.

## Additional resources

- For more details on using Apache Maven, see the [Apache Maven documentation](#).
- For open source examples of using the Apicurio Registry Maven plug-in, see the [Apicurio Registry demonstration examples](#).

## 5.3. 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 Apicurio 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 Apicurio Registry.

## Prerequisites

- You have created a Maven project for your client application. For more details, see the [Apache Maven documentation](#).

## Procedure

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

```

```

</execution>
</executions>
</plugin>

```

- 1 Specify **test-update** as the execution goal to test the schema artifact.
  - 2 Specify the Apicurio 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 Apicurio 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.
2. Build your Maven project, for example, by using the **mvn package** command.

### Additional resources

- For more details on using Apache Maven, see the [Apache Maven documentation](#).
- For open source examples of using the Apicurio Registry Maven plug-in, see the [Apicurio Registry demonstration examples](#).

## 5.4. ADDING ARTIFACT REFERENCES MANUALLY USING THE APICURIO REGISTRY MAVEN PLUG-IN

Some Apicurio Registry artifact types can include *artifact references* from one artifact file to another. You can create efficiencies by defining reusable schema or API artifacts, and then referencing them from multiple locations in artifact references.

The following artifact types support artifact references:

- Apache Avro
- Google Protobuf
- JSON Schema
- OpenAPI
- AsyncAPI

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

- You have created a Maven project for your client application. For more details, see the [Apache Maven documentation](#).
- The referenced **Exchange** schema artifact is already created in Apicurio Registry.

### Procedure

1. 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>
      <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
        <clientScope>MY-CLIENT-SCOPE</clientScope>
      </configuration>
    </execution>
  </executions>
  <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 artifacts to Apicurio Registry.
- 2 Specify the Apicurio Registry URL by using the `../apis/registry/v2` endpoint.
- 3 If authentication is required, you can specify your authentication server and client credentials.
- 4 Specify the Apicurio Registry artifact group ID. You can specify the **default** group if you do not want to use a unique group ID.
- 5 Specify the Apicurio Registry artifact reference using its group ID, artifact ID, version, type, and location. You can register multiple artifact references in this way.

2. Build your Maven project, for example, by using the **mvn package** command.

### Additional resources

- For more details on using Apache Maven, see the [Apache Maven documentation](#).
- For an open source example of using the Apicurio Registry Maven plug-in to manually register an artifact reference, see the [avro-maven-with-references demonstration example](#).
- For more examples of artifact references, see the section on configuring each artifact type in [Chapter 8, Configuring Kafka serializers/deserializers in Java clients](#).



## 5.5. ADDING ARTIFACT REFERENCES AUTOMATICALLY USING THE APICURIO REGISTRY MAVEN PLUG-IN

Some Apicurio Registry artifact types can include *artifact references* from one artifact file to another. You can create efficiencies by defining reusable schema or API artifacts, and then referencing them from multiple locations in artifact references.

The following artifact types support artifact references:

- Apache Avro
- Google Protobuf
- JSON Schema
- OpenAPI
- AsyncAPI

You can specify a single artifact and configure the Apicurio Registry Maven plugin to automatically detect all references to artifacts located in the same directory, and to automatically register those references. This is a Technology Preview feature.



### IMPORTANT

Technology Preview features are not supported with RedHat production service level agreements (SLAs) and might not be functionally complete. RedHat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information about the support scope of RedHat Technology Preview features, see [Technology Preview Features Support Scope](#).

This section shows a simple example of using the Maven plug-in to register an Avro schema and automatically detect and register an artifact reference to a simple schema artifact. This example assumes that the parent **TradeKey** artifact and the nested **Exchange** schema artifact are both available in the same directory:

### TradeKey schema with nested reference to 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"]
}

```

## Prerequisites

- You have created a Maven project for your client application. For more details, see the [Apache Maven documentation](#).
- The **TradeKey** schema artifact and the nested **Exchange** schema artifact files are both located in the same directory.

## Procedure

1. 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>
      <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
        <clientScope>MY-CLIENT-SCOPE</clientScope>
        <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 5
            </file>
            <ifExists>RETURN_OR_UPDATE</ifExists>
            <canonicalize>>true</canonicalize>
            <autoRefs>>true</autoRefs> 6
          </artifact>
        </artifacts>
      </configuration>
    </execution>
  </executions>
</plugin>

```

```

        </artifact>
      </artifacts>
    </configuration>
  </execution>
</executions>
</plugin>

```

- 1 Specify **register** as the execution goal to upload the schema artifacts to Apicurio Registry.
  - 2 Specify the Apicurio Registry URL by using the **../apis/registry/v2** endpoint.
  - 3 If authentication is required, you can specify your authentication server and client credentials.
  - 4 Specify the parent artifact group ID that contains the references. You can specify the **default** group if you do not want to use a unique group ID.
  - 5 Specify the location of the parent artifact file. All referenced artifacts must also be located in the same directory.
  - 6 Set the **<autoRefs>** option to true to automatically detect and register all references to artifacts in the same directory. You can register multiple artifact references in this way.
2. Build your Maven project, for example, by using the **mvn package** command.

### Additional resources

- For more details on using Apache Maven, see the [Apache Maven documentation](#).
- For an open source example of using the Apicurio Registry Maven plug-in to automatically register multiple artifact references, see the [avro-maven-with-references-auto demonstration example](#).
- For more examples of artifact references, see the section on configuring each artifact type in [Chapter 8, Configuring Kafka serializers/deserializers in Java clients](#).

## CHAPTER 6. MANAGING APICURIO REGISTRY CONTENT USING A JAVA CLIENT

You can write a Apicurio Registry Java client application and use it to manage artifacts stored in Apicurio Registry:

- [Section 6.1, “Apicurio Registry Java client”](#)
- [Section 6.2, “Writing Apicurio Registry Java client applications”](#)
- [Section 6.3, “Apicurio Registry Java client configuration”](#)

### 6.1. APICURIO REGISTRY JAVA CLIENT

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

You can access the Apicurio Registry Java client by adding the correct dependency to your Apache Maven project. For more details, see [Section 6.2, “Writing Apicurio Registry Java client applications”](#).

The Apicurio Registry client is implemented by using the HTTP client provided by the JDK, which you can customize as needed. For example, you can add custom headers or enable configuration options for Transport Layer Security (TLS) authentication. For more details, see [Section 6.3, “Apicurio Registry Java client configuration”](#).

### 6.2. WRITING APICURIO REGISTRY JAVA CLIENT APPLICATIONS

You can write a Java client application to manage artifacts stored in Apicurio Registry by using the Apicurio Registry Java client classes.

#### Prerequisites

- Apicurio Registry is installed and running in your environment.
- You have created a Maven project for your Java client application. For more details, see [Apache Maven](#).

#### 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 the Apicurio Registry client as follows:

```
public class ClientExample {
```

```

public static void main(String[] args) throws Exception {
    // Create a registry client
    String registryUrl = "https://my-registry.my-domain.com/apis/registry/v2"; 1
    RegistryClient client = RegistryClientFactory.create(registryUrl); 2
}

```

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

When the client is created, you can use all of the operations available in the Apicurio 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 Apicurio Registry client, see the [Apicurio Registry REST client demonstration](#).
- For details on how to use the Apicurio 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. APICURIO REGISTRY JAVA CLIENT CONFIGURATION

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

**Table 6.1. Apicurio Registry Java client configuration options**

Option	Description	Arguments
Plain client	Basic REST client used to interact with a running Apicurio Registry instance.	<b>baseUrl</b>
Client with custom configuration	Apicurio Registry client using the configuration provided by the user.	<b>baseUrl, Map&lt;String Object&gt; configs</b>
Client with custom configuration and authentication	Apicurio 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.	<b>baseUrl, Map&lt;String Object&gt; configs, Auth auth</b>

### Custom header configuration

To configure custom headers, you must add the **apicurio.registry.request.headers** prefix to the **configs** map key. For example, a **configs** map key of **apicurio.registry.request.headers.Authorization** with a value of **Basic: YWxhZGRpbjpvucGVuc2VzYW1** sets the **Authorization** header with the same value.

## TLS configuration options

You can configure Transport Layer Security (TLS) authentication for the Apicurio 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 Apicurio 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

Apicurio 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 Apicurio Registry”](#)
- [Section 7.2, “Strategies to look up a schema in Apicurio Registry”](#)
- [Section 7.3, “Registering a schema in Apicurio 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 Apicurio Registry\*](#).
- You have installed Apicurio Registry.
- You have created Kafka producer and consumer client applications.  
For more details on Kafka client applications, see [Deploying and Managing AMQ Streams on OpenShift](#).

## 7.1. KAFKA CLIENT APPLICATIONS AND APICURIO REGISTRY

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

You can store the schemas in Apicurio 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 Apicurio Registry at runtime.

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

### Apicurio Registry schema technologies

Apicurio 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 Apicurio Registry. The maturity and usage of the SerDes classes provided by Apicurio 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 Apicurio Registry for serialization:

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

After registering your schema, when you start Kafka and Apicurio 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 Apicurio 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 Apicurio Registry for deserialization:

- [Define and register your schema with Apicurio Registry](#) (if it does not already exist)
- [Configure the consumer client code](#) with the following:
  - URL of Apicurio Registry
  - Apicurio 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 Apicurio 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 Apicurio 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 Apicurio 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 APICURIO REGISTRY

The Kafka client serializer uses *lookup strategies* to determine the artifact ID and global ID under which the message schema is registered in Apicurio 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 Apicurio 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 Apicurio 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 Apicurio Registry, or by creating a custom Java class that implements

**io.apicurio.registry.serde.strategy.ArtifactReferenceResolverStrategy.**

### Strategies to return a reference to an artifact

Apicurio 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. Apicurio Registry lookup configuration options

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

Property	Type	Description	Default
<b>apicurio.registry.check-period-ms</b>	<b>String</b>	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 APICURIO REGISTRY

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

You can add the schema using the following approaches:

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

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

### Apicurio Registry web console

When Apicurio 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 Apicurio 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 Apicurio Registry URL with the **../apis/registry/v2** endpoint.
- 3** Specify the Apicurio 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 Apicurio Registry.

### Prerequisites

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

### Procedure

1. Configure the client with the URL of Apicurio 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 Apicurio 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 Apicurio 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 Apicurio Registry.

### Prerequisites

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

### Procedure

1. Configure the client with the URL of Apicurio 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 Apicurio 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 Apicurio Registry.
- 2** The serializer for the message value provided by Apicurio 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 Apicurio Registry.

### Prerequisites

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

### Procedure

1. Create and configure a Java client with the Apicurio 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 Apicurio Registry.
- 2** The Avro deserializer provided by Apicurio Registry.
- 3** Configures the Apicurio 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 serializers/deserializers (SerDes) in your producer and consumer Java client applications:

- [Section 8.1, “Apicurio Registry serializer/deserializer configuration in client applications”](#)
- [Section 8.2, “Apicurio Registry serializer/deserializer configuration properties”](#)
- [Section 8.3, “How to configure different client serializer/deserializer types”](#)
- [Section 8.3.1, “Configure Avro SerDes with Apicurio Registry”](#)
- [Section 8.3.2, “Configure JSON Schema SerDes with Apicurio Registry”](#)
- [Section 8.3.3, “Configure Protobuf SerDes with Apicurio Registry”](#)

### Prerequisites

- You have read [Chapter 7, Validating Kafka messages using serializers/deserializers in Java clients](#).

## 8.1. APICURIO REGISTRY SERIALIZER/DESERIALIZER CONFIGURATION IN CLIENT APPLICATIONS

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

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

### Configuration for SerDes 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 Apicurio Registry.
2. Extends ID handling to support other ID formats and make them compatible with Apicurio Registry SerDes 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, “Apicurio Registry serializer/deserializer configuration properties”](#)



## Configuration for SerDes lookup strategies

```
public class SerdeConfig {

    public static final String ARTIFACT_RESOLVER_STRATEGY = "apicurio.registry.artifact-resolver-
strategy"; ❶
    public static final String SCHEMA_RESOLVER = "apicurio.registry.schema-resolver"; ❷
    ...
}
```

❶❶ Java class that implements the artifact resolver strategy and maps between the Kafka SerDes and artifact ID. Defaults to the topic ID strategy. This is only used by the serializer class.

❷❷ 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, “Apicurio 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"; ❶
    public static final String REGISTRY_CONVERTER_DESERIALIZER_PARAM =
"apicurio.registry.converter.deserializer"; ❷
}
```

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

### Additional resources

- For more details, see the [SerdeBasedConverter Java class](#)

## Configuration for different schema types

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

- [Section 8.3.1, “Configure Avro SerDes with Apicurio Registry”](#)
- [Section 8.3.2, “Configure JSON Schema SerDes with Apicurio Registry”](#)
- [Section 8.3.3, “Configure Protobuf SerDes with Apicurio Registry”](#)

## 8.2. APICURIO REGISTRY SERIALIZER/DESERIALIZER CONFIGURATION PROPERTIES

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

### SchemaResolver interface

Apicurio 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
<b>SCHEMA_RESOLVER</b>	<b>apicurio.registry.schema-resolver</b>	Used by serializers and deserializers. Fully-qualified Java classname that implements <b>SchemaResolver</b> .	String	<b>io.apicurio.registry.resolver.DefaultSchemaResolver</b>



#### 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
<b>REGISTRY_URL</b>	<b>apicurio.registry.url</b>	Used by serializers and deserializers. URL to access the registry API.	<b>String</b>	None

Constant	Property	Description	Type	Default
<b>AUTH_SERVICE_URL</b>	<b>apicurio.auth.service.url</b>	Used by serializers and deserializers. URL of the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	<b>String</b>	None
<b>AUTH_TOKEN_ENDPOINT</b>	<b>apicurio.auth.service.token.endpoint</b>	Used by serializers and deserializers. URL of the token endpoint. Required when accessing a secure registry and <b>AUTH_SERVICE_URL</b> is not specified.	<b>String</b>	None
<b>AUTH_REALM</b>	<b>apicurio.auth.realm</b>	Used by serializers and deserializers. Realm to access the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	<b>String</b>	None
<b>AUTH_CLIENT_ID</b>	<b>apicurio.auth.client.id</b>	Used by serializers and deserializers. Client ID to access the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	<b>String</b>	None
<b>AUTH_CLIENT_SECRET</b>	<b>apicurio.auth.client.secret</b>	Used by serializers and deserializers. Client secret to access the authentication service. Required when accessing a secure registry using the OAuth client credentials flow.	<b>String</b>	None
<b>AUTH_USERNAME</b>	<b>apicurio.auth.username</b>	Used by serializers and deserializers. Username to access the registry. Required when accessing a secure registry using HTTP basic authentication.	<b>String</b>	None

Constant	Property	Description	Type	Default
<b>AUTH_PASSWORD</b>	<b>apicurio.auth.password</b>	Used by serializers and deserializers. Password to access the registry. Required when accessing a secure registry using HTTP basic authentication.	<b>String</b>	None

### Configuration for registry lookup options

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

Table 8.3. Configuration properties for registry artifact lookup

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

Constant	Property	Description	Type	Default
<b>EXPLICIT_ARTIFACT_ID</b>	<b>apicurio.registry.artifact.artifact-id</b>	Used by serializers only. Sets the <b>artifactId</b> used for querying or creating an artifact. Overrides the <b>artifactId</b> returned by the <b>ArtifactResolverStrategy</b> .	<b>String</b>	None
<b>EXPLICIT_ARTIFACT_VERSION</b>	<b>apicurio.registry.artifact.version</b>	Used by serializers only. Sets the artifact version used for querying or creating an artifact. Overrides the version returned by the <b>ArtifactResolverStrategy</b> .	<b>String</b>	None
<b>FIND_LATEST_ARTIFACT</b>	<b>apicurio.registry.find-latest</b>	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.	<b>boolean</b>	<b>false</b>
<b>AUTO_REGISTER_ARTIFACT</b>	<b>apicurio.registry.auto-register</b>	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.	<b>boolean, boolean String</b>	<b>false</b>
<b>AUTO_REGISTER_ARTIFACT_IF_EXISTS</b>	<b>apicurio.registry.auto-register.if-exists</b>	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 <b>FAIL, UPDATE, RETURN,</b> or <b>RETURN_OR_UPDATE</b> .	<b>String</b>	<b>RETURN_OR_UPDATE</b>

Constant	Property	Description	Type	Default
<b>CHECK_PERIOD_MS</b>	<b>apicurio.registry.check-period-ms</b>	Used by serializers and deserializers. Specifies how long to cache artifacts before auto-eviction (milliseconds). If set to zero, artifacts are fetched every time.	<b>java.time.Duration, non-negative Number, or integer String</b>	<b>30000</b>
<b>RETRY_BACKOFF_MS</b>	<b>apicurio.registry.retry-backoff-ms</b>	Used by serializers and deserializers. If a schema can not be retrieved from the Registry, it may retry a number of times. This configuration option controls the delay between the retry attempts (milliseconds).	<b>java.time.Duration, non-negative Number, or integer String</b>	<b>300</b>
<b>RETRY_COUNT</b>	<b>apicurio.registry.retry-count</b>	Used by serializers and deserializers. If a schema can not be retrieved from the Registry, it may retry a number of times. This configuration option controls the number of retry attempts.	<b>non-negative Number, or integer String</b>	<b>3</b>
<b>USE_ID</b>	<b>apicurio.registry.use-id</b>	Used by serializers and deserializers. Configures to use the specified <b>IdOption</b> as the identifier for artifacts. Options are <b>globalId</b> and <b>contentId</b> . Instructs the serializer to write the specified ID to Kafka, and instructs the deserializer to use this ID to find the schema.	<b>String</b>	<b>globalId</b>

### 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
<b>ENABLE_HEADERS</b>	<b>apicurio.registry.headers.enabled</b>	Used by serializers and deserializers. Configures to read/write the artifact identifier to Kafka message headers instead of in the message payload.	<b>boolean</b>	<b>true</b>
<b>HEADERS_HANDLER</b>	<b>apicurio.registry.headers.handler</b>	Used by serializers and deserializers. Fully-qualified Java classname that implements <b>HeadersHandler</b> and writes/reads the artifact identifier to/from the Kafka message headers.	<b>String</b>	<b>io.apicurio.registry.serde.headers.DefaultHeadersHandler</b>
<b>ID_HANDLER</b>	<b>apicurio.registry.id-handler</b>	Used by serializers and deserializers. Fully-qualified Java classname of a class that implements <b>IdHandler</b> and writes/reads the artifact identifier to/from the message payload. Only used if <b>apicurio.registry.headers.enabled</b> is set to <b>false</b> .	<b>String</b>	<b>io.apicurio.registry.serde.DefaultIdHandler</b>
<b>ENABLE_CONFLUENT_ID_HANDLER</b>	<b>apicurio.registry.as-confluent</b>	Used by serializers and deserializers. Shortcut for enabling the legacy Confluent-compatible implementation of <b>IdHandler</b> . Only used if <b>apicurio.registry.headers.enabled</b> is set to <b>false</b> .	<b>boolean</b>	<b>true</b>

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
<b>FALLBACK_ARTIFACT_PROVIDER</b>	<b>apicurio.registry fallback.provider</b>	Only used by deserializers. Sets a custom implementation of <b>FallbackArtifactProvider</b> for resolving the artifact used for deserialization. <b>FallbackArtifactProvider</b> configures a fallback artifact to fetch from the registry in case the lookup fails.	<b>String</b>	<b>io.apicurio.registry.serde.fallback.DefaultFallbackArtifactProvider</b>

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
<b>FALLBACK_ARTIFACT_ID</b>	<b>apicurio.registry.fallback.artifact-id</b>	Used by deserializers only. Sets the <b>artifactId</b> used as fallback for resolving the artifact used for deserialization.	<b>String</b>	None
<b>FALLBACK_ARTIFACT_GROUP_ID</b>	<b>apicurio.registry.fallback.group-id</b>	Used by deserializers only. Sets the <b>groupId</b> used as fallback for resolving the group used for deserialization.	<b>String</b>	None
<b>FALLBACK_ARTIFACT_VERSION</b>	<b>apicurio.registry.fallback.version</b>	Used by deserializers only. Sets the version used as fallback for resolving the artifact used for deserialization.	<b>String</b>	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. Apicurio 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 Apicurio Registry functionality using the Apicurio Registry REST Java client.

### Kafka application configuration for serializers/deserializers

Using the SerDe classes provided by Apicurio 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 Apicurio 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 Apicurio 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 Apicurio 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 Apicurio 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 Apicurio Registry

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

Apicurio 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:

- Apicurio 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. Apicurio 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

Apicurio 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. Apicurio Registry supports three different types:

- Generic
- Specific
- Reflect

The Apicurio 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:

- Apicurio 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 Apicurio 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 Apicurio Registry

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

Apicurio 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:

- Apicurio 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:

- Apicurio Registry URL
- Schema validation

- Class for deserializing data

You must provide the location of Apicurio 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 Apicurio 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 Apicurio 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 Apicurio Registry

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

Apicurio 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:

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

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

- [Section 8.1, “Apicurio Registry serializer/deserializer configuration in client applications”](#)
- [Section 8.3.1, “Configure Avro SerDes with Apicurio Registry”](#)

## Configure the Protobuf deserializer

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

- Apicurio 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 Apicurio Registry as separate artifacts. Then when Apicurio 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 Apicurio 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. APICURIO REGISTRY ARTIFACT REFERENCE

This chapter provides reference information on the supported artifact types, states, and metadata that are stored in Apicurio Registry.

- [Section 9.1, “Apicurio Registry artifact types”](#)
- [Section 9.2, “Apicurio Registry artifact states”](#)
- [Section 9.3, “Apicurio Registry artifact metadata”](#)

### Additional resources

- For more information, see the [Apicurio Registry REST API documentation](#).

## 9.1. APICURIO REGISTRY ARTIFACT TYPES

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

Table 9.1. Apicurio Registry artifact types

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

## 9.2. APICURIO REGISTRY ARTIFACT STATES

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

Table 9.2. Apicurio Registry artifact states

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

### 9.3. APICURIO REGISTRY ARTIFACT METADATA

When an artifact is added to Apicurio Registry, a set of metadata properties is created and stored along with the artifact content. This metadata consists of system-generated or user-generated properties that are read-only, and editable properties that you can update after the artifact is created.

Table 9.3. Apicurio Registry system-generated metadata

Property	Type	Description
<b>contentId</b>	integer	Unique identifier of artifact content in Apicurio Registry. The same content ID can be shared by multiple artifact versions when artifact versions have identical content. For example, a content ID of <b>4</b> can be used by multiple artifact versions with the same content.
<b>createdBy</b>	string	The name of the user who created the artifact.
<b>createdOn</b>	date	The date and time when the artifact was created, for example, <b>2023-10-11T14:15:28Z</b> .
<b>globalId</b>	integer	Globally unique identifier of an artifact version in Apicurio Registry. For example, a global ID of <b>1</b> is assigned to the first artifact version created in Apicurio Registry.
<b>modifiedBy</b>	string	The name of the user who modified the artifact.
<b>modifiedOn</b>	date	The date and time at which the artifact was modified, for example, <b>2023-10-11T14:15:28Z</b> .
<b>type</b>	ArtifactType	The supported artifact type, for example, <b>AVRO</b> , <b>OPENAPI</b> , or <b>PROTOBUF</b> .

Table 9.4. Apicurio Registry user-provided or system-generated metadata

Property	Type	Description
<b>groupid</b>	string	Unique identifier of an artifact group in Apicurio Registry, for example, <b>development</b> or <b>production</b> . When creating an artifact by using the Apicurio Registry web console, if you do not provide a group ID, this is set to <b>default</b> . You must provide a group ID when using the Apicurio Registry REST API, Java client, or Maven plug-in.
<b>id</b>	string	Unique identifier of an artifact in Apicurio Registry. You can provide an artifact ID or use the UUID generated by Apicurio Registry, for example, <b>8d168cad-1865-4e6c-bb7e-04e8be005bea</b> . Different versions of an artifact use the same artifact ID, but have different global IDs.
<b>references</b>	array of ArtifactReference	Optional set of artifact references contained in the artifact, which you can provide when creating the artifact. The following simple example shows a single artifact reference: [{"groupid":"my-group","artifactId":"ItemId","version":"1","name":"com.example.common.ItemId"}].
<b>version</b>	integer	The latest version of the artifact. You can use the generated version, for example, <b>3</b> , or provide a version by using the Apicurio Registry REST API or Maven plug-in, for example, <b>2.1.6</b> .

Table 9.5. Apicurio Registry editable metadata

Property	Type	Description
<b>description</b>	string	Optional meaningful description of the artifact, for example, <b>This is a simple OpenAPI for testing</b> . You can provide a description, or it can be automatically discovered from the <b>info</b> section of OpenAPI and AsyncAPI artifacts, if already provided.
<b>labels</b>	array of string	Optional comma-separated list of labels used to filter and search for the artifact, for example, <b>test,protobuf</b> . Provided by the user.
<b>name</b>	string	Optional human-readable name of the artifact, for example, <b>My first Avro schema</b> . You can provide a description, or it can be automatically discovered from the <b>info</b> section of OpenAPI and AsyncAPI artifacts, if the <b>title</b> field has a value.

Property	Type	Description
<b>properties</b>	map	Optional list of user-defined name-value pairs associated with the artifact. The name and value must be strings, for example, <b>my-key</b> and <b>my-value</b> .
<b>state</b>	ArtifactState	The latest state of the artifact: <b>ENABLED</b> , <b>DISABLED</b> , or <b>DEPRECATED</b> . Defaults to <b>ENABLED</b> .

### Updating artifact metadata

- You can use the Apicurio Registry REST API or web console to update the set of editable metadata properties.
- You can update the **state** property only by using the Apicurio Registry REST API.

### Additional resources

For more details, see the `/artifacts/{artifactId}/meta` endpoint in the [Apicurio Registry REST API documentation](#).

## CHAPTER 10. APICURIO REGISTRY CONTENT RULE REFERENCE

This chapter provides reference information on the supported content rule types, their level of support for artifact types, and order of precedence of artifact-specific and global rules.

- [Section 10.1, “Apicurio Registry content rule types”](#)
- [Section 10.2, “Apicurio Registry content rule maturity”](#)
- [Section 10.3, “Apicurio Registry content rule precedence”](#)

### Additional resources

- For more information, see the [Apicurio Registry REST API documentation](#) .

## 10.1. APICURIO REGISTRY CONTENT RULE TYPES

You can specify **VALIDITY**, **COMPATIBILITY**, and **INTEGRITY** rule types to govern content evolution in Apicurio Registry. These rule types apply to both global rules and artifact-specific rules.

Table 10.1. Apicurio Registry content rule types

Type	Description
<b>VALIDITY</b>	<p>Validate content before adding it to Apicurio Registry. The possible configuration values for this rule are as follows:</p> <ul style="list-style-type: none"><li>• <b>FULL</b>: The validation is both syntax and semantic.</li><li>• <b>SYNTAX_ONLY</b>: The validation is syntax only.</li><li>• <b>NONE</b>: All validation checks are disabled.</li></ul>

Type	Description
<b>COMPATIBILITY</b>	<p>Enforce a compatibility level when updating artifacts (for example, select <b>BACKWARD</b> for backwards compatibility). Ensures that new artifacts are compatible with previously added artifact versions or clients. The possible configuration values for this rule are as follows:</p> <ul style="list-style-type: none"> <li>● <b>FULL</b>: The new artifact is forward and backward compatible with the most recently added artifact.</li> <li>● <b>FULL_TRANSITIVE</b>: The new artifact is forward and backward compatible with all previously added artifacts.</li> <li>● <b>BACKWARD</b>: Clients using the new artifact can read data written using the most recently added artifact.</li> <li>● <b>BACKWARD_TRANSITIVE</b>: Clients using the new artifact can read data written using all previously added artifacts.</li> <li>● <b>FORWARD</b>: Clients using the most recently added artifact can read data written using the new artifact.</li> <li>● <b>FORWARD_TRANSITIVE</b>: Clients using all previously added artifacts can read data written using the new artifact.</li> <li>● <b>NONE</b>: All backward and forward compatibility checks are disabled.</li> </ul>
<b>INTEGRITY</b>	<p>Enforce artifact reference integrity when creating or updating artifacts. Enable and configure this rule to ensure that any artifact references provided are correct. The possible configuration values for this rule are as follows:</p> <ul style="list-style-type: none"> <li>● <b>FULL</b>: All artifact reference integrity checks are enabled.</li> <li>● <b>NO_DUPLICATES</b>: Detect if there are any duplicate artifact references.</li> <li>● <b>REFS_EXIST</b>: Detect if there are any references to non-existent artifacts.</li> <li>● <b>ALL_REFS_MAPPED</b>: Ensure that all artifact references are mapped.</li> <li>● <b>NONE</b>: All artifact reference integrity checks are disabled.</li> </ul>

## 10.2. APICURIO REGISTRY CONTENT RULE MATURITY

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

**Table 10.2. Apicurio Registry content rule maturity matrix**

Artifact type	Validity rule	Compatibility rule	Integrity rule
Avro	Full	Full	Full
Protobuf	Full	Full	Full
JSON Schema	Full	Full	Mapping detection not supported
OpenAPI	Full	None	Full
AsyncAPI	Syntax Only	None	Full
GraphQL	Syntax Only	None	Mapping detection not supported
Kafka Connect	Syntax Only	None	Mapping detection not supported
WSDL	Full	None	Mapping detection not supported
XML	Full	None	Mapping detection not supported
XSD	Full	None	Mapping detection not supported

## 10.3. APICURIO REGISTRY CONTENT RULE PRECEDENCE

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

**Table 10.3. Apicurio Registry content rule precedence**

Artifact-specific rule	Global rule	Rule applied to this artifact	Global rule available for other artifacts?
Enabled	Enabled	Artifact-specific	Yes
Disabled	Enabled	Global	Yes



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

## APPENDIX A. USING YOUR SUBSCRIPTION

Apicurio 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](https://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](https://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](https://access.redhat.com/downloads).
2. Locate the **Red Hat Integration** entries in the **Integration and Automation** category.
3. Select the desired Apicurio Registry product. The **Software Downloads** page opens.
4. Click the **Download** link for your component.

*Revised on 2024-02-22 17:15:28 UTC*