Cloudera Runtime 7.2.17

Schema Registry Security

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Contents

Schema Registry authorization through Ranger access policies

User and group access to various Schema Registry functions is controlled through Apache Ranger.

Predefined access policies for Schema Registry allow the administrator to quickly add a user or user group to specify:

- Who can add or evolve schemas to a schema metadata.
- Who can view and edit schemas within a schema metadata.
- Who can upload the SerDes JAR files.

If a higher level of granularity is necessary, the administrator can create an access policy and add the user or user group to this custom policy.

Related Information

Predefined access policies for Schema Registry

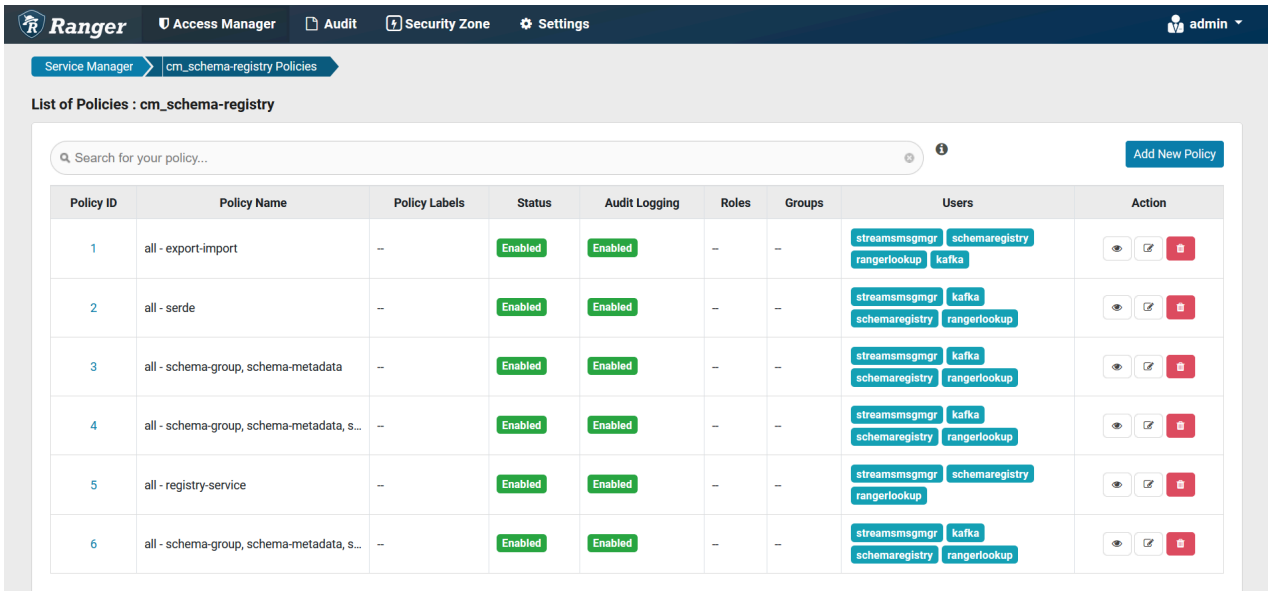
Adding the user or group to a predefined access policy

Creating a custom access policy

Predefined access policies for Schema Registry

Based on a user's responsibilities, you can add users or user groups to one or more of the predefined access policies for Schema Registry and you can specify if they have the permission to create, read, update, or delete access policies..

The following image shows the predefined access policies for Schema Registry:



The following table describes the predefined access policies for Schema Registry:

Access Policy	Description
all - export-import	Allows users to import and export schemas to or from the Schema Registry service. For example, a user can import a JSON file with schemas from a Confluent Kafka topic to Cloudera Schema Registry.
all - serde	Allows users to store metadata regarding the format of how data should be read and how it should be written. Users can store JAR files for serializers and deserializers and then map the SerDes to the schema.

Access Policy	Description
all - schema-group, schema-metadata	Allows users to access the schema groups and schema metadata.
all - schema-group, schema-metadata, schema-branch	Allows users to access the schema groups, schema metadata, and schema branch.
all - registry-service	Allows users to access the Schema Registry service. If a user is added to this policy, the user can access all Schema Registry entities.
all - schema-group, schema-metadata, schema-branch, schema-version	Allows users to access the schema groups, schema metadata, schema branch, and schema version.

Related Information

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Adding the user or group to a predefined access policy

When an authenticated user attempts to view, create, edit, or delete a Schema Registry entity, the system checks whether the user has privileges to perform that action. These privileges are determined by the Ranger access policies that a user is associated with.

Before you begin

For Ranger policies to work, you must have a user group named schemaregistry. If you use UNIX PAM, the sche maregistry user group must be on the node that hosts Schema Registry.

About this task

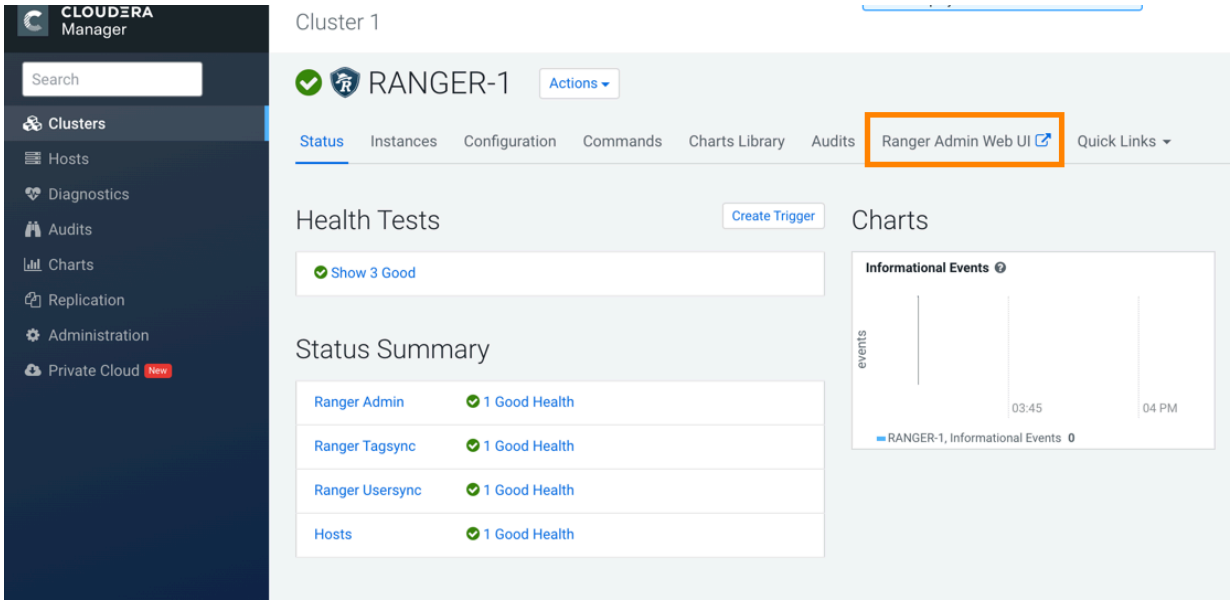
Determine the permissions required by a user or user group, and accordingly add the user or group to the appropriate predefined access policy.

Each predefined access policy controls access to one or more Schema Registry entities.

Procedure

1. From the Cloudera Manager home page, click the Ranger link.
   The **Ranger** management page appears.

2. Click Ranger Admin Web UI.

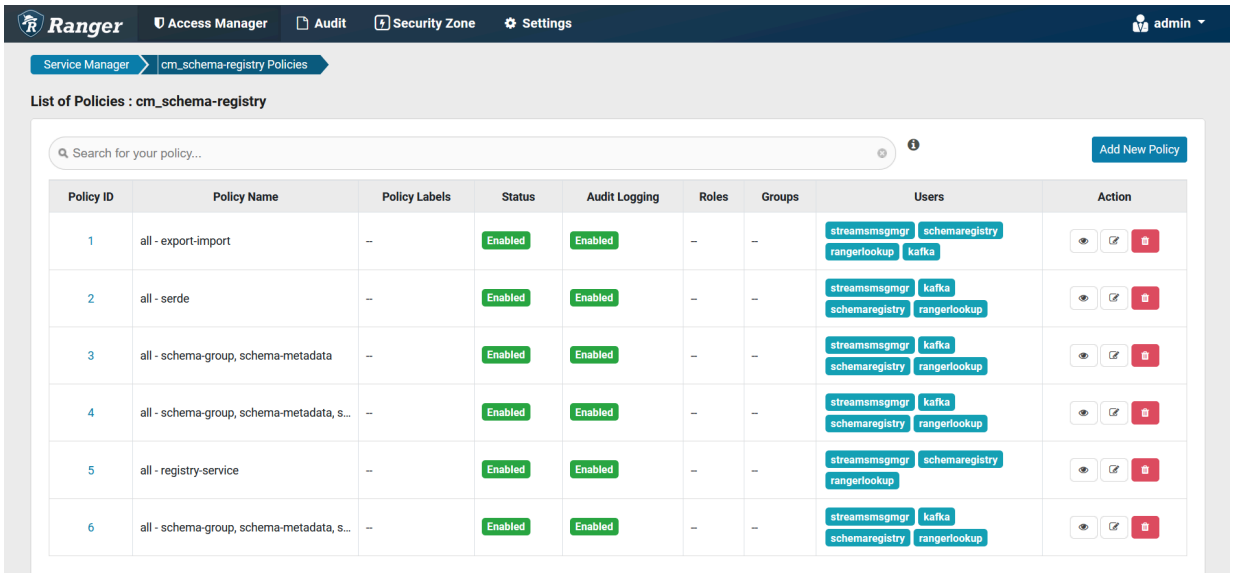


The **Ranger Log In** page appears.

3. Enter your user name and password to log in.
The **Ranger Service Manager** page appears.

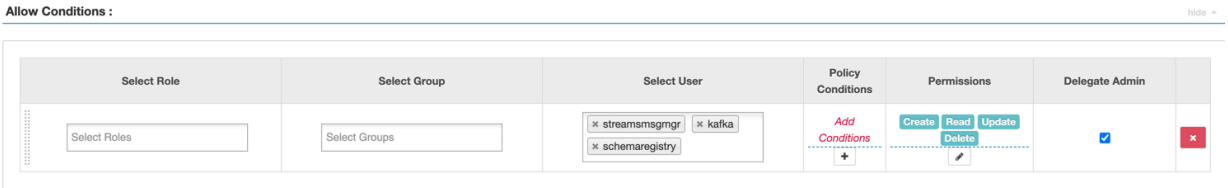
The page is organized by service. Each cluster is listed under its respective service. For example, the Schema Registry clusters in the environment are listed under Schema Registry.

4. Select a cluster from the Schema Registry section.
The **List of Policies** page appears.



5. Click the ID of a policy.
The **Edit Policy** page appears.

6. In the Allow Conditions section, add the user or group to the respective Select User or Select Group field.



7. In the Policy Conditions field, enter the appropriate IP address.
8. From the Permissions field, select the appropriate permission.
9. Click Save.

Results

The user now has the rights according to the policy and the permissions you assigned to the user. These rights apply to all objects in the entities unless you specified otherwise in the Policy Conditions field.

Related Information

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Creating a custom access policy

Creating a custom access policy

You can create a custom access policy for a specific Schema Registry entity, specify an access type, and add a user or user group to the policy.

Before you begin

Determine and note down the following information:

- The schema registry entity that the user needs access to.
- Whether the user requires all objects in the entity or specific objects.
- Whether the user needs read, view, edit, or delete permissions to the entity.
- If there are any IP addresses to include or exclude from the user's access.

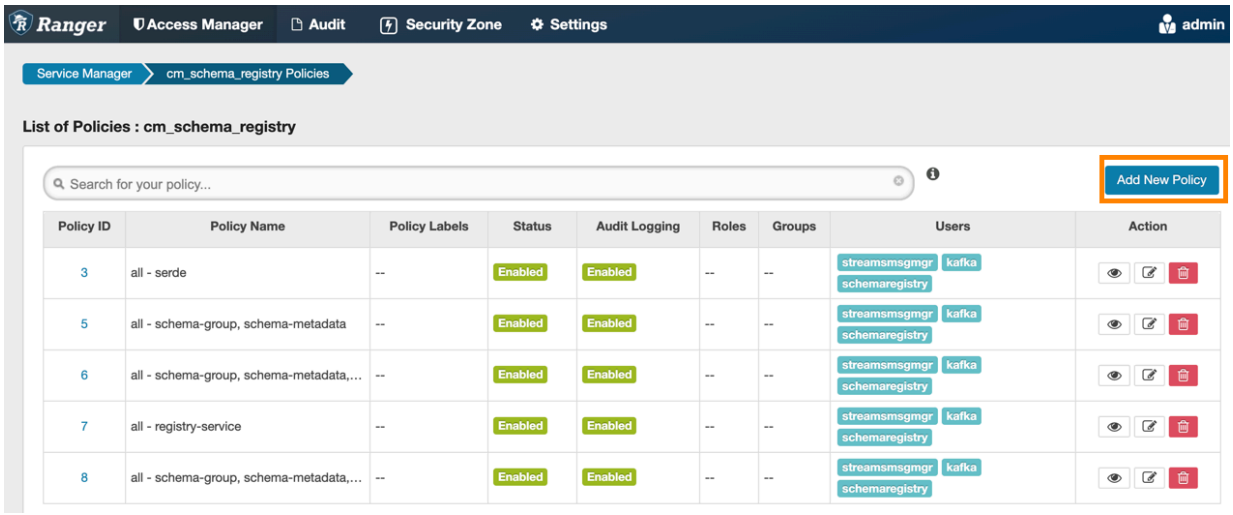
About this task

With a custom policy you can specify the Schema Registry entity and the type of access the user requires.

Procedure

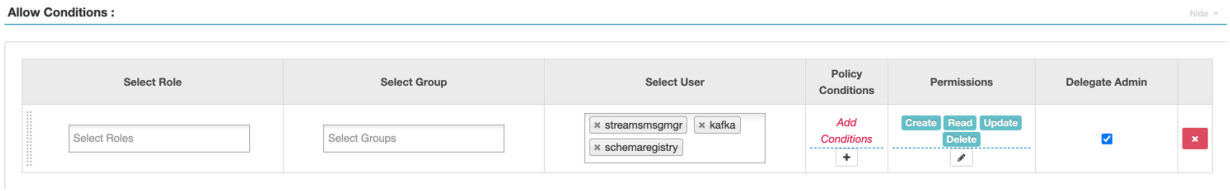
1. Go to the **Ranger List of Policies** page.

2. Click Add New Policy.



The **Create Policy** page appears.

3. Enter a unique name for the policy.
4. Optionally, enter a keyword in the Policy Label field to aid in searching for a policy.
5. Select a Schema Registry entity. You can choose the Schema Registry service, schema group, or SerDe. Then, perform one of the following tasks:
   - If you want the user to access all the objects in the entity, enter *.
   - If you want to specify the objects in the entity that a user can access, enter the name of the object in the text field.
6. Optionally, enter a description.
7. In the Allow Conditions section, add the user or group to the respective Select User or Select Group field.



8. Optionally, from the Policy Conditions field, enter the appropriate IP address.
9. From the Permissions field, select the appropriate permission.
10. Click Save.

Results

The user now has the rights according to the policy and the permissions you assigned to the user.

Related Information

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Adding the user or group to a predefined access policy

Schema Registry authentication through OAuth2 JWT tokens

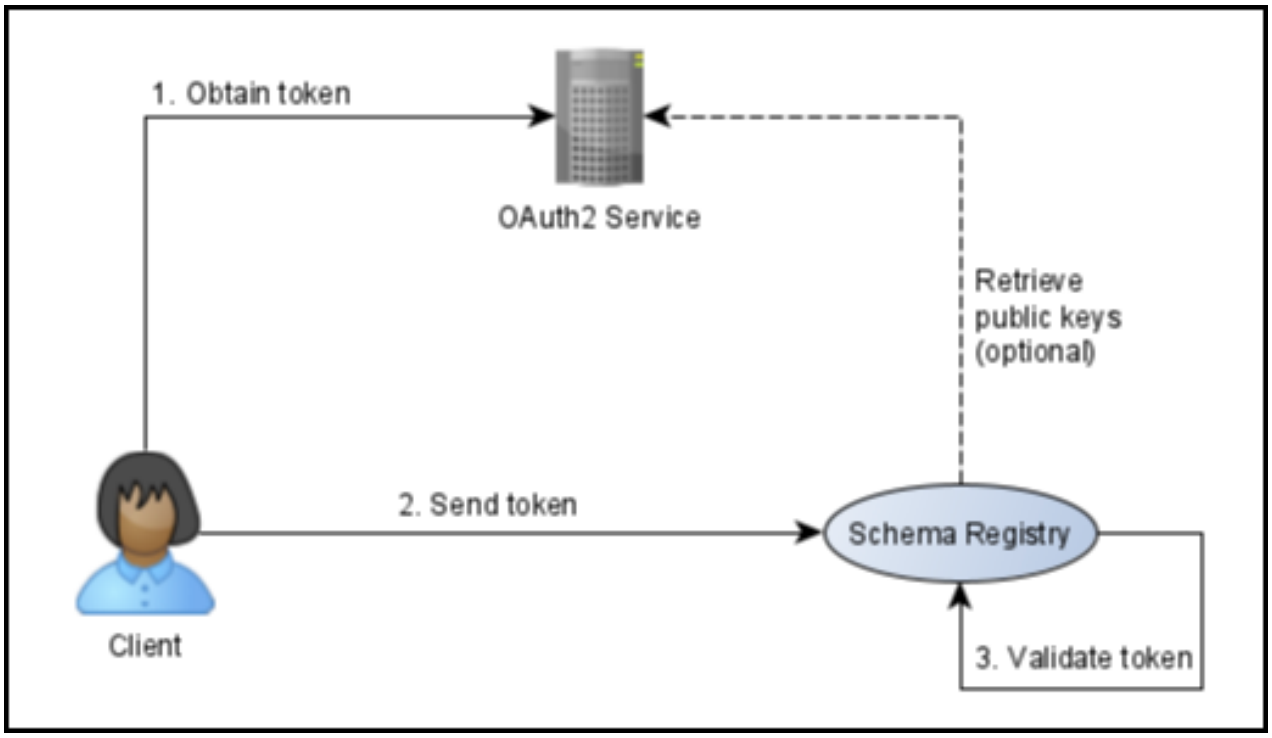
You can use OAuth2 JSON Web Token (JWT) in Schema Registry for authentication. Authorization continues to be implemented in Ranger; however, you can obtain the principal from a JWT token.

The flow for authenticating with OAuth2 tokens is as follows:

1. A client requests a token from the OAuth2 service.

   During Schema Registry startup the application obtains the public keys needed for validating the incoming tokens.
2. The client sends the HTTP requests to Schema Registry and these requests contain the bearer token in the HTTP header.
3. Schema Registry validates the token.

The following image shows the authentication flow with OAuth2 tokens:



Note: Schema Registry currently supports JWT tokens only. There is no support for opaque tokens. The following is an example of a JWT token:

```
{
  "kid": "3",
  "alg": "HS256"
}
-------------------------------------------------
{
  "iss": "sender",
  "aud": "receiver",
  "exp": 1644492815,
  "jti": "5vgglGQCjC9_WZJMJg7mHQ",
  "iat": 1644492515,
  "sub": "abigel"
}
-------------------------------------------------
<signature>
```

The flow for authorization is as follows:

1. Once the token is validated, the principal is extracted from the JWT token. By default, the principal is stored in the sub field.
2. The principal is passed to Ranger which performs the authorization.

JWT algorithms

Similarly to Kafka, Schema Registry also uses Jose4J for validating the JWT tokens and their signatures.

This library supports a range of signing algorithms: HS256, HS384, HS512, RS256, RS384, and RS512.

For more information, see *Bitbucket jose4j Wiki*.

Related Information
Bitbucket jose4j Wiki

Public key and secret storage

Learn about public key, private key, and secret in JSON Web Token (JWT). Also learn about JSON Web Key (JWK), keystore, and property that Schema Registry supports for storing the public key or the secret.

When JWTs are signed with RSA, there is a private and public key pair. The private key is located on the OAuth2 server and is hidden from you. Schema Registry uses the public key for validating the signature of the JWT token.

When JWTs are signed with HMAC, there is a secret which is shared by all parties. The secret is used for signing the token and also for verifying it.

Schema Registry supports the following ways to store the public key or the secret:

- JWK

  JSON Web Key is a data structure that describes a key. When you have multiple keys collected in a set, that data structure is named JWKS. A JWKS contains a collection of keys.

  Usually, there is a public web service that exposes the JWKS. You can obtain the JWKS through an HTTP request. Other transportation methods are possible, for example, the keys can be stored in a file or on a network storage.

  The keys are usually short lived (depending on the provider the validity period ranges from one day to one week). For this reason, Schema Registry runs a thread every 5 minutes to refresh the keys. The interval can be customized.
- Keystore

  The keys can be stored in a Java keystore file. You need to ensure that Schema Registry has access to the file and permission to read the key.
- Property

  The public key or secret can be stored directly in Schema Registry. In this case, you enter the key in Cloudera Manager and Schema Registry loads it during startup. This option is useful when the public key expires rarely and you do not want to depend on an external JWK service for managing the keys.

Authentication using OAuth2 with Kerberos

It is possible to have both Kerberos and OAuth2 enabled at the same time for Schema Registry.

OAuth2 is added as yet another authentication layer to Schema Registry. It is possible to have both Kerberos and OAuth2 enabled at the same time. In this scenario, if either one of them succeeds in authenticating the client, the client is given a pass.

This setup can be useful for cases when you have different services communicating with Schema Registry and some of them use Kerberos while others rely on OAuth2.

Schema Registry server configuration

Learn how to configure general settings for Schema Registry server. Also learn about the extra parameters which you can set when storage type is JWK, keystore, or property.

General settings

Property	Data type	Description
schema.registry.oauth.enabled	Boolean	Select this option to enable OAuth2 authentication.
schema.registry.oauth.key.store.type	Enum	Select the type of the key storage where the public key is read from. Possible values are: property, keystore, jwk. Depending on the chosen value, additional configuration might be necessary. These are detailed in the following sections.
schema.registry.oauth.jwt.principal.claim.name	String	The JWT token needs to contain the principal which is used during Ranger authorization. By default, it is assumed that the sub claim contains the principal, but this can be modified with this parameter.
schema.registry.oauth.jwt.expected.audience	String	The JWT token can optionally contain an audience aud claim. When this claim is present, the same audience value needs to be expected on the server side, otherwise the token is considered invalid.
schema.registry.oauth.jwt.expected.issuer	String	The JWT token can optionally contain an issuer iss claim. You can configure Schema Registry to only accept tokens issued by a specific issuer.
schema.registry.oauth.clock.skew	Integer	The clock of the server issuing the token might not be in sync with the clock where Schema Registry is running. You can adjust this value to tolerate a certain difference between the two clocks (in seconds).

JWK configuration settings

When storage type is JSON Web Key (JWK), you can also apply the following parameters.

Property	Data type	Description
schema.registry.oauth.jwks.url	String	URL to the server issuing the JWK keys. This can also be a local file if the URL starts with file://.
schema.registry.oauth.jwks.refresh.ms	Long	Refresh interval for reading the keys from the JWK server. Default value is 30000 ms (30 seconds).

The following parameters are optional. When the keys are downloaded from a remote server, you might need special configuration for accessing the server.

Property	Data type	Description
schema.registry.oauth.jwks.httpClient.basic.user	String	If the JWK server requires basic authentication, then you can provide the username.

Property	Data type	Description
schema.registry.oauth.jwks.httpClient.basic.password	String	If the JWK server requires basic authentication, then you can provide the password.
schema.registry.oauth.jwks.httpClient.keyStorePath	String	If a key is required for accessing the JWK server, then you can provide the keystore path.
schema.registry.oauth.jwks.httpClient.keyStoreType	String	Schema Registry keystore type of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.keyPassword	String	Schema Registry key password of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.keyStorePassword	String	Schema Registry keystore password of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.keyStoreProvider	String	Schema Registry keystore provider of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.keyManagerFactoryAlgorithm	String	Schema Registry algorithm of KeyManagerFactory for HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.keyManagerFactoryProvider	String	Schema Registry KeyManagerFactory provider for HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.trustStorePath	String	You can add the certificate of the JWK server to a truststore.
schema.registry.oauth.jwks.httpClient.trustStoreType	String	Schema Registry truststore type of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.trustStorePassword	String	Schema Registry truststore password of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.trustStoreProvider	String	Schema Registry truststore provider of HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.trustManagerFactoryAlgorithm	String	Schema Registry TrustManagerFactory algorithm for HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.trustManagerFactoryProvider	String	Schema Registry TrustManagerFactory provider for HTTP client used for JWK OAuth2. This can be required when keystore type is jwk.
schema.registry.oauth.jwks.httpClient.protocol	String	HTTPS security protocol. By default, it is TLS.

Keystore configuration settings

When storage type is keystore, you can also apply the following parameters.

Property	Data type	Description
schema.registry.oauth.keystore.public.key.keystore	String	Path to the keystore file. Ensure the file is readable by Schema Registry.
schema.registry.oauth.keystore.public.key.keystore.alias	String	The alias of the key within the keystore.

Property	Data type	Description
schema.registry.oauth.keystore.public.key.keystore.pass	String password	Password for reading the keystore.

Property configuration settings

When storage type is property, you can also apply the following parameters.

Property	Data type	Description
schema.registry.oauth.property.public.key.property	String	The public key or the secret.
schema.registry.oauth.property.key.algorithm	Enum	The algorithm of the key. The values are: RS256, HS256.

Configuring the Schema Registry client

Learn how to configure the Schema Registry client to access the server.

When running together with Kafka, the existing parameters still apply.

The client first sends a request to the OAuth2 auth server and requests a token. Configure the settings required to access the server.

Property	Data type	Description
schema.registry.auth.type	String	It needs to be set to oauth2.
schema.registry.oauth.server.url	String	URL of the server issuing the tokens.
schema.registry.oauth.client.id	String	ID of the client.
schema.registry.oauth.secret	String	Secret.
schema.registry.oauth.scope	String	Scope (optional).
schema.registry.oauth.request.method	String	HTTP request method. By default, it is post.