ROMA Connect

Developer Guide

Issue 01

Date 2023-04-23

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1 Developer Guide for Service Integration

1.1 How Do I Choose an Authentication Mode

API Providers

You can choose any of the following authentication modes:

- **App authentication** (recommended)

  Simple and non-simple authentication is supported.

  – Non-simple authentication: Requests are authenticated using the key and secret of an integration application.

  – Simple authentication: Requests are authenticated using an AppCode.

  App authentication supports IP-based API access control.

- **IAM authentication**

  Token and AK/SK authentication is supported.

  – Token authentication: Requests are authenticated using a token. This authentication mode is recommended because it requires no SDK signatures.

  – AK/SK authentication: Requests are authenticated using an AK/SK. Request signing is similar to that of App authentication.

  IAM authentication supports IP- and account-based API access control.

- **Custom authentication**

  If you want to use your own authentication mode, you can create a function backend as your authentication service.

  Custom authentication supports IP-based API access control.

- **None authentication**

  APIs can be accessed without authentication.

  This authentication mode supports IP-based API access control.

API Callers

Obtain the API calling information from the API provider, confirm the authentication mode, and then call the API according to the instructions in this document.

1.2 Using App Authentication to Call APIs

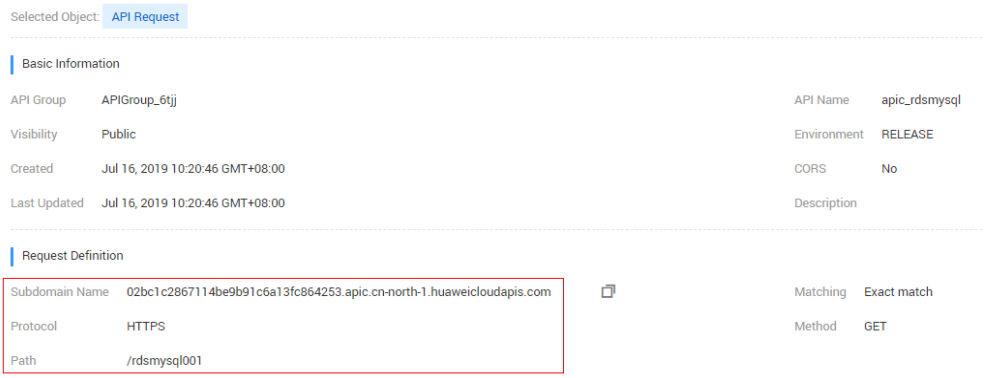
1.2.1 Preparations

Before accessing an API through an SDK in App authentication mode, you must collect the required information.

- Obtain the subdomain name, request path, and request protocol of the API.

  Log in to the ROMA Connect console. Choose **API Connect** > **API Management** > **APIs**, click an API to access the API details, and click **API Request** on the **API Calling** page. View the values of **Subdomain Name**, **Path**, and **Protocol**.

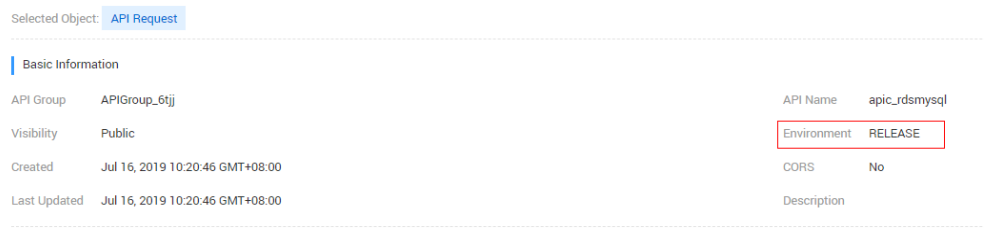
  Figure 1-1 Request definition

- Publish the API in an environment before you can access it.

  Log in to the ROMA Connect console. Choose **API Connect** > **API Management** > **APIs**, click an API to access the API details, and click **API Request** on the **API Calling** page. View the API running environment. If no running environment is available, return to the API list and publish the API to the specified environment.

  Figure 1-2 Running environment information

- Provide a valid AppKey and AppSecret to generate an authentication signature.

On the ROMA Connect console, choose **Integration Applications** and click **Create Integration Application** to create an integration application. Click the application name to view the key and secret in the **Basic Information** area. Choose **API Connect** > **API Management** > **APIs** and authorize the API to the app. Then, you can use the key and secret of the app to access the API.

NOTE

- Key: access key ID of the app. It is a unique identifier associated with a secret access key and is used in conjunction with a secret access key to sign requests cryptographically.
- Secret: secret access key used together with an AppKey to sign requests. The AppKey and AppSecret can be together used to identify a request sender to prevent the request from being modified.

- When sending an API request, the SDK adds the current time to the X-Sdk-Date header and adds the signature information to the Authorization header. The signature is valid only within a limited period of time.

CAUTION

The client must synchronize the local time with the NTP server to avoid a large offset in the value of **X-Sdk-Date** in the request header.

In addition to verifying the time format of **X-Sdk-Date**, ROMA Connect also verifies the time difference between the time specified by **X-Sdk-Date** and the actual time when the request is received. If the time difference exceeds 15 minutes, ROMA Connect rejects the request.

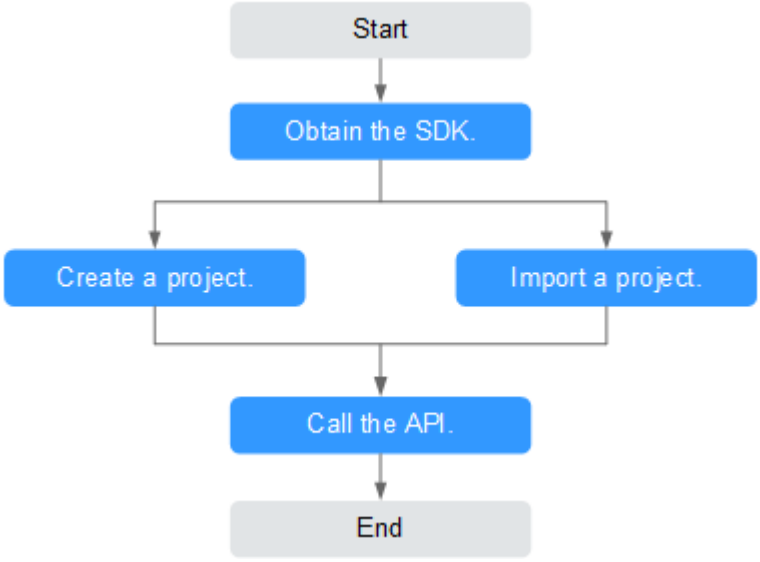
1.2.2 Java

Scenarios

To use Java to call an API through App authentication, obtain the Java SDK, create a new project or import an existing project, and then call the API by referring to the API calling example.

This section uses IntelliJ IDEA 2018.3.5 as an example.

Figure 1-3 API calling process



Prerequisites

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- You have installed IntelliJ IDEA 2018.3.5 or later. Otherwise, download one from the **IntelliJ IDEA official website** and install it.
- You have installed Java Development Kit (JDK) 1.8.111 or a later version. Otherwise, download one from the **Oracle official website** and install it.

Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

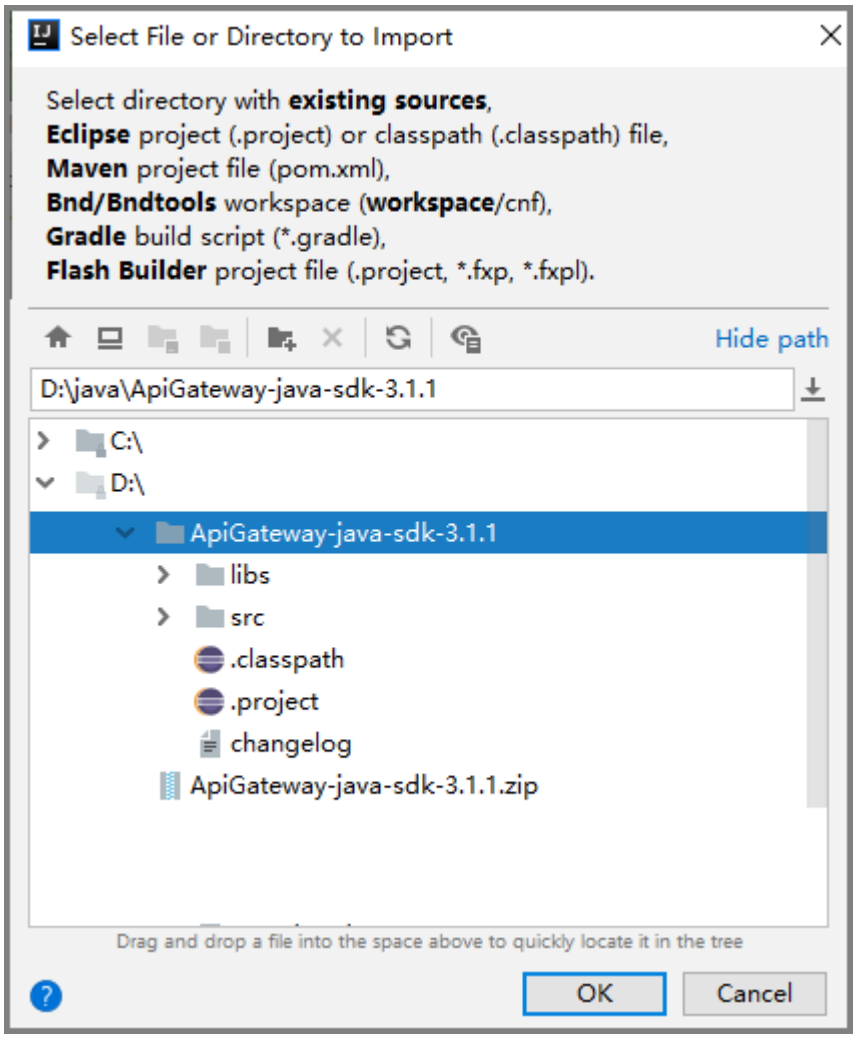
Name	Description
libs\	SDK dependencies
libs\java-sdk-core-*x.x.x*.jar	SDK package
src\com\apig\sdk\demo\Main.java	Sample code for signing requests
src\com\apig\sdk\demo\OkHttpDemo.java	
src\com\apig\sdk\demo\LargeFileUploadDemo.java	
.classpath	Java project configuration files
.project	

Importing a Project

Step 1 Start IntelliJ IDEA and choose **Import Project**.

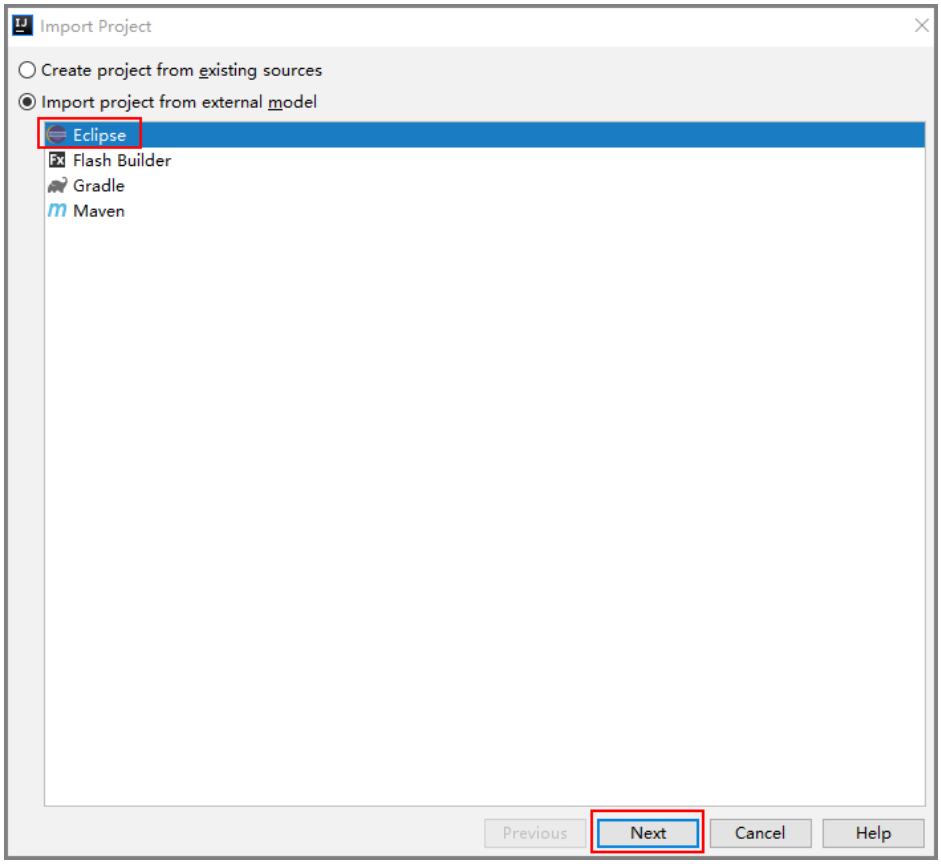
The **Select File or Directory to Import** dialog box is displayed.

Step 2 Select the directory where the SDK is decompressed and click **OK**.



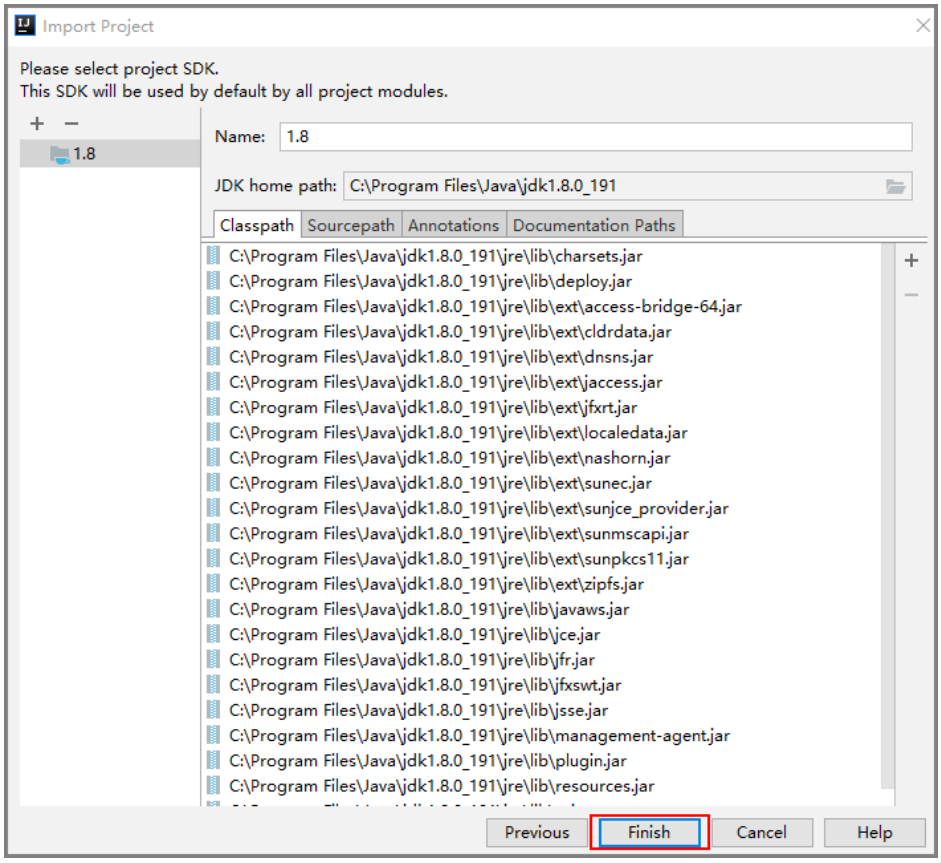
Step 3 Select **Eclipse** for **Import project from external model** and click **Next**. Retain the default settings and click **Next** until the **Please select project SDK** page is displayed.

Figure 1-4 Import Project



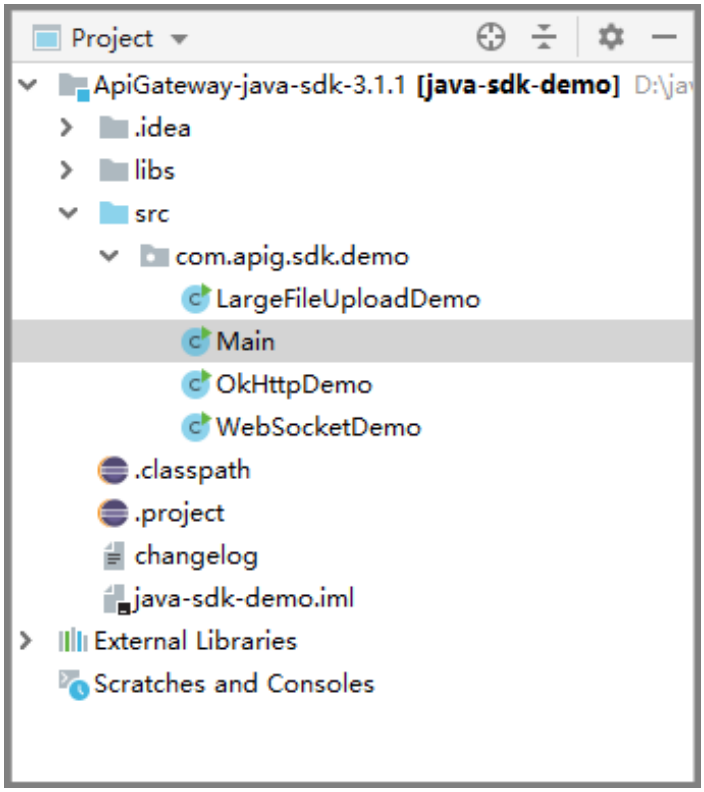
Step 4 Click **Finish**.

Figure 1-5 Finish



Step 5 After the import is complete, the directory structure is shown in the following figure.

Figure 1-6 Directory structure



----End

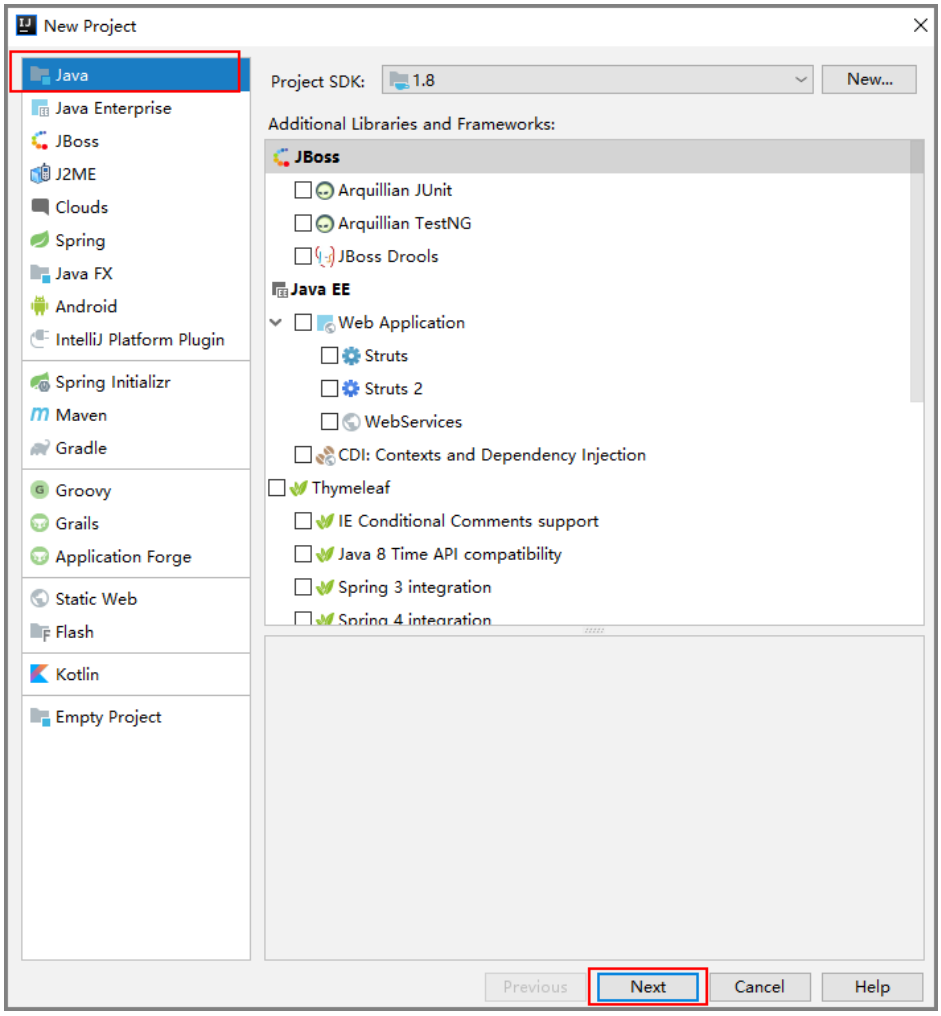
Creating a Project

Step 1 Start IntelliJ IDEA and choose **Create New Project**.

The **New Project** dialog box is displayed.

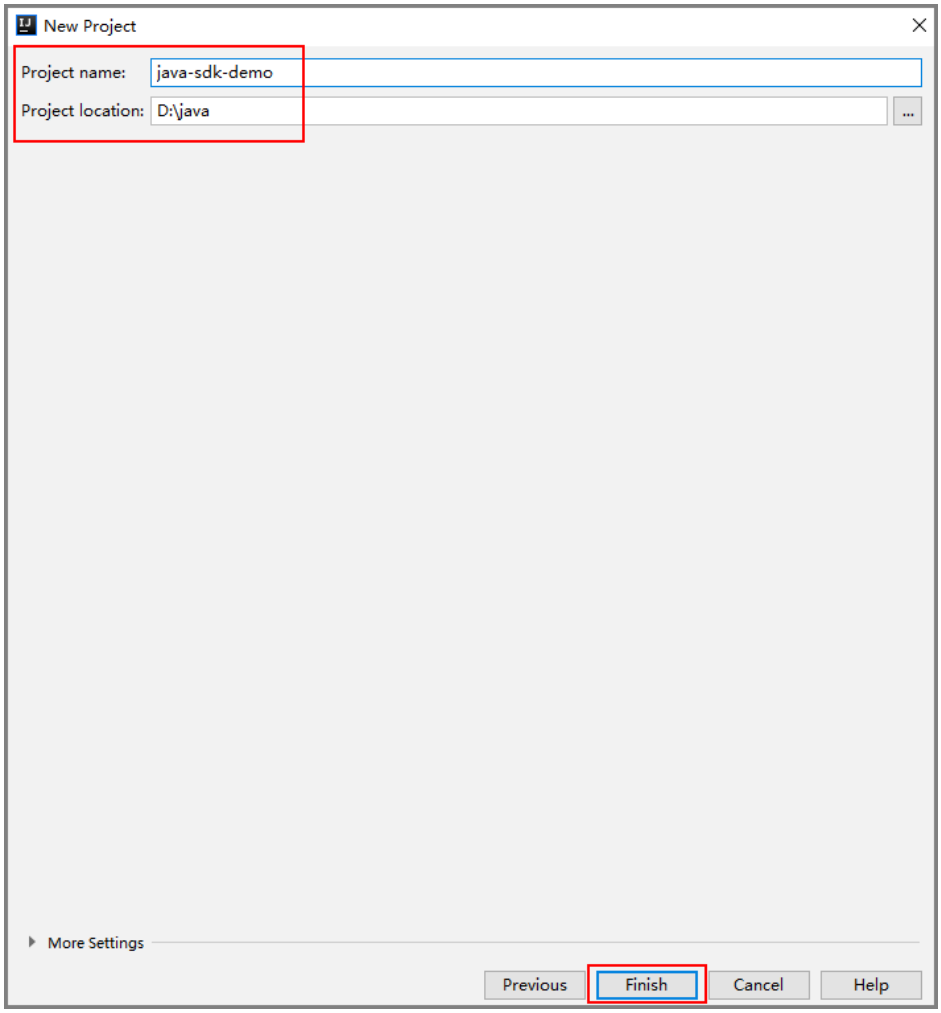
Step 2 In the right pane, select **Java** and click **Next**.

Figure 1-7 New Project dialog box



Step 3 Retain the default settings and click **Next**. On the page displayed, set **Project name** and select the local directory where the project is created for **Project location**.

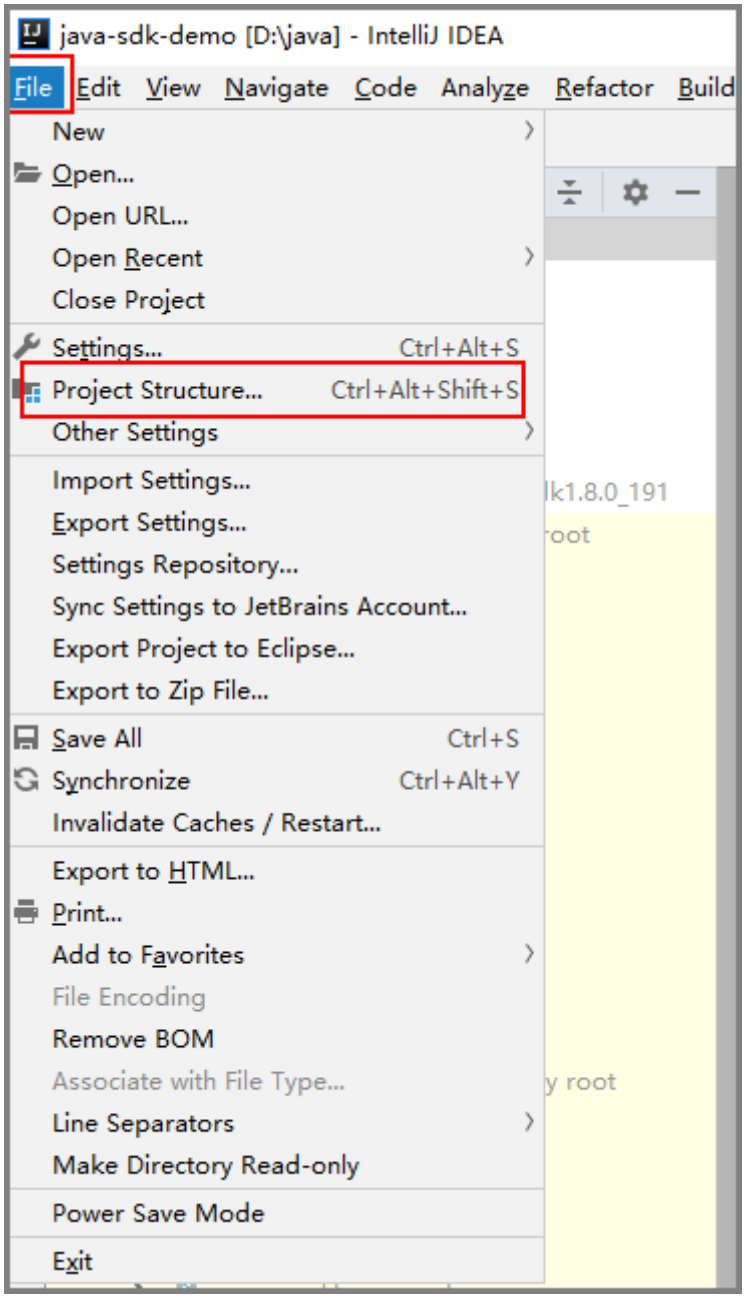
Figure 1-8 New Project dialog box



Step 4 Import the **.jar** files in the Java SDK.

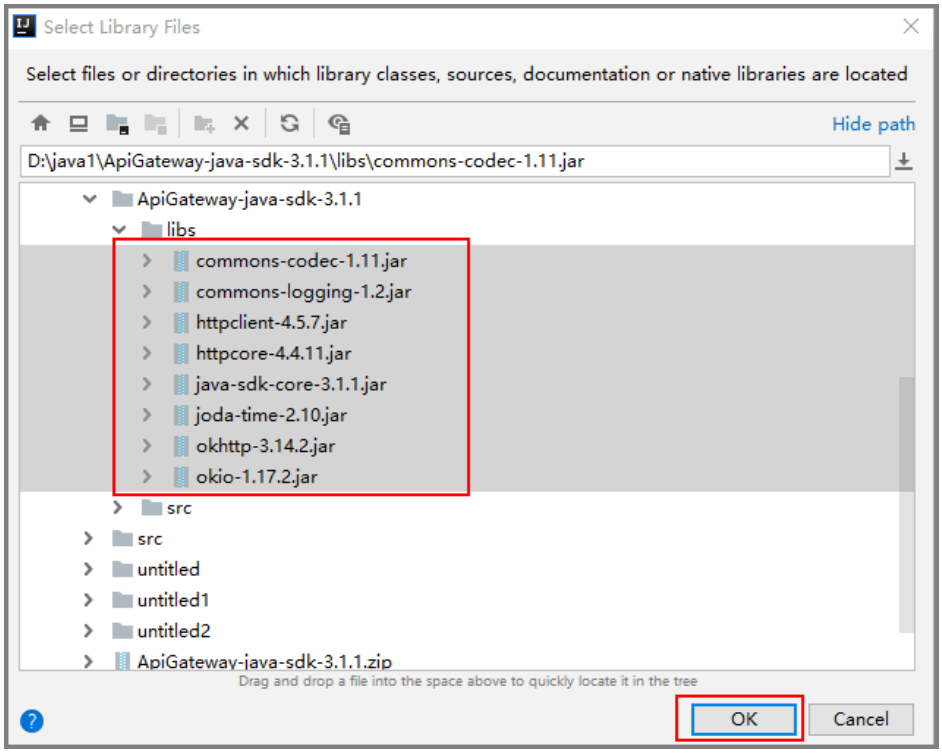
1. Choose **File** > **Project Structure**. The **Project Structure** dialog box is displayed.

Figure 1-9 Importing the .jar files



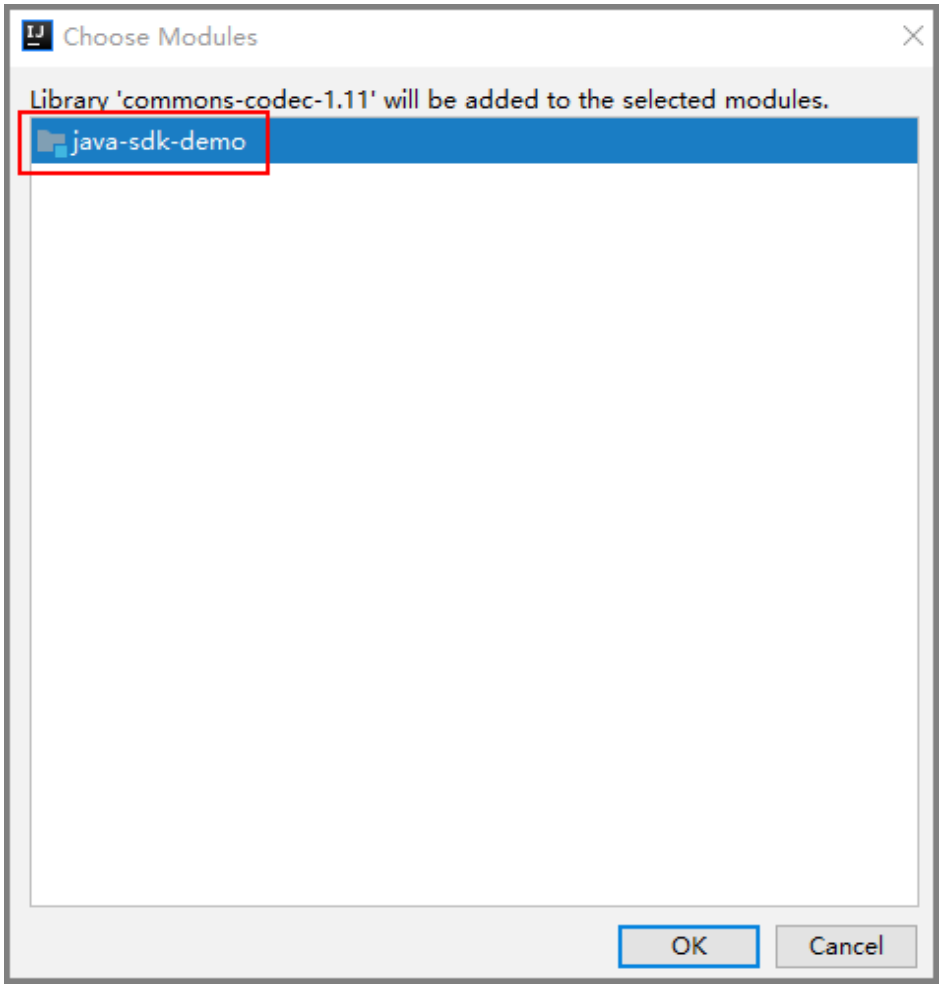
2. In the **Project Structure** dialog box, choose **Libraries** > **+** > **Java**. The **Select Library Files** dialog box is displayed.
3. Select all **.jar** files in **\libs** of the directory where the SDK is located and click **OK**.

Figure 1-10 Selecting the .jar files



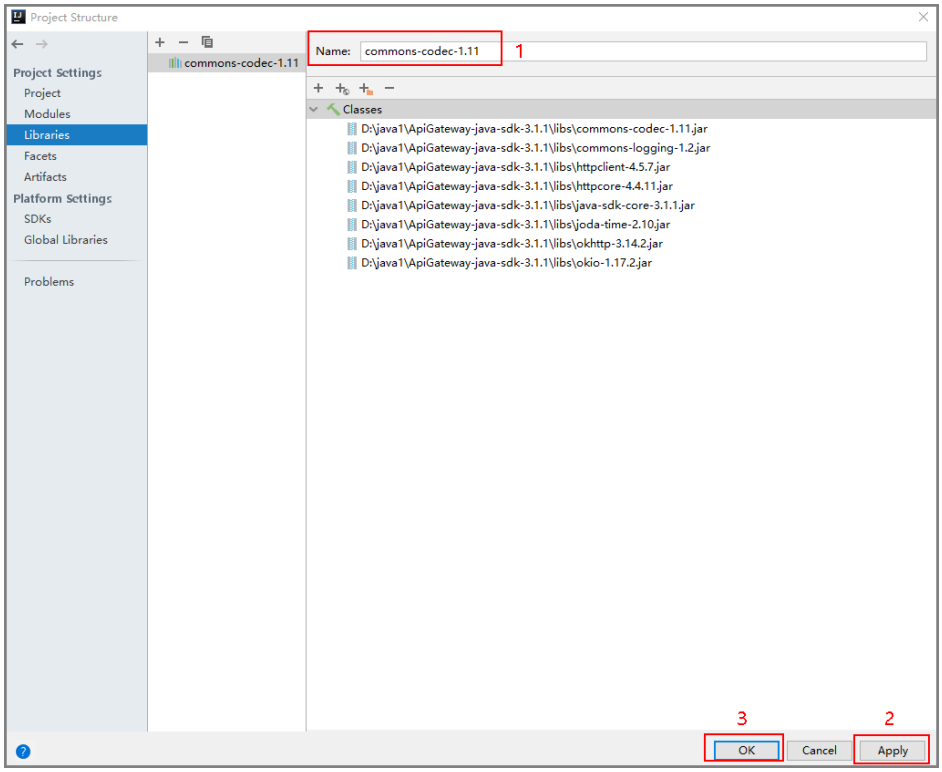
4. Select the project created in **Step 3** and click **OK**.

Figure 1-11 Selecting a project



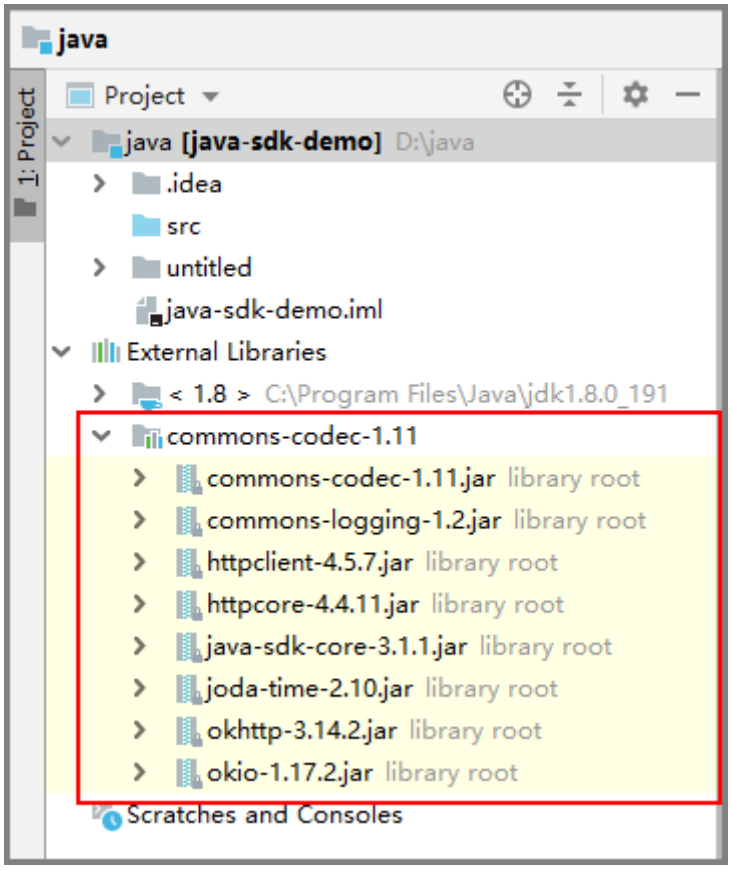
5. Enter the name of the directory where the JAR file is located and click **Apply** and **OK**.

Figure 1-12 JAR file directory



6. After the JAR file is imported, the directory structure is shown in the following figure.

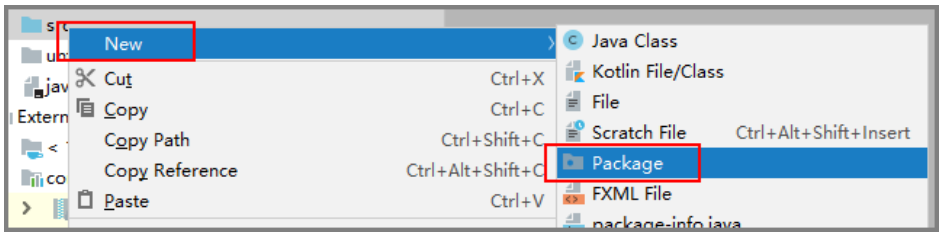
Figure 1-13 Directory structure



Step 5 Create a package and a class named **Main**.

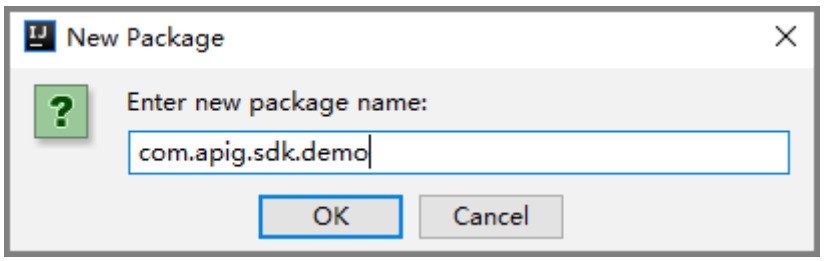
1. Right-click **src** and choose **New** > **Package** from the shortcut menu.

Figure 1-14 Creating a package



2. Enter **com.apig.sdk.demo** for **Name**.

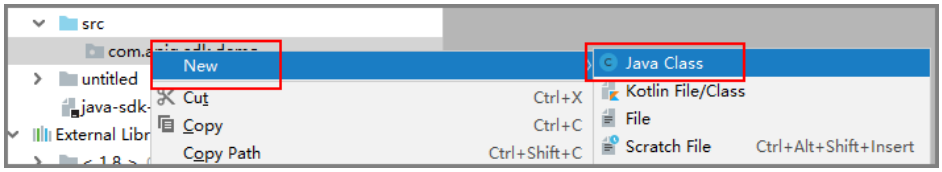
Figure 1-15 Setting a package name



3. Click **OK**.

4. Right-click **com.apig.sdk.demo**, choose **New** > **Java Class** from the shortcut menu, enter **Main** in the **Name** text box, and click **OK**.

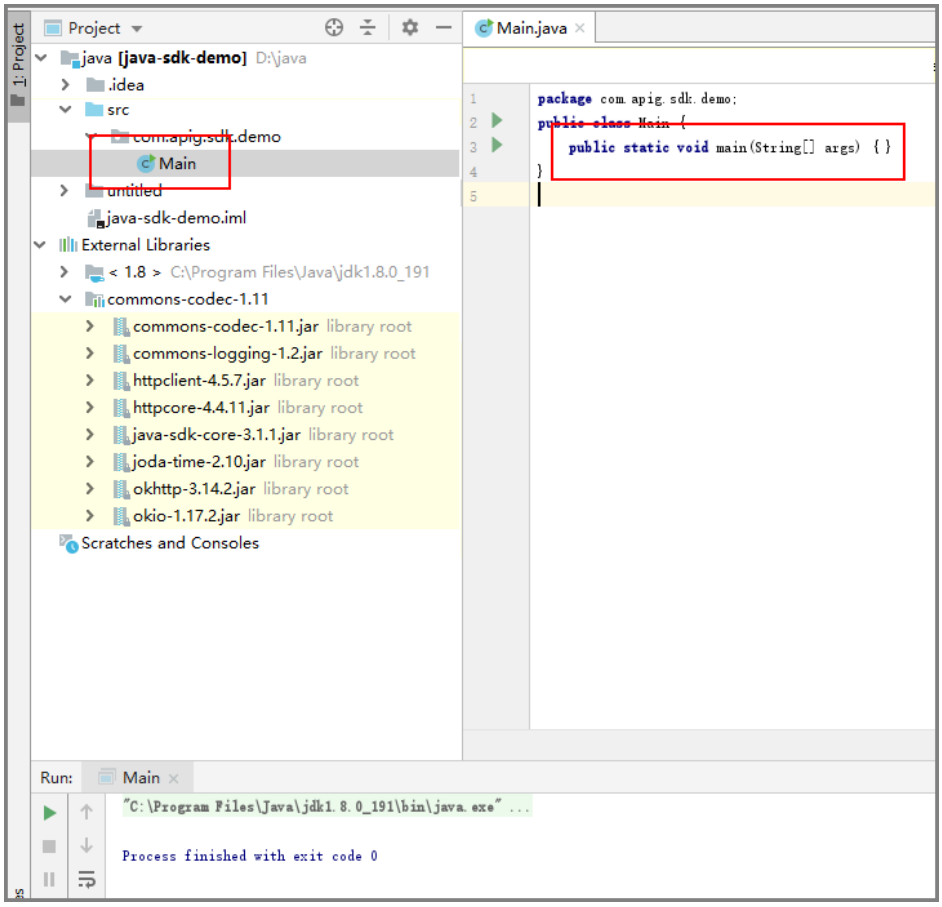
Figure 1-16 Creating a class



5. Configure a class.

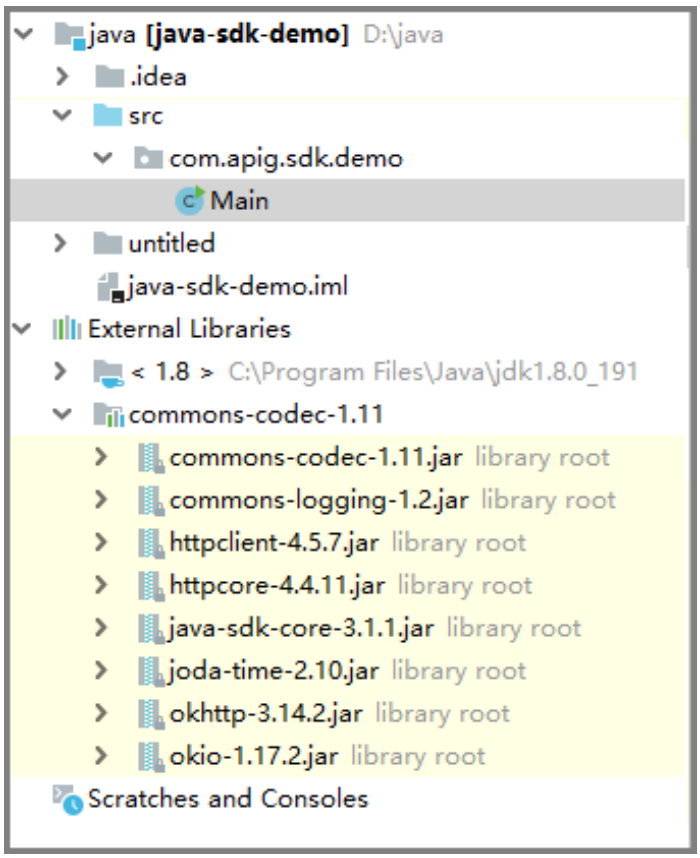
   After the class is created, open the Main file and add **public static void main(String[] args)** to the file.

Figure 1-17 Configuring the class



Step 6 View the directory structure of the project.

Figure 1-18 Directory structure of the new project



Before using **Main.java**, enter the required code according to **API Calling Example**.

----End

API Calling Example

NOTE

- This section demonstrates how to access a published API.
- Before accessing an API, you must create and publish the API on the ROMA Connect console. You can specify the Mock backend for the API.
- The backend of this API is a fake HTTP service, which returns response code **200** and message body **Congratulations, sdk demo is running**.

Step 1 Add the following references to **Main.java**:

```
import java.io.IOException;
import javax.net.ssl.SSLContext;

import org.apache.http.Header;
import org.apache.http.HttpEntity;
import org.apache.http.HttpResponse;
import org.apache.http.client.methods.HttpRequestBase;
import org.apache.http.conn.ssl.AllowAllHostnameVerifier;
import org.apache.http.conn.ssl.SSLConnectionSocketFactory;
import org.apache.http.conn.ssl.SSLContexts;
import org.apache.http.conn.ssl.TrustSelfSignedStrategy;
import org.apache.http.impl.client.CloseableHttpClient;
import org.apache.http.impl.client.HttpClients;
```



```
import org.apache.http.util.EntityUtils;

import com.cloud.apigateway.sdk.utils.Client;
import com.cloud.apigateway.sdk.utils.Request;
```

Step 2 Construct a request by configuring the following parameters:

- **AppKey**: Obtain it by referring to **Preparations**. The sample code uses **4f5f626b-073f-402f-a1e0-e52171c6100c**.
- **AppSecret**: Obtain it by referring to **Preparations**. Set this parameter based on the site requirements. The example code uses ****** as an example.
- **Method**: Specify a request method. The sample code uses **POST**.
- **url**: Request URL of the API, excluding the QueryString and fragment parts. For the domain name, use your own independent domain name bound to the group to which the API belongs. The example code uses **http://serviceEndpoint/java-sdk** as an example.
- **queryString**: Specify query parameters to be carried in the URL. Characters (0-9a-zA-Z./;[]\-=~#%^&_+:") are allowed. The sample code uses **name=value**.
- Header: Request header. Set a request header as required. It cannot contain underscores (_). The sample code uses **Content-Type:text/plain**. If you are going to publish the API in a non-RELEASE environment, specify an environment name. The sample code uses **x-stage:publish_env_name**.
- **body**: Specify the request body. The sample code uses **demo**.

The sample code is as follows:

```
    Request request = new Request();
    try
    {
        request.setKey("4f5f626b-073f-402f-a1e0-e52171c6100c"); //Obtain the value when creating an integration application.
        request.setSecret("*****"); //Obtained when an integration application is created.
        request.setMethod("POST");
        request.setUrl("http://serviceEndpoint/java-sdk");
         //Obtain the URL when creating an API group.
        //The subdomain name is obtained when the API group is created.
        request.addQueryStringParam("name", "value");
        request.addHeader("Content-Type", "text/plain");
        //request.addHeader("x-stage", "publish_env_name"); //Specify an environment name before publishing the API in a non-RELEASE environment.
        request.setBody("demo");
    } catch (Exception e)
    {
        e.printStackTrace();
        return;
    }
```

Step 3 Sign the request, access the API, and print the result.

The sample code is as follows:

```
    CloseableHttpClient client = null;
    try
    {
        HttpRequestBase signedRequest = Client.sign(request);

//If the subdomain name allocated by the system is used to access the API of HTTPS requests, uncomment the two lines of code to ignore the certificate verification.
        // SSLContext sslContext = SSLContexts.custom().loadTrustMaterial(null, new TrustSelfSignedStrategy()).useTLS().build();
        // SSLConnectionSocketFactory sslSocketFactory = new SSLConnectionSocketFactory(sslContext, new AllowAllHostnameVerifier());
```



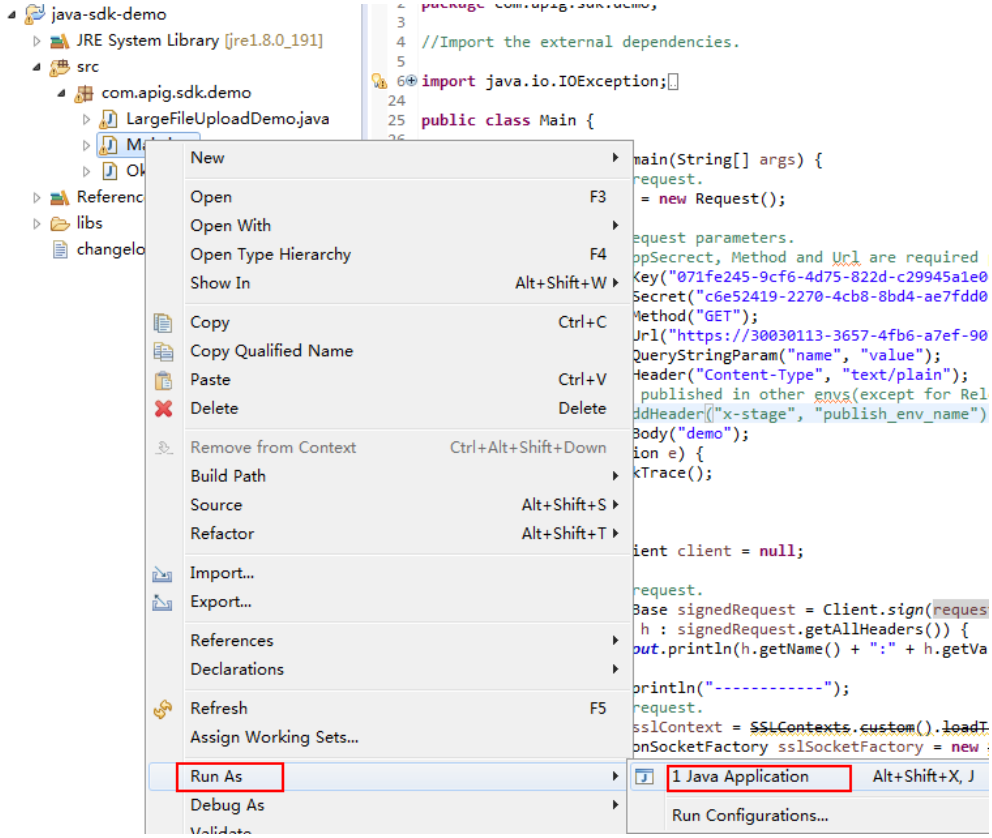
```
//If the subdomain name allocated by the system is used to access the API of HTTPS requests,
add .setSSLSocketFactory(sslSocketFactory) to the end of custom() to ignore the certificate verification.
        client = HttpClients.custom().build();

        HttpResponse response = client.execute(signedRequest);
        System.out.println(response.getStatusLine().toString());
        Header[] resHeaders = response.getAllHeaders();
        for (Header h : resHeaders)
        {
            System.out.println(h.getName() + ":" + h.getValue());
        }
        HttpEntity resEntity = response.getEntity();
        if (resEntity != null)
        {
            System.out.println(System.getProperty("line.separator") + EntityUtils.toString(resEntity, "UTF-8"));
        }

    } catch (Exception e)
    {
        e.printStackTrace();
    } finally
    {
        try
        {
            if (client != null)
            {
                client.close();
            }
        } catch (IOException e)
        {
            e.printStackTrace();
        }
    }
```

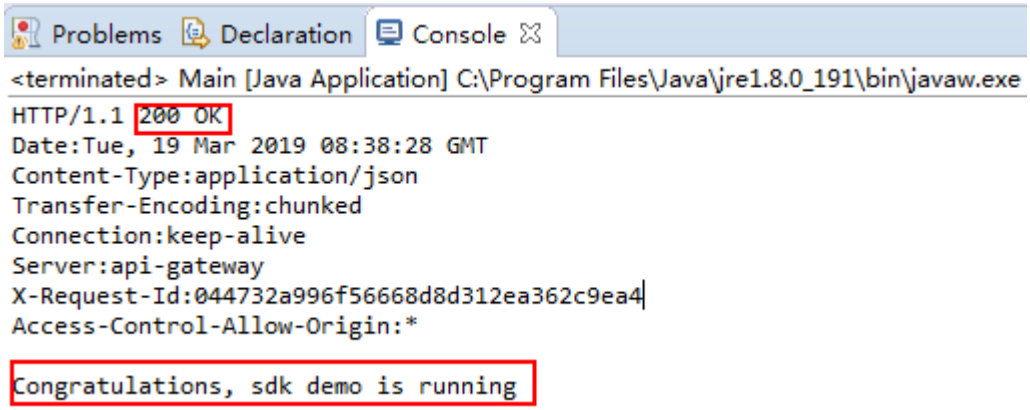
Step 4 Choose **Main.java**, right-click, and choose **Run As** > **Java Application** to run the project test code.

Figure 1-19 Running the project test code



Step 5 On the **Console** tab page, view the running result.

Figure 1-20 Response displayed if the calling is successful



----End

1.2.3 Go

Scenarios

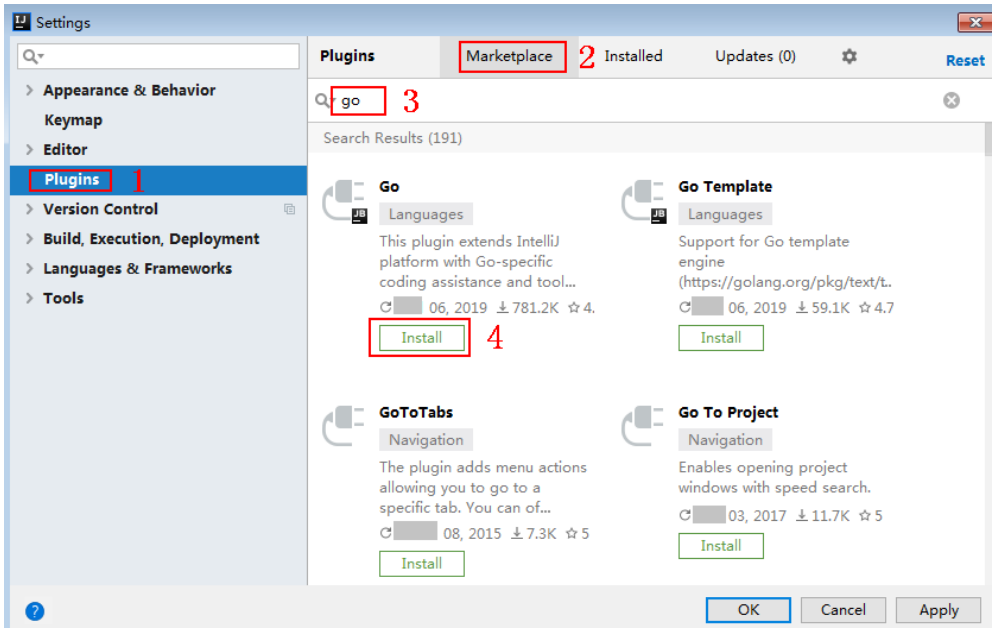
To use Go to call an API through App authentication, obtain the Go SDK, create a new project, and then call the API by referring to the API calling example.

This section uses IntelliJ IDEA 2018.3.5 as an example.

Prerequisites

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- You have installed Go 1.14 or later. If not, download the Go installation package from the **Go official website** and install it.
- You have installed IntelliJ IDEA 2018.3.5 or later. If not, download IntelliJ IDEA from the **IntelliJ IDEA official website** and install it.
- You have installed the Go plug-in on IntelliJ IDEA. If not, install the Go plug-in according to **Figure 1-21**.

Figure 1-21 Installing the Go plug-in



Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

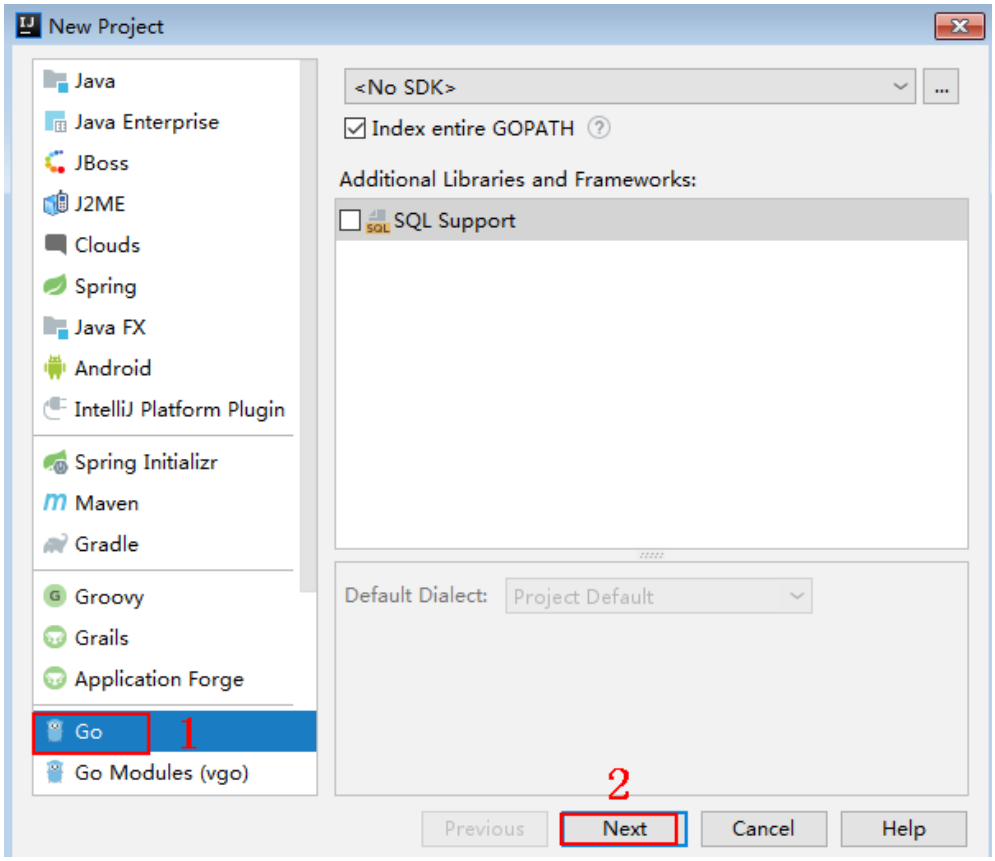
Name	Description
core\escape.go	SDK code
core\signer.go	
demo.go	Sample code

Creating a Project

Step 1 Start IntelliJ IDEA and choose **File** > **New** > **Project**.

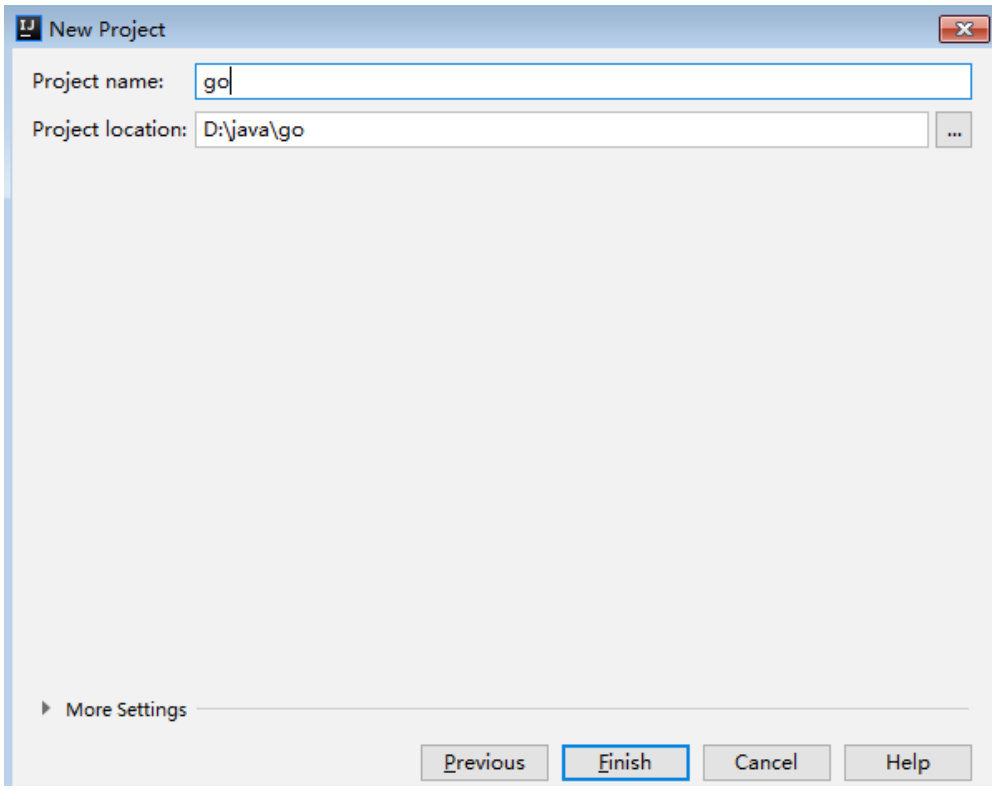
On the displayed **New Project** page, choose **Go** and click **Next**.

Figure 1-22 New Project



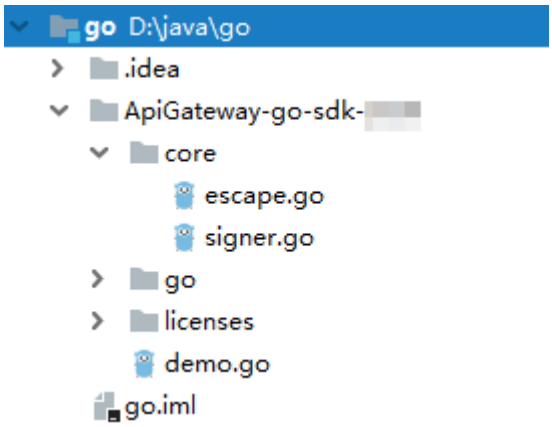
Step 2 Click **...**, select the directory where the SDK is decompressed, and click **Finish**.

Figure 1-23 Selecting the SDK directory after decompression



Step 3 View the directory structure of the project.

Figure 1-24 Directory structure of the new project



Modify the parameters in sample code **demo.go** as required. For details about the sample code, see **API Calling Example**.

----End

API Calling Example

Step 1 Import the Go SDK (signer.go) to the project.

```
import "apig-sdk/go/core"
```


Step 2 Generate a new signer and enter the key and secret of the integration application.

```
s := core.Signer{
        Key: "4f5f626b-073f-402f-a1e0-e52171c6100c",
        Secret: "******",
}
```

Step 3 Generate a new request, and specify the domain name, method, request URL, query parameters, and body.

```
r, _ := http.NewRequest("POST", "http://c967a237-cd6c-470e-906f-
a8655461897e.apigw.exampleRegion.com/api?a=1&b=2",
                        ioutil.NopCloser(bytes.NewBuffer([]byte("foo=bar"))))
```

Step 4 Add the x-stage header to the request to specify an environment name. Add other headers to be signed as necessary.

```
r.Header.Add("x-stage", "RELEASE")
```

Step 5 Execute the following function to add the **X-Sdk-Date** and **Authorization** headers for signing:

```
s.Sign(r)
```

Step 6 If the subdomain name allocated by the system is used to access the API of HTTPS requests, ignore the certificate verification. Otherwise, skip this step.

```
client:=&http.Client{
  Transport:&http.Transport{
    TLSClientConfig:&tls.Config{InsecureSkipVerify:true},
  },
}
```

Step 7 Access the API and view the access result.

```
resp, err := http.DefaultClient.Do(r)
body, err := ioutil.ReadAll(resp.Body)
```

----End

1.2.4 Python

Scenarios

To use Python to call an API through App authentication, obtain the Python SDK, create a new project, and then call the API by referring to the API calling example.

This section uses IntelliJ IDEA 2018.3.5 as an example.

Preparing the Environment

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- You have installed Python 2.7 or 3.X. If not, download the Python installation package from the **Python official website** and install it.

  After Python is installed, run the **pip** command to install the **requests** library.

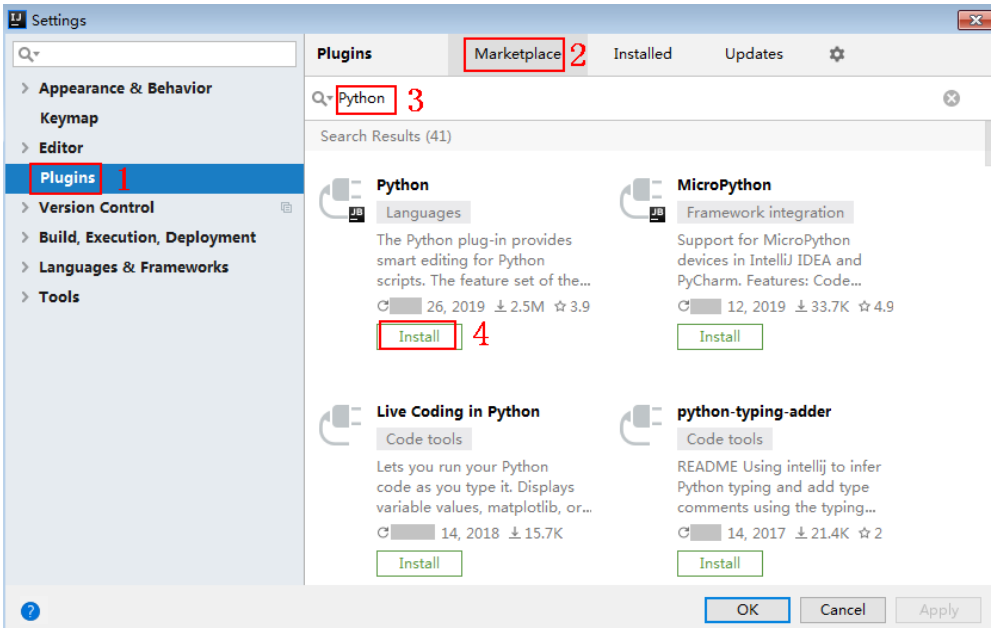
  ```
  pip install requests
  ```

  NOTE

  If a certificate error occurs during the installation, download the **get-pip.py** file to upgrade the pip environment, and try again.

- You have installed IntelliJ IDEA 2018.3.5 or later. If not, download IntelliJ IDEA from the **IntelliJ IDEA official website** and install it.
- You have installed the Python plug-in on IntelliJ IDEA. If not, install the Python plug-in according to **Figure 1-25**.

Figure 1-25 Installing the Python plug-in



Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

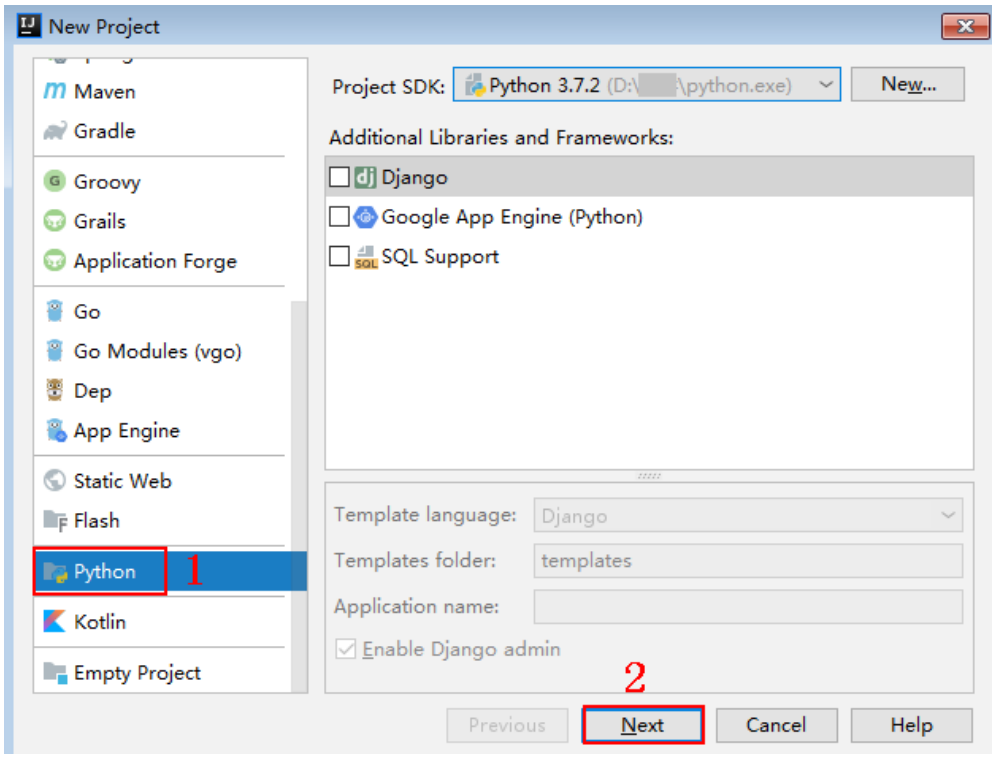
Name	Description
apig_sdk__init__.py	SDK code
apig_sdk\signer.py	
main.py	Sample code
backend_signature.py	Sample code for backend signing
licenses\license-requests	Third-party licenses

Creating a Project

Step 1 Start IDEA and choose **File** > **New** > **Project**.

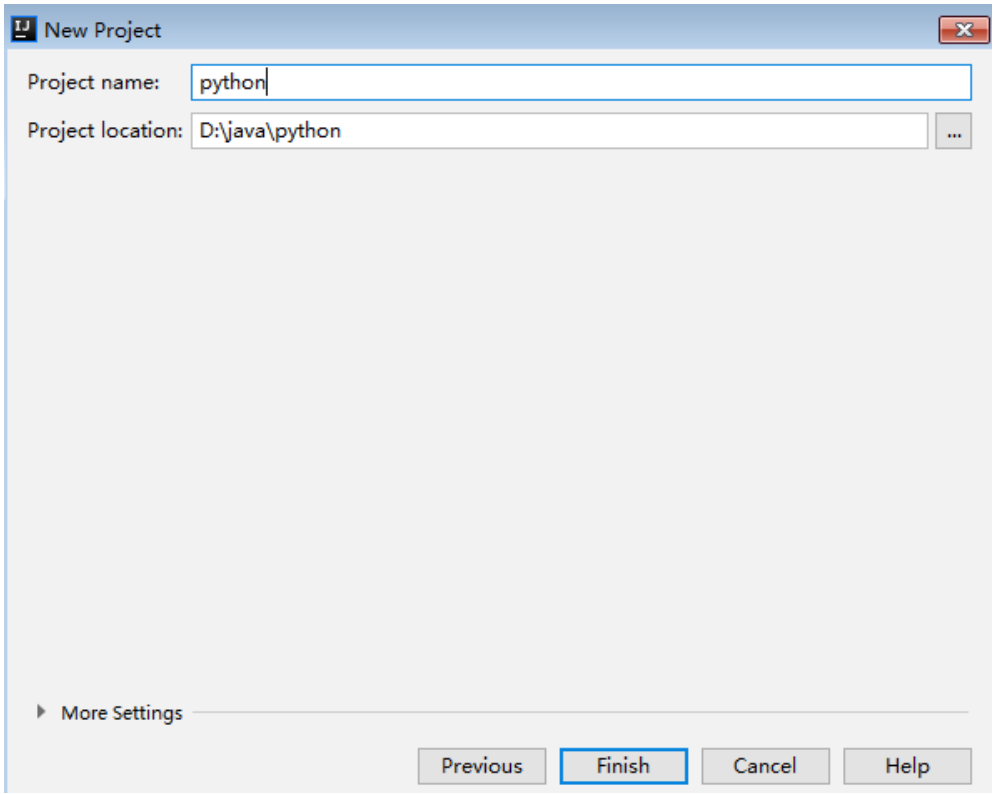
On the displayed **New Project** page, choose **Python** and click **Next**.

Figure 1-26 New Project



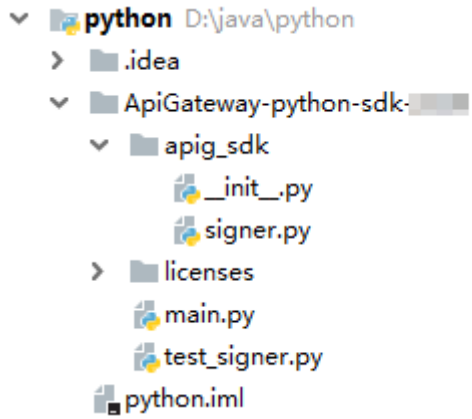
Step 2 Click **Next**. Click **...**, select the directory where the SDK is decompressed, and click **Finish**.

Figure 1-27 Selecting the SDK directory after decompression



Step 3 View the directory structure shown in the following figure.

Figure 1-28 Directory structure of the new project



Modify the parameters in sample code **main.py** as required. For details about the sample code, see **API Calling Example**.

----End

API Calling Example

Step 1 Import **apig_sdk** to the project.

```
from apig_sdk import signer
import requests
```

Step 2 Generate a new signer and enter the key and secret of the integration application.

```
sig = signer.Signer()
sig.Key = "4f5f626b-073f-402f-a1e0-e52171c6100c"
sig.Secret = "******"
```

Step 3 Generate a request, and specify the method, request URI, header, and request body.

```
r = signer.HttpRequest("POST",
                       "https://c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com/app1?a=1",
                       {"x-stage": "RELEASE"},
                       "body")
```

Step 4 Execute the following function to add the X-Sdk-Date and Authorization headers for signing:

NOTE

X-Sdk-Date is a request header parameter required for signing requests.

```
sig.Sign(r)
```

Step 5 Access the API and view the access result.

```
//If the subdomain name allocated by the system is used to access the API of HTTPS requests,
add ,verify=False to the end of data=r.body to ignore the certificate verification.
resp = requests.request(r.method, r.scheme + "://" + r.host + r.uri, headers=r.headers, data=r.body)
print(resp.status_code, resp.reason)
print(resp.content)
```

----End

1.2.5 C#

Scenarios

To use C# to call an API through App authentication, obtain the C# SDK, open the project file in the SDK, and then call the API by referring to the API calling example.

Preparing the Environment

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- You have installed Visual Studio 2019 version 16.8.4 or later. If not, download Visual Studio from the **Visual Studio official website** and install it.

Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

Name	Description
apigateway-signature\Signer.cs	SDK code
apigateway-signature\HttpEncoder.cs	
sdk-request\Program.cs	Sample code for signing requests
backend-signature\	Sample project for backend signing
csharp.sln	Project file
licenses\license-referencesource	Third-party licenses

Opening the Sample Project

Double-click **csharp.sln** in the SDK package to open the project. The project contains the following:

- **apigateway-signature**: Shared library that implements the signature algorithm. It can be used in the .Net Framework and .Net Core projects.
- **backend-signature**: Example of a backend service signature.
- **sdk-request**: Example of invoking the signature algorithm. Modify the parameters as required. For details about the sample code, see **API Calling Example**.

API Calling Example

Step 1 Import the SDK to the project.

```
using APIGATEWAY_SDK;
```

Step 2 Generate a new signer and enter the key and secret of the integration application.

```
Signer signer = new Signer();
signer.Key = "4f5f626b-073f-402f-a1e0-e52171c6100c";
signer.Secret = "******";
```

Step 3 Generate an HttpRequest, and specify the method, request URL, and body.

```
HttpRequest r = new HttpRequest("POST",
                    new Uri("https://c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com/app1?
query=value"));
r.body = "{\"a\":1}";
```

Step 4 Add the x-stage header to the request to specify an environment name. Add other headers to be signed as necessary.

```
r.headers.Add("x-stage", "RELEASE");
```

Step 5 Execute the following function to generate **HttpWebRequest**, and add the **X-Sdk-Date** and **Authorization** headers for signing the request:

```
HttpWebRequest req = signer.Sign(r);
```

Step 6 If the subdomain name allocated by the system is used to access the API of HTTPS requests, ignore the certificate verification. Otherwise, skip this step.

```
System.Net.ServicePointManager.ServerCertificateValidationCallback = new
System.Net.Security.RemoteCertificateValidationCallback(delegate { return true; });
```

Step 7 Access the API and view the access result.

```
var writer = new StreamWriter(req.GetRequestStream());
writer.Write(r.body);
writer.Flush();
HttpWebResponse resp = (HttpWebResponse)req.GetResponse();
var reader = newStreamReader(resp.GetResponseStream());
Console.WriteLine(reader.ReadToEnd());
```

----End

1.2.6 JavaScript

Scenarios

To use JavaScript to call an API through App authentication, obtain the JavaScript SDK, create a new project, and then call the API by referring to the API calling example.

The JavaScript SDK can run in a Node.js or browser environment.

This section uses IntelliJ IDEA 2018.3.5 as an example to describe how to set up a Node.js development environment.

Preparing the Environment

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- The browser version is Chrome 89.0 or later.

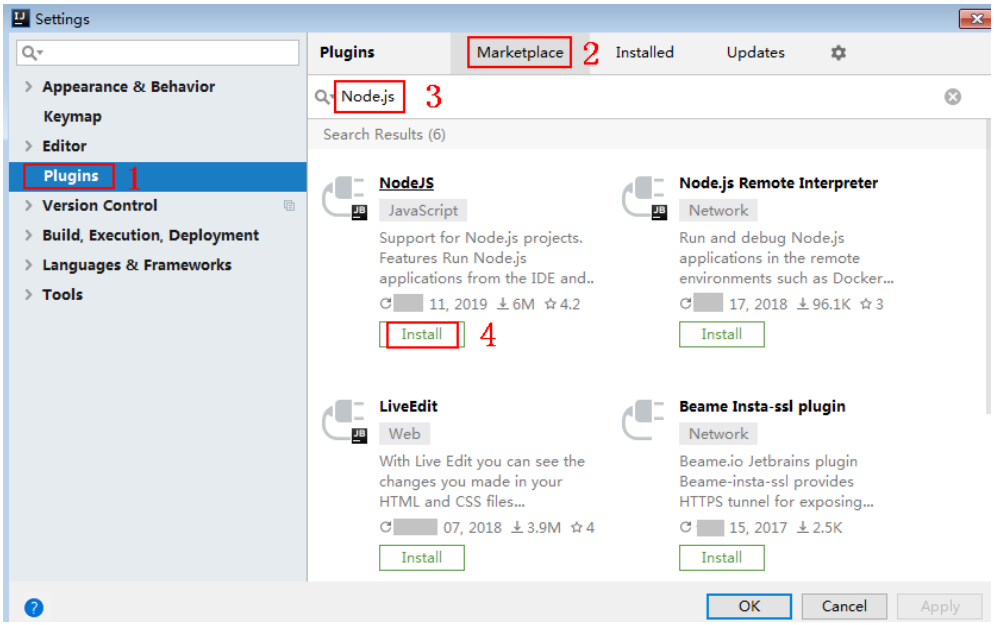
- You have installed Node.js 15.10.0 or later. If not, download the Node.js installation package from the **Node.js official website** and install it.

  After Node.js is installed, run the **npm** command to install the **moment** and **moment-timezone** modules.

  ```
  npm install moment --save
  npm install moment-timezone --save
  ```

- You have installed IntelliJ IDEA 2018.3.5 or later. If not, download IntelliJ IDEA from the **IntelliJ IDEA official website** and install it.
- You have installed the Node.js plug-in on IntelliJ IDEA. If not, install the Python plug-in according to **Figure 1-29**.

Figure 1-29 Installing the Node.js plug-in



Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

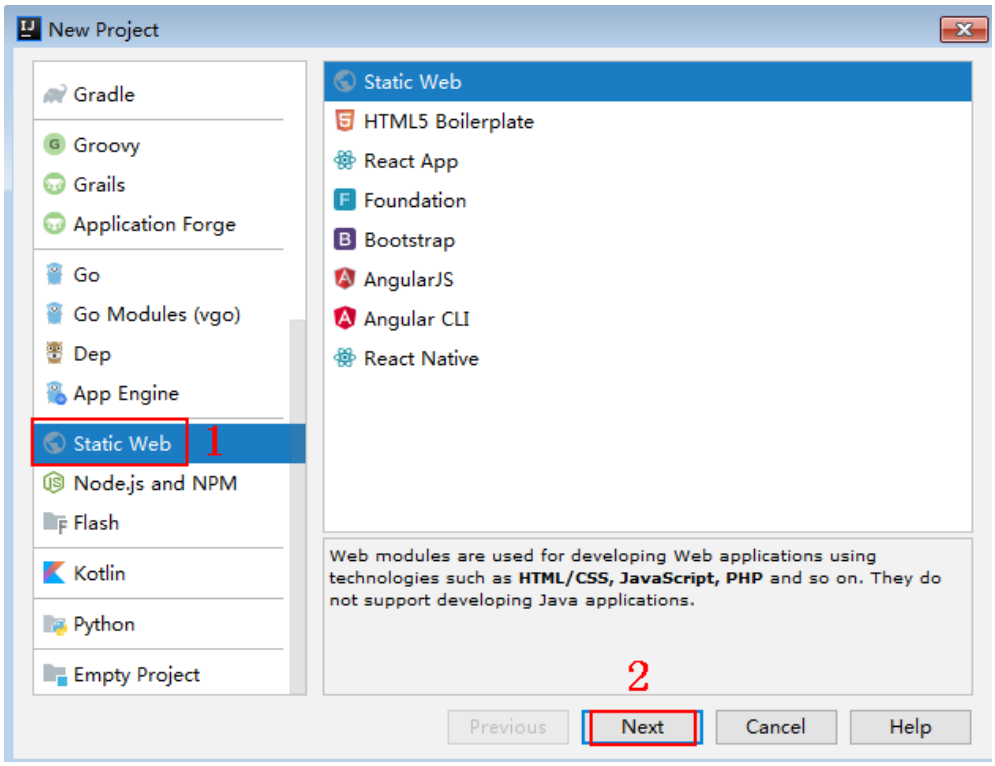
Name	Description
signer.js	SDK code
node_demo.js	Node.js sample code
demo.html	Browser sample code
demo_require.html	Browser sample code (loaded using **require**)
test.js	Test Cases
js\hmac-sha256.js	Dependencies
licenses\license-crypto-js	Third-party licenses
licenses\license-node	

Creating a Project

Step 1 Start IntelliJ IDEA and choose **File** > **New** > **Project**.

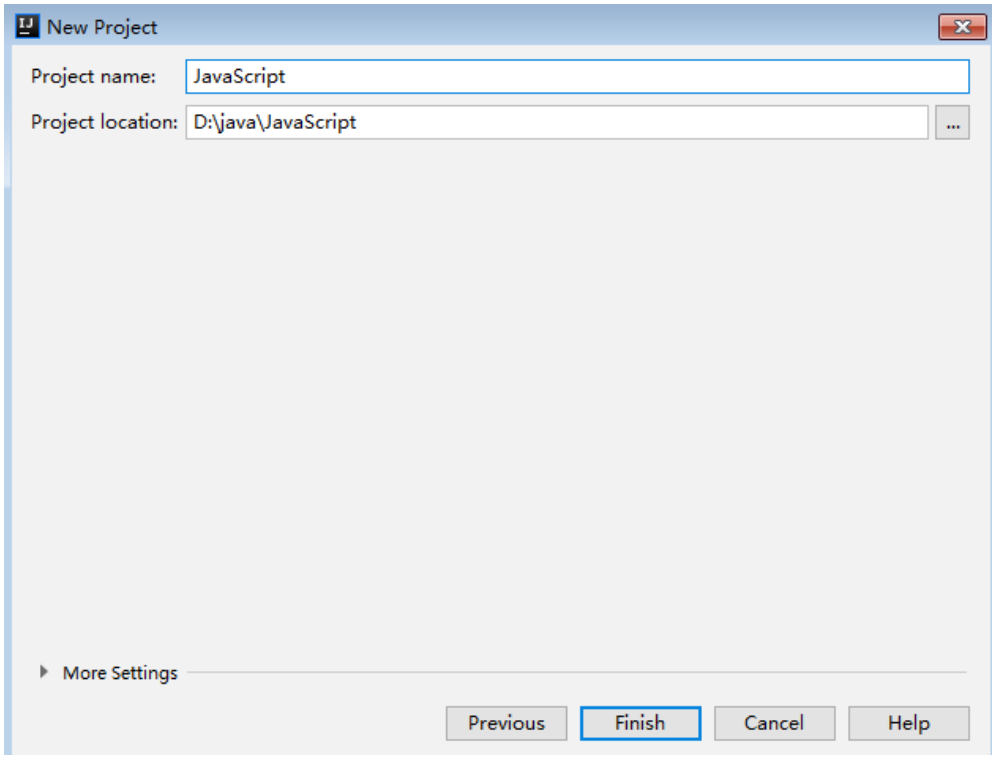
In the **New Project** dialog box, choose **Static Web** and click **Next**.

Figure 1-30 New Project



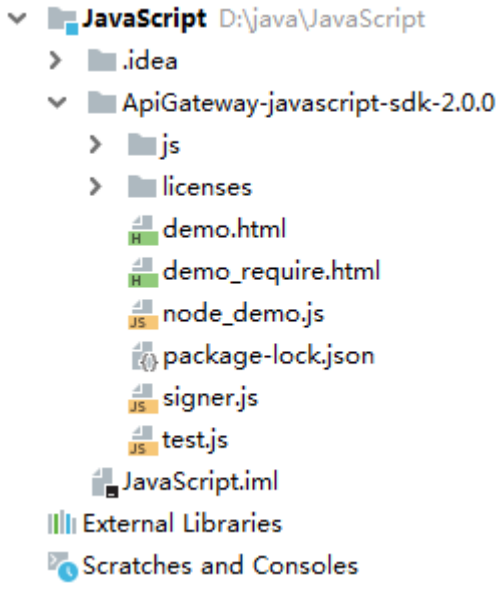
Step 2 Click **...**, select the directory where the SDK is decompressed, and click **Finish**.

Figure 1-31 Selecting the SDK directory after decompression



Step 3 View the directory structure shown in the following figure.

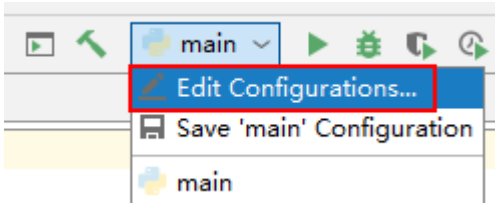
Figure 1-32 Directory structure of the new project



- **node_demo.js**: Sample code in Node.js. Modify the parameters in the sample code as required. For details about the sample code, see **API Calling Example (Node.js)**.
- **demo.html**: Browser sample code. Modify the parameters in the sample code as required. For details about the sample code, see **API Calling Example (Browser)**.

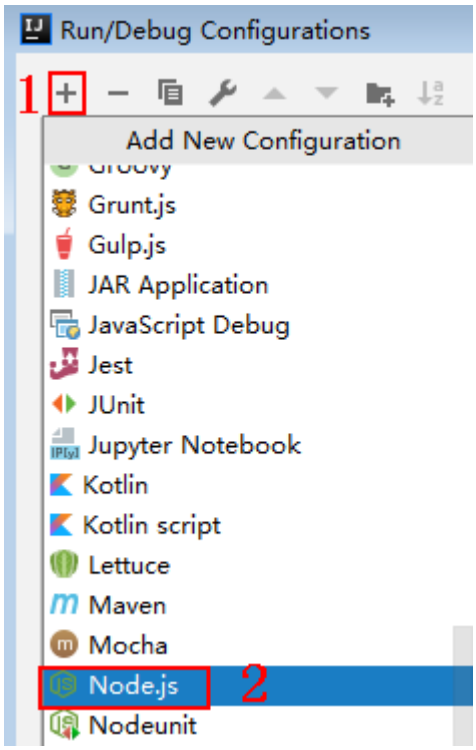
Step 4 Click **Edit Configurations**.

Figure 1-33 Edit Configurations



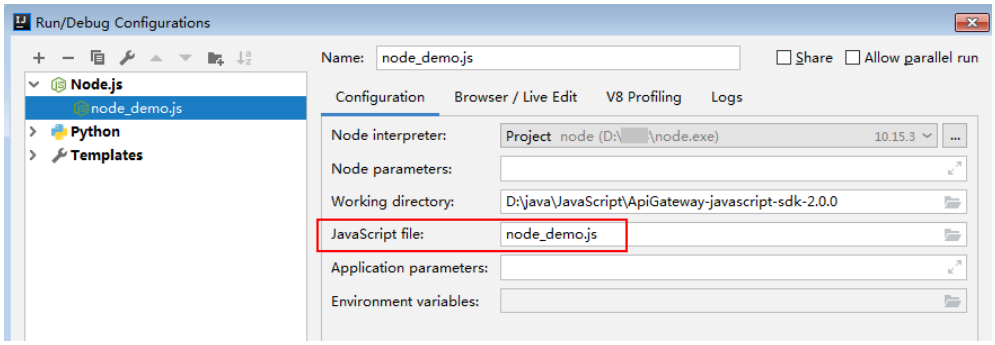
Step 5 Click **+** and select **Node.js**.

Figure 1-34 Selecting Node.js



Step 6 Set **JavaScript file** to **node_demo.js** and click **OK**.

Figure 1-35 Selecting node_demo.js



----End

API Calling Example (Node.js)

Step 1 Import **signer.js** to your project.

```
var signer = require('./signer')
var http = require('http')
```

Step 2 Generate a new signer and enter the AppKey and AppSecret.

```
var sig = new signer.Signer()
sig.Key = "4f5f626b-073f-402f-a1e0-e52171c6100c"
sig.Secret = "******"
```

Step 3 Generate a request, and specify the method, request URI, and request body.

```
var r = new signer.HttpRequest("POST", "c967a237-cd6c-470e-906f-
a8655461897e.apigw.exampleRegion.com/app1?a=1");
r.body = '{"a":1}'
```

Step 4 Add the x-stage header to the request to specify an environment name. Add other headers to be signed as necessary.

```
r.headers = { "x-stage":"RELEASE" }
```

Step 5 Execute the following function to generate HTTP(s) request parameters, and add the X-Sdk-Date and Authorization headers for signing the request:

```
var opts = sig.Sign(r)
```

Step 6 Access the API and view the access result. If you access the API using HTTPS, change **http.request** to **https.request**.

```
var req=http.request(opts, function(res){
        console.log(res.statusCode)
        res.on("data",    function(chunk){
        console.log(chunk.toString())
    })
})
req.on("error",function(err){
    console.log(err.message)
})
req.write(r.body)
req.end()
```

----End

API Calling Example (Browser)

To use a browser to access APIs, you need to register an API that supports the OPTIONS method. For details, see **Creating an API in OPTIONS Mode**. The response header contains Access-Control-Allow-* headers. You can add these headers by enabling CORS when creating an API.

Step 1 Import **signer.js** and dependencies to the HTML page.

```
<script src="js/hmac-sha256.js"></script>
<script src="js/moment.min.js"></script>
<script src="js/moment-timezone-with-data.min.js"></script>
<script src='signer.js'></script>
```

Step 2 Sign the request and access the API.

```
var sig = new signer.Signer()
sig.Key = "4f5f626b-073f-402f-a1e0-e52171c6100c"
sig.Secret = "******"
var r= new signer.HttpRequest()
r.host = "c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com"
r.method = "POST"
r.uri = "/app1"
r.body = '{"a":1}'
```



```
r.query = { "a":"1","b":"2" }
r.headers = { "Content-Type":"application/json" }
var opts = sig.Sign(r)
var scheme = "https"
$.ajax({
    type: opts.method,
    data: req.body,
    processData: false,
    url: scheme + "://" + opts.hostname + opts.path,
    headers: opts.headers,
    success: function (data) {
        $('#status').html('200')
        $('#recv').html(data)
    },
    error: function (resp) {
        if (resp.readyState === 4) {
            $('#status').html(resp.status)
            $('#recv').html(resp.responseText)
        } else {
            $('#status').html(resp.state())
        }
    },
    timeout: 1000
});
```

----End

1.2.7 PHP

Scenarios

To use PHP to call an API through App authentication, obtain the PHP SDK, create a new project, and then call the API by referring to the API calling example.

This section uses IntelliJ IDEA 2018.3.5 as an example.

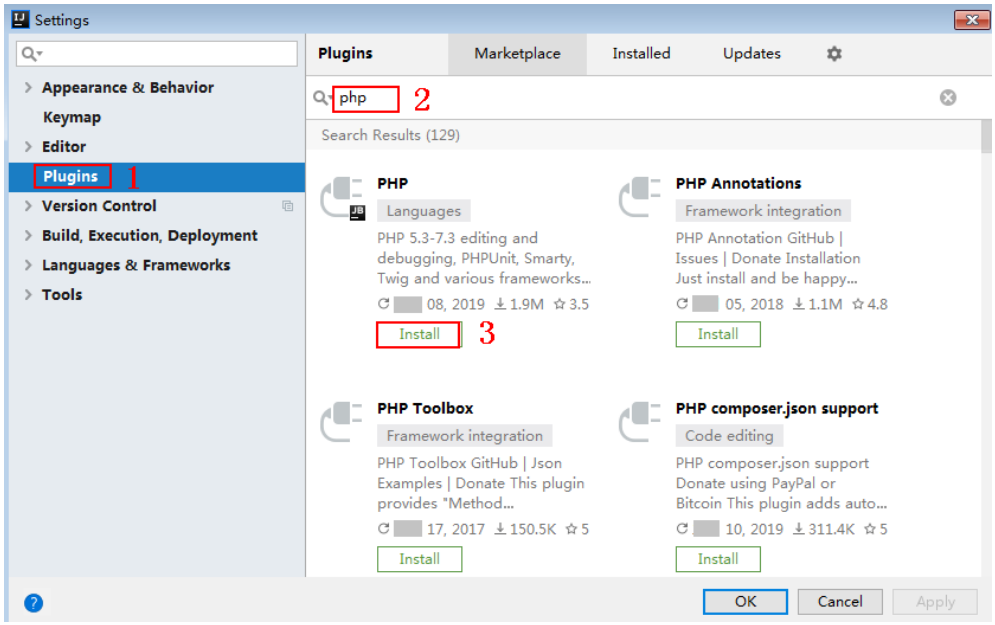
Preparing the Environment

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- You have installed IntelliJ IDEA 2018.3.5 or later. If not, download IntelliJ IDEA from the **IntelliJ IDEA official website** and install it.
- You have installed PHP 8.0.3 or later. If not, download the PHP installation package from the **PHP official website** and install it.
- Copy the **php.ini-production** file from the PHP installation directory to the **C:\windows** directory, rename the file as **php.ini**, and then add the following lines to the file:

  ```
  extension_dir = "PHP installation directory/ext"
  extension=openssl
  extension=curl
  ```

- You have installed the PHP plug-in on IntelliJ IDEA. If not, install the PHP plug-in according to **Figure 1-36**.

Figure 1-36 Installing the PHP plug-in



Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

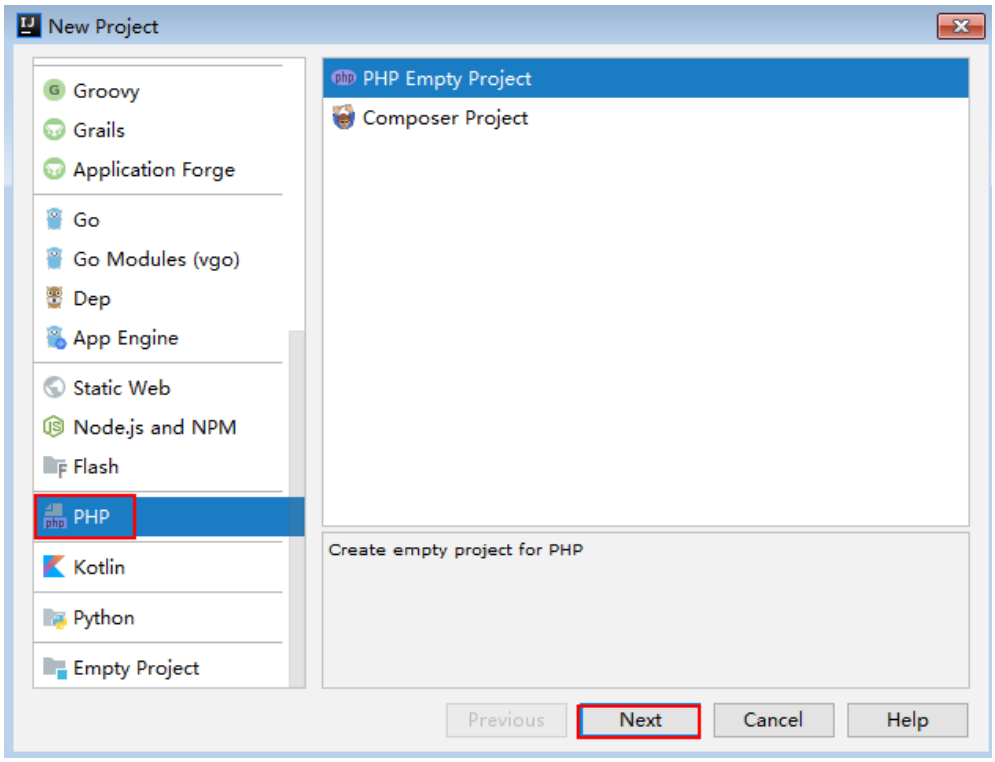
Name	Description
signer.php	SDK code
index.php	Sample code

Creating a Project

Step 1 Start IDEA and choose **File** > **New** > **Project**.

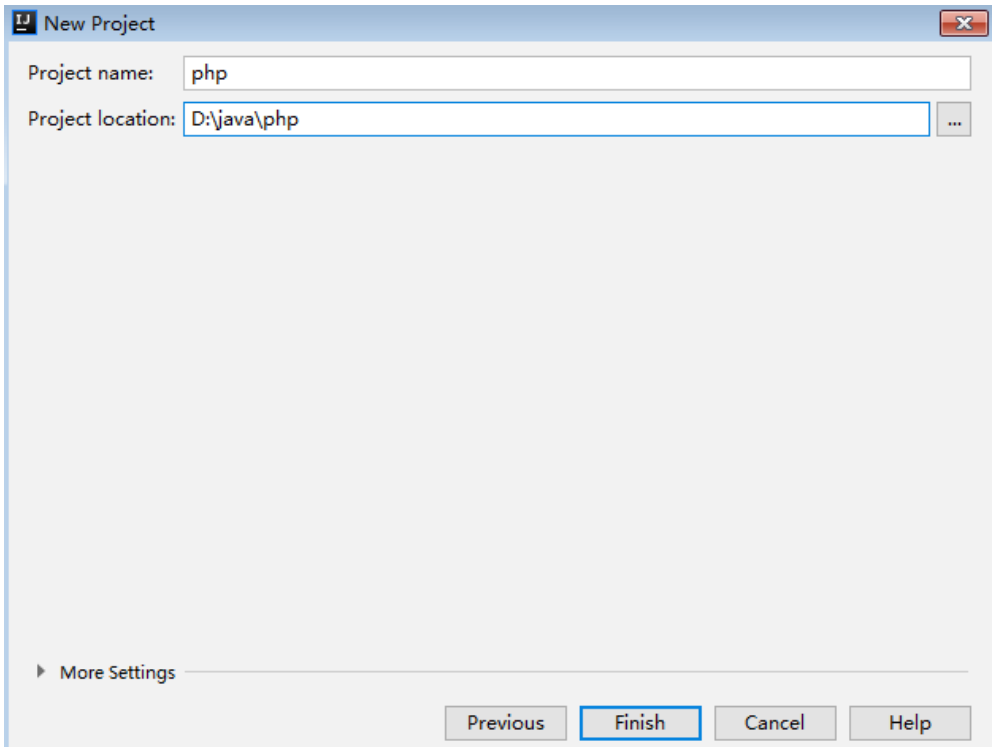
On the displayed **New Project** page, choose **PHP** and click **Next**.

Figure 1-37 New Project



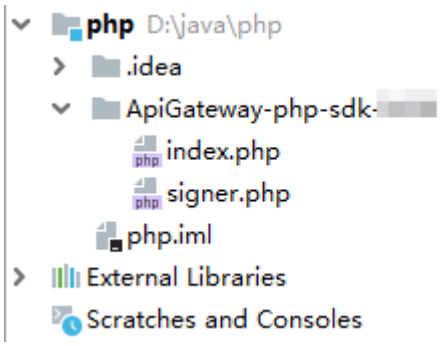
Step 2 Click **...**, select the directory where the SDK is decompressed, and click **Finish**.

Figure 1-38 Selecting the SDK directory after decompression



Step 3 View the directory structure shown in the following figure.

Figure 1-39 Directory structure of the new project



Modify the parameters in sample code **signer.php** as required. For details about the sample code, see **API Calling Example**.

----End

API Calling Example

Step 1 Import the PHP SDK to your code.

```
require 'signer.php';
```

Step 2 Generate a new signer and enter the key and secret of the integration application.

```
$signer = new Signer();
$signer->Key = '4f5f626b-073f-402f-a1e0-e52171c6100c';
$signer->Secret = "******";
```

Step 3 Generate a new request, and specify the method, request URL, and body.

```
$req = new Request('GET', "https://c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com/app1?a=1");
$req->body = '';
```

Step 4 Add the x-stage header to the request to specify an environment name. Add other headers to be signed as necessary.

```
$req->headers = array(
    'x-stage' => 'RELEASE',
);
```

Step 5 Execute the following function to generate a **$curl** context variable.

```
$curl = $signer->Sign($req);
```

Step 6 If the subdomain name allocated by the system is used to access the API of HTTPS requests, ignore the certificate verification. Otherwise, skip this step.

```
curl_setopt($curl, CURLOPT_SSL_VERIFYHOST, 0);
curl_setopt($curl, CURLOPT_SSL_VERIFYPEER, 0);
```

Step 7 Access the API and view the access result.

```
$response = curl_exec($curl);
echo curl_getinfo($curl, CURLINFO_HTTP_CODE);
echo $response;
curl_close($curl);
```

----End

1.2.8 C++

Scenarios

To use C++ to call an API through App authentication, obtain the C++ SDK, and then call the API by referring to the API calling example.

Preparing the Environment

1. You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
2. Install the OpenSSL library.
   ```
   apt-get install libssl-dev
   ```
3. Install the curl library.
   ```
   apt-get install libcurl4-openssl-dev
   ```

Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

Name	Description
hasher.cpp	SDK code
hasher.h	
header.h	
RequestParams.cpp	
RequestParams.h	
signer.cpp	
signer.h	
Makefile	**Makefile** file
main.cpp	Sample code

API Calling Example

Step 1 Add the following references to **main.cpp**:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <curl/curl.h>
#include "signer.h"
```

Step 2 Generate a new signer and enter the AppKey and AppSecret.

```
Signer signer("4f5f626b-073f-402f-a1e0-e52171c6100c", "******");
```


Step 3 Generate a new **RequestParams** request, and specify the method, domain name, request URI, query strings, and request body.

```
 RequestParams* request = new RequestParams("POST", "c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com", "/app1",
        "Action=ListUsers&Version=2010-05-08", "demo");
```

Step 4 Add the x-stage header to the request to specify an environment name. Add other headers to be signed as necessary.

```
request->addHeader("x-stage", "RELEASE");
```

Step 5 Execute the following function to add the generated headers to the request variable.

```
signer.createSignature(request);
```

Step 6 Use the curl library to access the API and view the access result.

```
static size_t
WriteMemoryCallback(void *contents, size_t size, size_t nmemb, void *userp)
{
    size_t realsize = size * nmemb;
    struct MemoryStruct *mem = (struct MemoryStruct *)userp;

    mem->memory = (char*)realloc(mem->memory, mem->size + realsize + 1);
    if (mem->memory == NULL) {
        /* out of memory! */
        printf("not enough memory (realloc returned NULL)\n");
        return 0;
    }

    memcpy(&(mem->memory[mem->size]), contents, realsize);
    mem->size += realsize;
    mem->memory[mem->size] = 0;

    return realsize;
}

//send http request using curl library
int perform_request(RequestParams* request)
{
    CURL *curl;
    CURLcode res;
    struct MemoryStruct resp_header;
    resp_header.memory = (char*)malloc(1);
    resp_header.size = 0;
    struct MemoryStruct resp_body;
    resp_body.memory = (char*)malloc(1);
    resp_body.size = 0;

    curl_global_init(CURL_GLOBAL_ALL);
    curl = curl_easy_init();

    curl_easy_setopt(curl, CURLOPT_CUSTOMREQUEST, request->getMethod().c_str());
    std::string url = "http://" + request->getHost() + request->getUri() + "?" + request->getQueryParams();
    curl_easy_setopt(curl, CURLOPT_URL, url.c_str());
    struct curl_slist *chunk = NULL;
    std::set<Header>::iterator it;
    for (auto header : *request->getHeaders()) {
        std::string headerEntry = header.getKey() + ": " + header.getValue();
        printf("%s\n", headerEntry.c_str());
        chunk = curl_slist_append(chunk, headerEntry.c_str());
    }
    printf("--------------\n");
    curl_easy_setopt(curl, CURLOPT_HTTPHEADER, chunk);
    curl_easy_setopt(curl, CURLOPT_COPYPOSTFIELDS, request->getPayload().c_str());
    curl_easy_setopt(curl, CURLOPT_NOBODY, 0L);
    curl_easy_setopt(curl, CURLOPT_WRITEFUNCTION, WriteMemoryCallback);
    curl_easy_setopt(curl, CURLOPT_HEADERDATA, (void *)&resp_header);
    curl_easy_setopt(curl, CURLOPT_WRITEDATA, (void *)&resp_body);
```



```
    //curl_easy_setopt(curl, CURLOPT_VERBOSE, 1L);
    res = curl_easy_perform(curl);
    if (res != CURLE_OK) {
        fprintf(stderr, "curl_easy_perform() failed: %s\n", curl_easy_strerror(res));
    }
    else {
        long status;
        curl_easy_getinfo(curl, CURLINFO_HTTP_CODE, &status);
        printf("status %d\n", status);
        printf(resp_header.memory);
        printf(resp_body.memory);
    }
    free(resp_header.memory);
    free(resp_body.memory);
    curl_easy_cleanup(curl);

    curl_global_cleanup();

    return 0;
}
```

Step 7 Run the **make** command to obtain a **main** executable file, execute the file, and then view the execution result.

----End

1.2.9 C

Scenarios

To use C to call an API through App authentication, obtain the C SDK, and then call the API by referring to the API calling example.

Preparing the Environment

1. You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
2. Install the OpenSSL library.
   ```
   apt-get install libssl-dev
   ```
3. Install the curl library.
   ```
   apt-get install libcurl4-openssl-dev
   ```

Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

Name	Description
signer_common.c	SDK code
signer_common.h	
signer.c	
signer.h	
Makefile	**Makefile** file

Name	Description
main.c	Sample code

API Calling Example

Step 1 Add the following references to **main.c**:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <curl/curl.h>
#include "signer.h"
```

Step 2 Generate a sig_params_t variable, and enter the AppKey and AppSecret.

```
sig_params_t params;
sig_params_init(&params);
sig_str_t app_key = sig_str("4f5f626b-073f-402f-a1e0-e52171c6100c");
sig_str_t app_secret = sig_str("******");
params.key = app_key;
params.secret = app_secret;
```

Step 3 Specify the method, domain name, request URI, query strings, and request body.

```
sig_str_t host = sig_str("c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com");
sig_str_t method = sig_str("GET");
sig_str_t uri = sig_str("/app1");
sig_str_t query_str = sig_str("a=1&b=2");
sig_str_t payload = sig_str("");
params.host = host;
params.method = method;
params.uri = uri;
params.query_str = query_str;
params.payload = payload;
```

Step 4 Add the x-stage header to the request to specify an environment name. Add other headers to be signed as necessary.

```
sig_headers_add(&params.headers, "x-stage", "RELEASE");
```

Step 5 Execute the following function to add the generated headers to the request variable.

```
sig_sign(&params);
```

Step 6 Use the curl library to access the API and view the access result.

```
static size_t
WriteMemoryCallback(void *contents, size_t size, size_t nmemb, void *userp)
{
    size_t realsize = size * nmemb;
    struct MemoryStruct *mem = (struct MemoryStruct *)userp;

    mem->memory = (char*)realloc(mem->memory, mem->size + realsize + 1);
    if (mem->memory == NULL) {
        /* out of memory! */
        printf("not enough memory (realloc returned NULL)\n");
        return 0;
    }

    memcpy(&(mem->memory[mem->size]), contents, realsize);
    mem->size += realsize;
    mem->memory[mem->size] = 0;

    return realsize;
}
```



```
//send http request using curl library
int perform_request(RequestParams* request)
{
    CURL *curl;
    CURLcode res;
    struct MemoryStruct resp_header;
    resp_header.memory = malloc(1);
    resp_header.size = 0;
    struct MemoryStruct resp_body;
    resp_body.memory = malloc(1);
    resp_body.size = 0;

    curl_global_init(CURL_GLOBAL_ALL);
    curl = curl_easy_init();

    curl_easy_setopt(curl, CURLOPT_CUSTOMREQUEST, params.method.data);
    char url[1024];
    sig_snprintf(url, 1024, "http://%V%V?%V", &params.host, &params.uri, &params.query_str);
    curl_easy_setopt(curl, CURLOPT_URL, url);
    struct curl_slist *chunk = NULL;
    for (int i = 0; i < params.headers.len; i++) {
        char header[1024];
        sig_snprintf(header, 1024, "%V: %V", &params.headers.data[i].name, &params.headers.data[i].value);
        printf("%s\n", header);
        chunk = curl_slist_append(chunk, header);
    }
    printf("-------------\n");
    curl_easy_setopt(curl, CURLOPT_HTTPHEADER, chunk);
    curl_easy_setopt(curl, CURLOPT_POSTFIELDS, params.payload.data);
    curl_easy_setopt(curl, CURLOPT_NOBODY, 0L);
    curl_easy_setopt(curl, CURLOPT_WRITEFUNCTION, WriteMemoryCallback);
    curl_easy_setopt(curl, CURLOPT_HEADERDATA, (void *)&resp_header);
    curl_easy_setopt(curl, CURLOPT_WRITEDATA, (void *)&resp_body);
    //curl_easy_setopt(curl, CURLOPT_VERBOSE, 1L);
    res = curl_easy_perform(curl);
    if (res != CURLE_OK) {
        fprintf(stderr, "curl_easy_perform() failed: %s\n", curl_easy_strerror(res));
    }
    else {
        long status;
        curl_easy_getinfo(curl, CURLINFO_HTTP_CODE, &status);
        printf("status %d\n", status);
        printf(resp_header.memory);
        printf(resp_body.memory);
    }
    free(resp_header.memory);
    free(resp_body.memory);
    curl_easy_cleanup(curl);

    curl_global_cleanup();

    //free signature params
    sig_params_free(&params);
    return 0;
}
```

Step 7 Run the **make** command to obtain a **main** executable file, execute the file, and then view the execution result.

----End

1.2.10 Android

Scenarios

To use Android to call an API through App authentication, obtain the Android SDK, create a new project, and then call the API by referring to the API calling example.

Preparing the Environment

- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- You have installed Android Studio 4.1.2 or later. If not, download Android Studio from the **Android Studio official website** and install it.

Obtaining the SDK

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, and download the SDK. The directory structure after the decompression is as follows:

Name	Description
app\	Android project code
gradle\	Gradle files
build.gradle	Gradle configuration files
gradle.properties	
settings.gradle	
gradlew	Gradle Wrapper scripts
gradlew.bat	

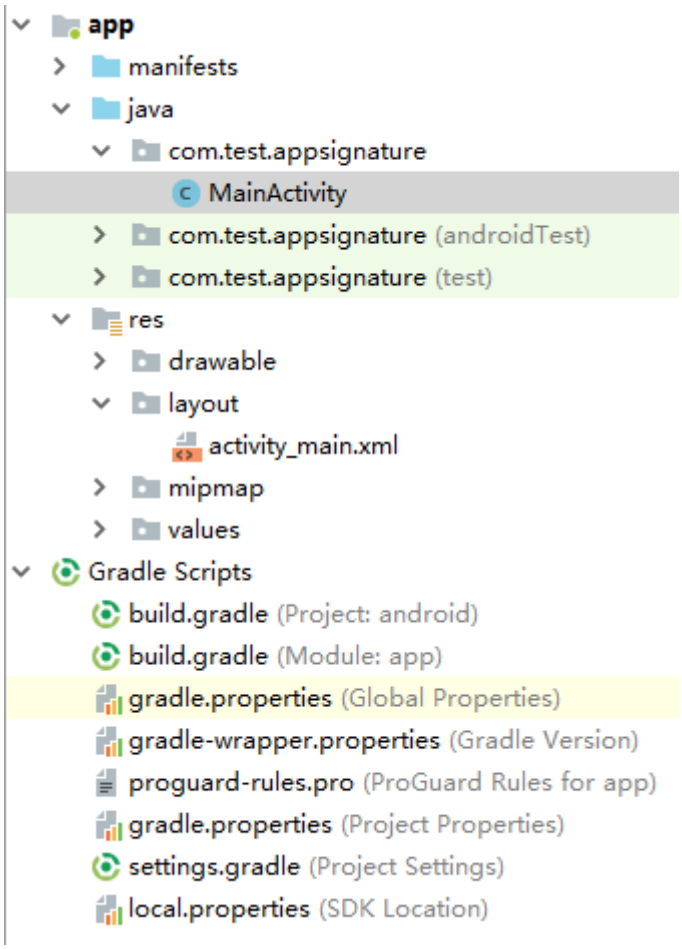
Opening the Sample Project

Step 1 Start Android Studio and choose **File** > **Open**.

Select the directory where the SDK is decompressed.

Step 2 View the directory structure of the project shown in the following figure.

Figure 1-40 Project directory structure



----End

API Calling Example

Step 1 Add required JAR files to the **app/libs** directory of the Android project. The following JAR files must be included:

- java-sdk-core-x.x.x.jar
- joda-time-2.10.jar

Step 2 Add dependencies of the **okhttp** library to the **build.gradle** file.

Add **implementation 'com.squareup.okhttp3:okhttp:3.14.2'** in the **dependencies** field of the **build.gradle** file.

```
dependencies {
    ...
    ...
    implementation 'com.squareup.okhttp3:okhttp:3.14.3'
}
```

Step 3 Create a request, enter an AppKey and AppSecret, and specify the domain name, method, request URI, and body.

```
Request request = new Request();
try {
    request.setKey("4f5f626b-073f-402f-a1e0-e52171c6100c");
    request.setSecrect("******");
```



```
    request.setMethod("POST");
    request.setUrl("https://c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com/app1");
    request.addQueryStringParam("name", "value");
    request.addHeader("Content-Type", "text/plain");
    request.setBody("demo");
} catch (Exception e) {
    e.printStackTrace();
    return;
}
```

Step 4 Sign the request to generate an **okhttp3.Request** object for API access.

```
okhttp3.Request signedRequest = Client.signOkhttp(request);
OkHttpClient client = new OkHttpClient.Builder().build();
Response response = client.newCall(signedRequest).execute();
```

----End

1.2.11 curl

Scenarios

To use the curl command to call an API through App authentication, download the JavaScript SDK to generate the curl command, and copy the command to the CLI to call the API.

Prerequisites

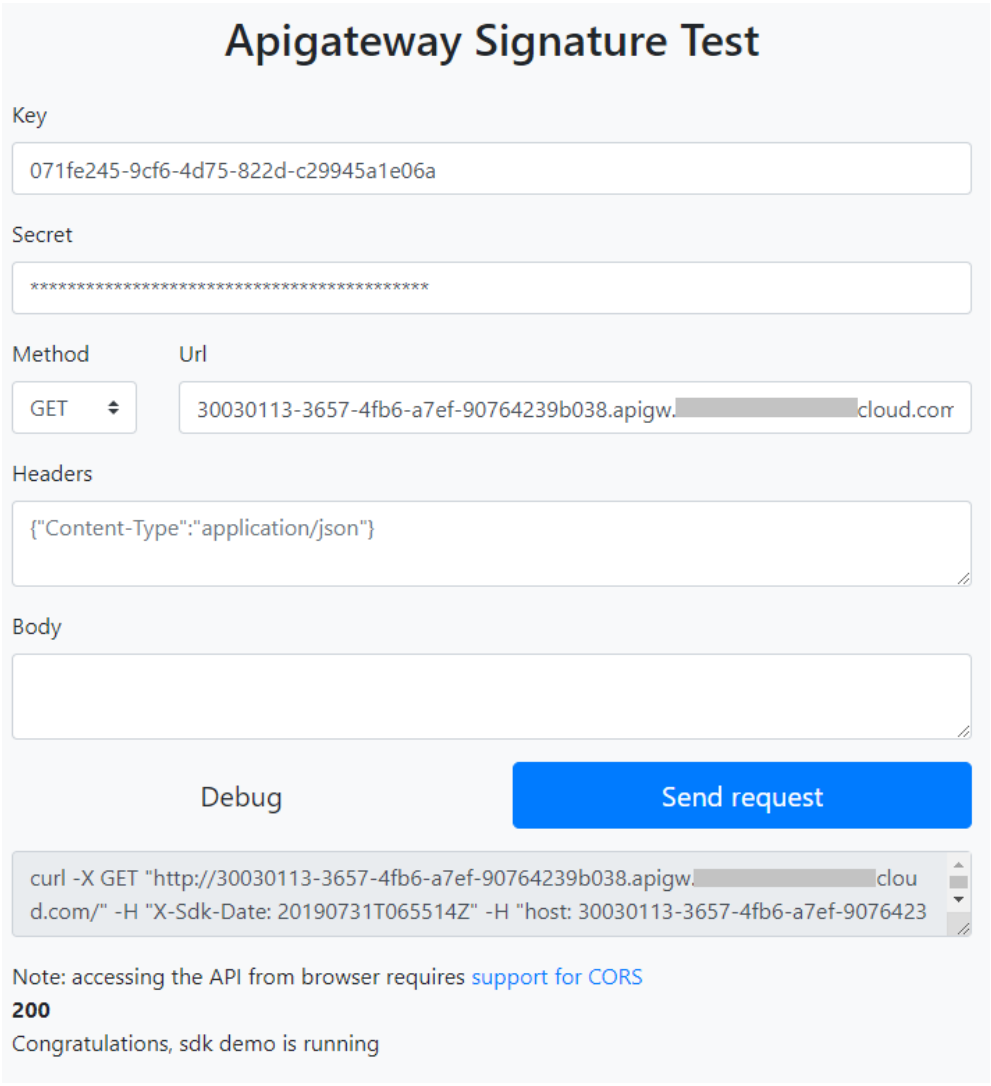
- You have obtained the domain name, request URL, and request method of the API as well as the key and secret (or AppKey and AppSecret of the client) of the integration application. For details, see **Preparations**.
- The browser version is Chrome 89.0 or later.

API Calling Example

Step 1 Use the JavaScript SDK to generate the curl command.

Log in to the ROMA Connect console, choose **API Connect** > **API Calling**, download the SDK, and decompress it.

Open **demo.html** in a browser. The following figure shows the demo page.



Step 2 Specify the key, secret, method, protocol, domain name, and URL. Example:

```
Key=4f5f626b-073f-402f-a1e0-e52171c6100c
Secret=******
Method=POST
Url=https://c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com
```

Step 3 Specify query and header parameters in JSON format, and set the request body.

Step 4 Click **Send request** to generate a **curl** command. Copy the **curl** command to the CLI to access the API.

```
//If the subdomain name allocated by the system is used to access the API of HTTPS requests, add -k to the end of -d to ignore the certificate verification.
$ curl -X POST "https://c967a237-cd6c-470e-906f-a8655461897e.apigw.exampleRegion.com/" -H "X-Sdk-Date: 20180530T115847Z" -H "Authorization: SDK-HMAC-SHA256 Access=071fe245-9cf6-4d75-822d-c29945a1e06a, SignedHeaders=host;x-sdk-date, Signature=9e5314bd156d517******dd3e5765fdde4" -d ""
Congratulations, sdk demo is running
```

NOTE

The **curl** command generated using an SDK does not meet the format requirements of Windows. Please run the **curl** command in Git Bash.

----End

1.2.12 Other Programming Languages

App Authentication Principle

1. Construct a standard request.

   Assemble the request content according to the rules of APIC, ensuring that the client signature is consistent with that in the backend request.
2. Create a to-be-signed string using the standard request and other related information.
3. Calculate a signature using the AK/SK and to-be-signed string.
4. Add the generated signature to an HTTP request as a header or query parameter.
5. After receiving the request, APIC performs **1** to **3** to calculate a signature.
6. The new signature is compared with the signature generated in **3**. If they are consistent, the request is processed; otherwise, the request is rejected.

NOTE

The body of a signing request in app authentication mode cannot exceed 12 MB.

Step 1: Construct a Standard Request

To access an API through app authentication, standardize the request content, and then sign the request. The client must follow the same request specifications as APIC so that each HTTP request can obtain the same signing result from the frontend and backend to complete identity authentication.

The pseudocode of standard HTTP requests is as follows:

```
CanonicalRequest =
    HTTPRequestMethod + '\n' +
    CanonicalURI + '\n' +
    CanonicalQueryString + '\n' +
    CanonicalHeaders + '\n' +
    SignedHeaders + '\n' +
    HexEncode(Hash(RequestPayload))
```

The following example shows how to construct a standard request.

Original request:

```
GET https://30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com/app1?b=2&a=1 HTTP/1.1
Host: 30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com
X-Sdk-Date: 20180330T123600Z
```

1. Specify an HTTP request method (**HTTPRequestMethod**) and end with a carriage return line feed (CRLF).

   Specify GET, PUT, POST, or another request method. Example of a request method:

   ```
   GET
   ```
2. Add a standard URI (**CanonicalURI**) and end with a CRLF.

   Description

   Path of the requested resource, which is the URI code of the absolute path.

   Format

According to RFC 3986, each part of a standard URI except the redundant and relative paths must be URI-encoded. If a URI does not end with a slash (/), add a slash at its end.

Example

For the URI **/app1**, the standard URI code is as follows:

```
GET
/app1/
```

NOTE

During signature calculation, the URI must end with a slash (/). When a request is sent, the URI does not need to end with a slash (/).

3. Add a standard query string (**CanonicalQueryString**) and end with a CRLF.

   Description

   Query parameters. If no query parameters are configured, the query string is an empty string.

   Format

   Standard query strings must meet the following requirements:

   - Perform URI encoding on each parameter and value according to the following rules:
     - Do not perform URI encoding on any non-reserved characters defined in RFC 3986, including A–Z, a–z, 0–9, hyphen (-), underscore (_), period (.), and tilde (~).
     - Use **%XY** to perform percent encoding on all non-reserved characters. **X** and **Y** indicate hexadecimal characters (0–9 and A–F). For example, the space character must be encoded as **%20**, and an extended UTF-8 character must be encoded in the "%XY%ZA%BC" format.
   - Add "*URI-encoded parameter name*=*URI-encoded parameter value*" to each parameter. If no value is specified, use a null string instead. The equal sign (=) is required.

     For example, in the following string that contains two parameters, the value of parameter **parm2** is null.

     ```
     parm1=value1&parm2=
     ```
   - Sort the parameters in alphabetically ascending order. For example, a parameter starting with uppercase letter **F** precedes another parameter starting with lowercase letter **b**.
   - Construct standard query strings from the first parameter after sorting.

   Example

   The following example contains two optional parameters **a** and **b**.

   ```
   GET
   /app1/
   a=1&b=2
   ```

4. Add standard headers (**CanonicalHeaders**) and end with a CRLF.

   Description

   List of standard request headers, including all HTTP message headers in the to-be-signed request. The **X-Sdk-Date** header must be included to verify the signing time, which is in the UTC time format *YYYYMMDDTHHMMSSZ* as

specified in ISO 8601. When publishing an API in a non-RELEASE environment, you need to specify an environment name.

CAUTION

The client must synchronize the local time with the clock server to avoid a large offset in the value of **X-Sdk-Date** in the request header.

In addition to verifying the time format of **X-Sdk-Date**, ROMA Connect also verifies the time difference between the time specified by **X-Sdk-Date** and the actual time when the request is received. If the time difference exceeds 15 minutes, ROMA Connect rejects the request.

Format

CanonicalHeaders consists of multiple message headers, for example, **CanonicalHeadersEntry0 + CanonicalHeadersEntry1 + ...**. Each message header (**CanonicalHeadersEntry**) is in the format of **Lowercase(HeaderName) + ':' + Trimall(HeaderValue) + '\n'**.

NOTE

- **Lowercase**: a function for converting all letters into lowercase letters.
- **Trimall**: a function for deleting the spaces before and after a value.
- The last message header carries a CRLF. Therefore, an empty line appears because the **CanonicalHeaders** field also contains a CRLF according to the specifications.

Example

```
GET
/app1/
a=1&b=2
host:30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com
x-sdk-date:20180330T123600Z
```

NOTICE

Standard message headers must meet the following requirements:

- All letters in a header are converted to lowercase letters, and all spaces before and after the header are deleted.
- All headers are sorted in alphabetically ascending order.

For example, the original headers are as follows:

```
Host:30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com\n
Content-Type: application/json;charset=utf8\n
My-header1:    a   b   c  \n
X-Sdk-Date:20180330T123600Z\n
My-Header2:    "a   b   c"  \n
```

A standard header is as follows:

```
content-type:application/json;charset=utf8\n
host:30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com\n
my-header1:a   b   c\n
my-header2:"a   b   c"\n
x-sdk-date:20180330T123600Z\n
```

5. Add message headers (**SignedHeaders**) for request signing, and end with a CRLF.

Description

List of message headers used for request signing. This step is to determine which headers are used for signing the request and which headers can be ignored during request verification. The **X-Sdk-date** header must be included.

Format

SignedHeaders = Lowercase(HeaderName0) + ';' + Lowercase(HeaderName1) + ";" + ...

Letters in the message headers are converted to lowercase letters. All headers are sorted alphabetically and separated with commas.

Lowercase is a function for converting all letters into lowercase letters.

Example

In the following example, two message headers **host** and **x-sdk-date** are used for signing the request.

```
GET
/app1/
a=1&b=2
host:30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com
x-sdk-date:20180330T123600Z

host;x-sdk-date
```

6. Use a hash function, such as SHA-256, to create a hash value based on the body (**RequestPayload**) of the HTTP or HTTPS request.

   Description

   Request message body. The message body needs two layers of conversion (**HexEncode(Hash(*RequestPayload*))**). **Hash** is a function for generating message digest. Currently, SHA-256 is supported. **HexEncode**: the Base16 encoding function for returning a digest consisting of lowercase letters. For example, **HexEncode("m")** returns **6d** instead of **6D**. Each byte you enter is expressed as two hexadecimal characters.

   NOTE

   If **RequestPayload** is null, the null value is used for calculating a hash value.

   Example

   For a request with the GET method and an empty body, the body (empty string) after hash processing is as follows:

```
GET
/app1/
a=1&b=2
host:30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com
x-sdk-date:20180330T123600Z

host;x-sdk-date
e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855
```

7. Perform hash processing on the standard request in the same way as that on the **RequestPayload**. After hash processing, the standard request is expressed with lowercase hexadecimal strings.

   Algorithm pseudocode:
   Lowercase(HexEncode(Hash.SHA256(CanonicalRequest)))

   Example of the standard request after hash processing:

```
4bd8e1afe76738a332ecff075321623fb90ebb181fe79ec3e23dcb081ef15906
```


Step 2: Create a To-Be-Signed String

After a standard HTTP request is constructed and the request hash value is obtained, create a to-be-signed string by combining them with the signature algorithm and signing time.

```
StringToSign =
    Algorithm + \n +
    RequestDateTime + \n +
    HashedCanonicalRequest
```

Parameters in the pseudocode are described as follows:

- **Algorithm**

  Signature algorithm. For SHA256, the value is **SDK-HMAC-SHA256**.

- **RequestDateTime**

  Request timestamp, which is the same as **X-Sdk-Date** in the request header. The format is *YYYYMMDDTHHMMSSZ*.

- **HashedCanonicalRequest**

  Standard request generated after hash processing.

In this example, the following to-be-signed string is obtained:

```
SDK-HMAC-SHA256
20180330T123600Z
4bd8e1afe76738a332ecff075321623fb90ebb181fe79ec3e23dcb081ef15906
```

Step 3: Calculate the Signature

Use the AppSecret and created character string as the input of the encryption hash function, and convert the calculated binary signature into a hexadecimal expression.

The pseudocode is as follows:

```
signature = HexEncode(HMAC(APP secret, string to sign))
```

HMAC indicates hash calculation, and **HexEncode** indicates hexadecimal conversion. **Table 1-1** describes the parameters in the pseudocode.

Table 1-1 Parameter description

Name	Description
APP secret	Signature key.
string to sign	Character string to be signed.

Assuming that the AppSecret is **12345678-1234-1234-1234-123456781234**, a signature similar to the following will be calculated:

```
cb978df7c06ac242bab1d1b39d697ef7df4806664a6e09d5f5308a6b25043ea2
```


Step 4: Add the Signature to the Request Header

Add the signature to the HTTP Authorization header. The Authorization header is used for identity authentication and not included in the signed headers.

The pseudocode is as follows:

```
Pseudocode for Authorization header creation:
Authorization: algorithm Access=APP key, SignedHeaders=SignedHeaders, Signature=signature
```

There is no comma before the algorithm and **Access**. **SignedHeaders** and **Signature** must be separated with commas.

The signed headers are as follows:

```
Authorization: SDK-HMAC-SHA256 Access=071fe245-9cf6-4d75-822d-c29945a1e06a, SignedHeaders=host;x-sdk-date, Signature=cb978df7c06ac242bab1d1b39d697ef7df4806664a6e09d5f5308a6b25043ea2
```

The signed headers are added to the HTTP request for identity authentication. If the identity authentication is successful, the request is sent to the corresponding backend service for processing.

1.3 Using IAM Authentication to Call APIs

1.3.1 Token Authentication

Scenarios

To use token authentication, you need to obtain a token and add **X-Auth-Token** to the request header when making API calls.

NOTE

You can use either of the following authentication modes to call APIs.

- Token authentication: Requests are authenticated using a token.
- AK/SK authentication: Requests are encrypted using an AK/SK.

Calling an API Through Token Authentication

1. Obtain a token.

   For details, see "Obtaining a User Token" in the *Identity and Access Management (IAM) API Reference*.

   The token is the value of **X-Subject-Token** in the response.

   The following is an example request:

```
POST https://{iam_endpoint}/v3/auth/tokens
Content-Type: application/json

{
    "auth": {
        "identity": {
            "methods": [
                "password"
            ],
            "password": {
                "user": {
                    "name": "username",
```



```
                "password": "********",
                "domain": {
                    "name": "domainname"
                }
            }
        }
    },
    "scope": {
        "project": {
            "id": "xxxxxxxx"
        }
    }
  }
}
```

In the preceding command:

- For details about *{iam_endpoint}*, see **Regions and Endpoints**.
- ***username*** indicates the username.
- ***domainname*** indicates the account name of the user.
- ******** indicates the login password of the user.
- ***xxxxxxxx*** indicates the project ID.

  On the management console, click the username in the upper right corner, choose **My Credentials** from the drop-down list, and then view the project ID.

2. To call a service API, add **X-Auth-Token** to the request header. The value of **X-Auth-Token** is that of the token obtained in 1.

1.3.2 AK/SK Authentication

This section describes how to use AK and SK to sign requests.

NOTE

- AK indicates the access key ID. It is a unique identifier associated with a secret access key and is used in conjunction with a secret access key to sign requests cryptographically.
- SK indicates the secret access key used together with the access key ID to sign requests. AK and SK can be used together to identify a request sender to prevent the request from being modified.

Generating an AK and SK Pair

If an AK/SK pair has already been generated, skip this step. Find the downloaded AK/SK file, which is usually named **credentials.csv**.

As shown in the following figure, the file contains the username, access key ID, and secret access key.

Figure 1-41 Content of the credential.csv file

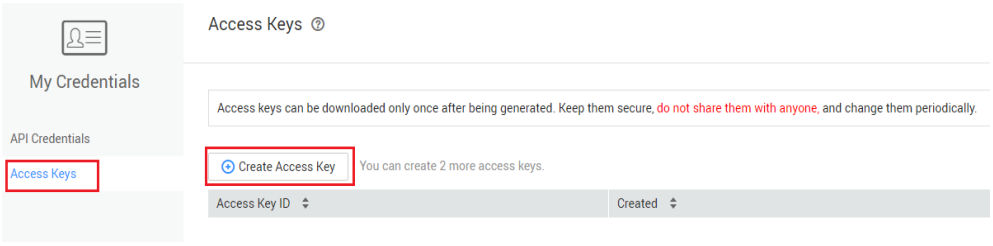
	A	B	C
1	User Name	Access Key Id	Secret Access Key
2	hu[redacted]dg	QTWA[redacted]UT2QVKYUC	MFyfvK41ba2[redacted]npdUKGpownRZlmVmHc

Perform the following procedure to generate an AK/SK pair:

1. Log in to the management console.

2. Click the username in the upper right corner and choose **My Credentials** from the drop-down list.
3. On the **My Credentials** page, choose **Access Keys**.
4. Click **Create Access Key**.
5. Enter the password and verification code, and click **OK** to download the access key. Keep the access key secure.

Figure 1-42 Obtaining an access key



Generating a Signature

Generate a signature in the same way as in **App authentication** mode. Replace AppKey with AK and replace AppSecret with SK to complete the signing and request processing.

CAUTION

The client must synchronize the local time with the clock server to avoid a large offset in the value of **X-Sdk-Date** in the request header.

In addition to verifying the time format of **X-Sdk-Date**, ROMA Connect also verifies the time difference between the time specified by **X-Sdk-Date** and the actual time when the request is received. If the time difference exceeds 15 minutes, ROMA Connect rejects the request.

1.4 Signing Backend Services

1.4.1 Java

Scenarios

To use Java to sign backend requests, obtain the Java SDK, import the project, and verify the backend signature by referring to the example provided in this section.

This section uses IntelliJ IDEA 2018.3.5 as an example.

Prerequisites

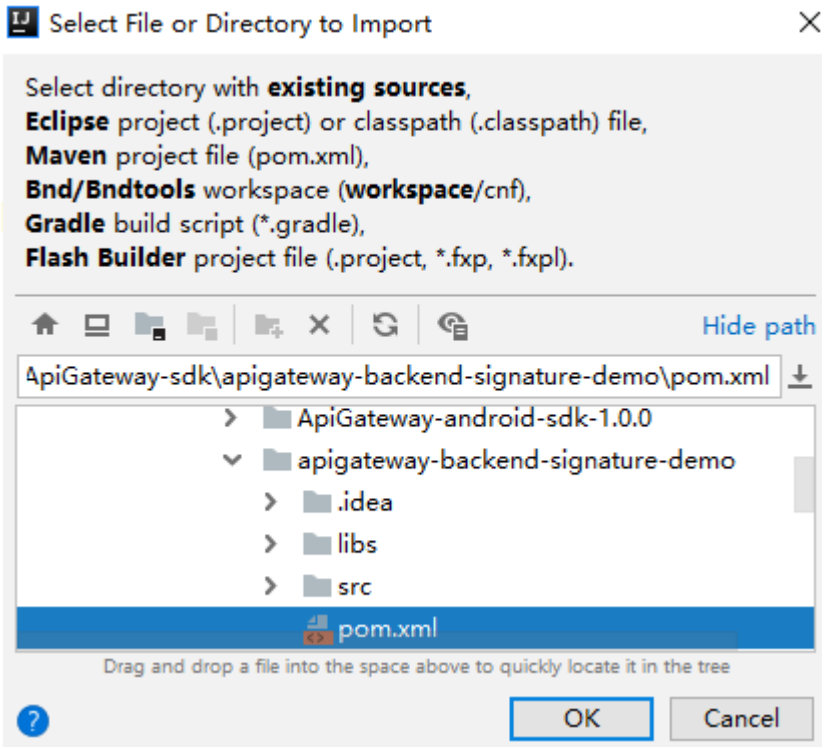
- You have obtained the key and secret of the signature key to be used.
- You have created a signature key on the console and bound it to the API. For more information, see **Configuring Signature Verification for Backend Services**.

- You have obtained the backend signature sample code. To download the signature sample code, log in to the ROMA Connect console, choose **API Connect** > **API Management**, click the **Signature Keys** tab, and click **Download SDK**.
- You have installed IntelliJ IDEA 2018.3.5 or later. If not, download IntelliJ IDEA from the **IntelliJ IDEA official website** and install it.
- You have installed Java Development Kit (JDK) 1.8.111 or a later version. If not, download JDK from the **Oracle official website** and install it.

Importing a Project

Step 1 Open IntelliJ IDEA, choose **File** > **New** > **Project from Existing Sources**, select the **apigateway-backend-signature-demo\pom.xml** file, and click **OK**.

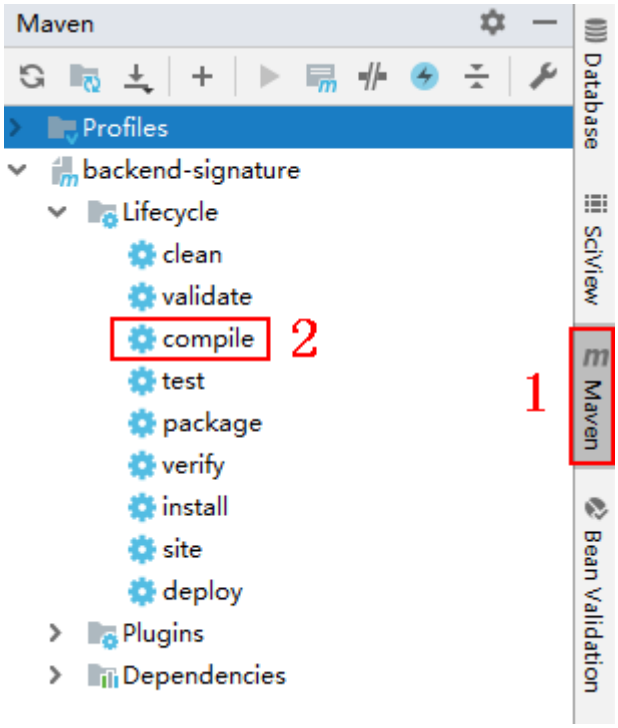
Figure 1-43 Select File or Directory to Import



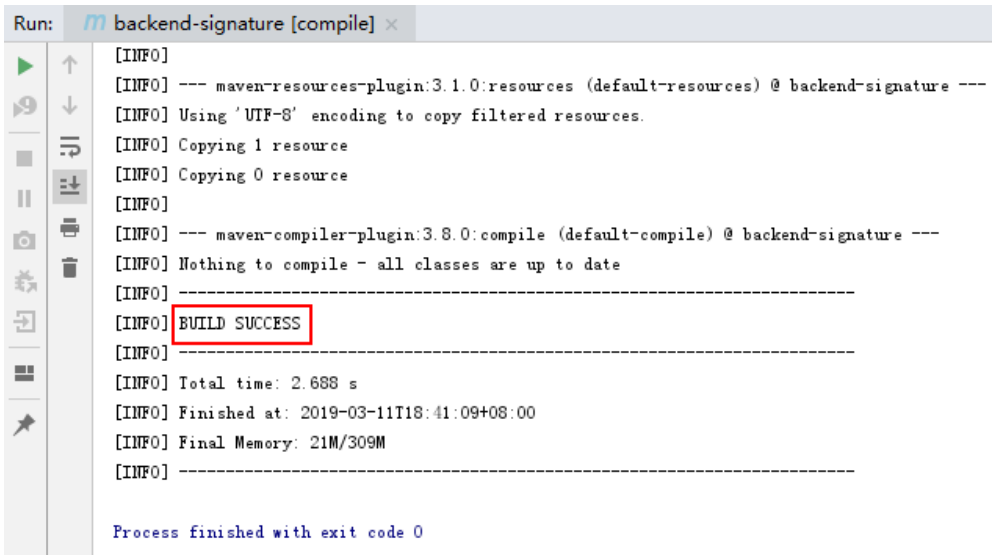
Step 2 Retain the default settings, click **Next** for the following four steps, and then click **Finish**.

Step 3 On the **Maven** tab page on the right, double-click **compile** to compile the file.

Figure 1-44 Compiling the project

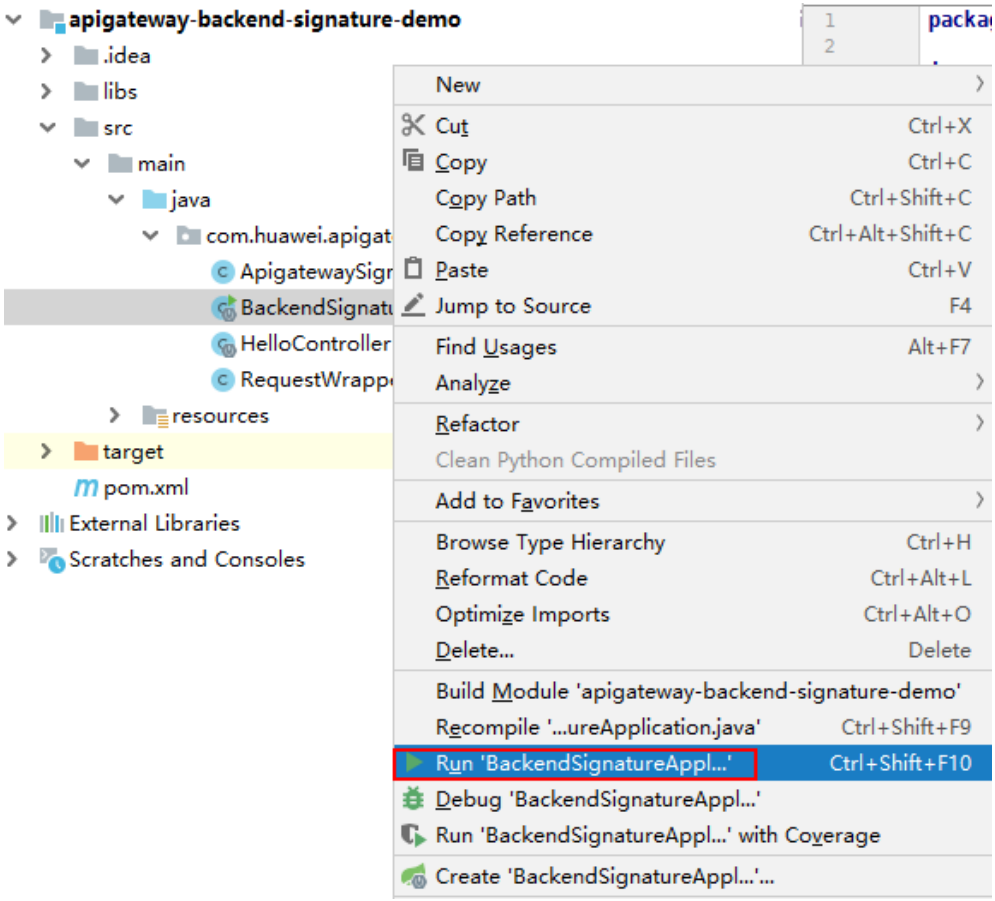


If the message "BUILD SUCCESS" is displayed, the compilation is successful.



Step 4 Right-click **BackendSignatureApplication** and choose **Run**.

Figure 1-45 Running the BackendSignatureApplication service



Modify the parameters in sample code **ApigatewaySignatureFilter.java** as required. For details about the sample code, see **Example of Verifying the Backend Signature of hmac Type**.

----End

Example of Verifying the Backend Signature of hmac Type

NOTE

- This example demonstrates how to write a Spring boot–based server as the backend of an API and implement a filter to verify the signature of requests sent from APIC.
- Signature information is added to requests sent to access the backend of an API after a signature key of hmac type is bound to the API.

Step 1 Compile a controller in the **/hmac** directory.

```
// HelloController.java

@RestController
@EnableAutoConfiguration
public class HelloController {

    @RequestMapping("/hmac")
    private String hmac() {
        return "Hmac authorization success";
    }
}
```


Step 2 Compile a filter that matches all request paths and methods, and put the signature key and secret in a **Map**.

```
public class ApigatewaySignatureFilter implements Filter {
    private static Map<String, String> secrets = new HashMap<>();
    static {
        secrets.put("signature_key1", "signature_secret1");
        secrets.put("signature_key2", "signature_secret2");
    }

    @Override
    public void init(FilterConfig filterConfig) throws ServletException {
    }

    @Override
    public void doFilter(ServletRequest servletRequest, ServletResponse servletResponse, FilterChain chain) {
      //Signature verification code
        ...
    }
}
```

Step 3 To ensure that the body can be read in the filter and controller, wrap the request and send it to the filter and controller. The doFilter function is used for signature verification. For the implementation of wrapper classes, see RequestWrapper.java.

```
RequestWrapper request = new RequestWrapper((HttpServletRequest) servletRequest);
```

Step 4 Use a regular expression to parse the **Authorization** header to obtain **signingKey** and **signedHeaders**.

```
private static final Pattern authorizationPattern = Pattern.compile("SDK-HMAC-SHA256\\s+Access=([^,]+),\
\s?SignedHeaders=([^,]+),\\s?Signature=(\\w+)");

...

String authorization = request.getHeader("Authorization");
if (authorization == null || authorization.length() == 0) {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Authorization not found.");
    return;
}

Matcher m = authorizationPattern.matcher(authorization);
if (!m.find()) {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Authorization format incorrect.");
    return;
}
String signingKey = m.group(1);
String signingSecret = secrets.get(signingKey);
if (signingSecret == null) {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Signing key not found.");
    return;
}
String[] signedHeaders = m.group(2).split(";");
```

For example, for **Authorization** header:

```
SDK-HMAC-SHA256 Access=signature_key1, SignedHeaders=host;x-sdk-date,
Signature=e11adf65a20d1b82c25419b5********8d0ba12fed1ceb13ed00
```

The parsing result is as follows:

```
signingKey=signature_key1
signedHeaders=host;x-sdk-date
```

Step 5 Find **signingSecret** based on **signingKey**. If **signingKey** does not exist, the authentication failed.

```
String signingSecret = secrets.get(signingKey);
if (signingSecret == null) {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Signing key not found.");
```



```
    return;
}
```

Step 6 Create a request, and add the method, URL, query, and signedHeaders headers to the request. Determine whether the body needs to be set.

The body is read if there is no **x-sdk-content-sha256** header with value **UNSIGNED-PAYLOAD**.

```
Request apiRequest = new DefaultRequest();
apiRequest.setHttpMethod(HttpMethodName.valueOf(request.getMethod()));
String url = request.getRequestURL().toString();
String queryString = request.getQueryString();
try {
    apiRequest.setEndpoint((new URL(url)).toURI());
    Map<String, String> parametersmap = new HashMap<>();
    if (null != queryString && !"".equals(queryString)) {
        String[] parameterarray = queryString.split("&");
        for (String p : parameterarray) {
            String[] p_split = p.split("=", 2);
            String key = p_split[0];
            String value = "";
            if (p_split.length >= 2) {
                value = p_split[1];
            }
            parametersmap.put(URLDecoder.decode(key, "UTF-8"), URLDecoder.decode(value, "UTF-8"));
        }
        apiRequest.setParameters(parametersmap); //set query
    }
} catch (URISyntaxException e) {
    e.printStackTrace();
}

boolean needbody = true;
String dateHeader = null;
for (int i = 0; i < signedHeaders.length; i++) {
    String headerValue = request.getHeader(signedHeaders[i]);
    if (headerValue == null || headerValue.length() == 0) {
        ((HttpServletResponse) response).sendError(HttpServletResponse.SC_UNAUTHORIZED, "signed
header" + signedHeaders[i] + " not found.");
    } else {
        apiRequest.addHeader(signedHeaders[i], headerValue);//set header
        if (signedHeaders[i].toLowerCase().equals("x-sdk-content-sha256") &&
headerValue.equals("UNSIGNED-PAYLOAD")) {
            needbody = false;
        }
        if (signedHeaders[i].toLowerCase().equals("x-sdk-date")) {
            dateHeader = headerValue;
        }
    }
}

if (needbody) {
        apiRequest.setContent(new ByteArrayInputStream(request.getBody()));    //set body
}
```

Step 7 Check whether the signature has expired. Obtain the time from the **X-Sdk-Date** header, and check whether the difference between this time and the server time is within 15 minutes. If **signedHeaders** does not contain **X-Sdk-Date**, the authentication failed.

```
private static final DateTimeFormatter timeFormatter =
DateTimeFormat.forPattern("yyyyMMdd'T'HHmmss'Z'").withZoneUTC();

...

if (dateHeader == null) {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Header x-sdk-date not found.");
    return;
}
```



```
long date = timeFormatter.parseMillis(dateHeader);
long duration = Math.abs(DateTime.now().getMillis() - date);
if (duration > 15 * 60 * 1000) {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Signature expired.");
    return;
}
```

Step 8 Add the **Authorization** header to the request, and invoke the **verify** method to verify the request signature. If the verification is successful, the next filter is executed. Otherwise, the authentication failed.

```
DefaultSigner signer = (DefaultSigner) SignerFactory.getSigner();
boolean verify = signer.verify(apiRequest, new BasicCredentials(signingKey, signingSecret));
if (verify) {
    chain.doFilter(request, response);
} else {
    response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "verify authroization failed.");
}
```

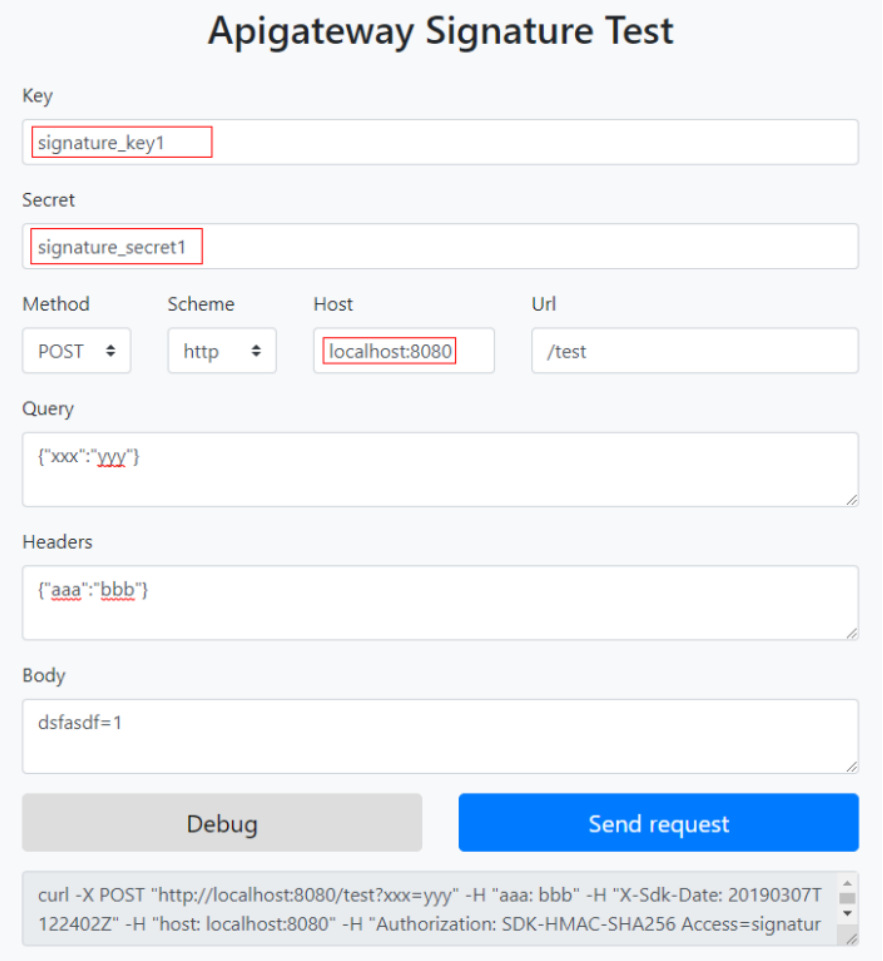
Step 9 Register the mapping between filters and paths.

```
@Configuration
public class FilterConfig {
    @Bean
    public FilterRegistrationBean registApigatewaySignatureFilter() {
        FilterRegistrationBean registration = new FilterRegistrationBean();
        registration.setFilter(new ApigatewaySignatureFilter());
        registration.addUrlPatterns("/hmac");
        registration.setName("ApigatewaySignatureFilter");
        return registration;
    }
}
```

Step 10 Run the server to verify the code. The following example uses the HTML signature tool in the JavaScript SDK to generate a signature.

Set the parameters according to the following figure, and click **Send request**. Copy the generated curl command, execute it in the CLI, and check whether the server returns **Hello World!**

If an incorrect key or secret is used, the server returns **401**, which means authentication failure.



----End

Example of Verifying the Backend Signature of basic Type

NOTE

- This example demonstrates how to write a Spring boot–based server as the backend of an API and implement a filter to verify the signature of requests sent from APIC.
- Basic authentication information is added to requests sent to the backend of an API after a basic signature key is bound to an API. The username for basic authentication is the key of the signature key, and the password is the secret of the signature key.

Step 1 Compile a controller in the **/basic** directory.

```
// HelloController.java

@RestController
@EnableAutoConfiguration
public class HelloController {

    @RequestMapping("/basic")
    private String basic() {
        return "Basic authorization success";
    }
}
```

Step 2 Compile a filter. According to the basic authentication rule, the Authorization header is in the format of "Basic "+base64encode(username+":"+password). The following is the verification code compiled according to the rule:


```
// BasicAuthFilter.java
public class BasicAuthFilter implements Filter {
    private static final String CREDENTIALS_PREFIX = "Basic ";
    private static Map<String, String> secrets = new HashMap<>();

    static {
        secrets.put("signature_key1", "signature_secret1");
        secrets.put("signature_key2", "signature_secret2");
    }

    @Override
    public void doFilter(ServletRequest servletRequest, ServletResponse servletResponse, FilterChain chain) {
        HttpServletRequest request = (HttpServletRequest) servletRequest;
        HttpServletResponse response = (HttpServletResponse) servletResponse;
        try {
            String credentials = request.getHeader("Authorization");
            if (credentials == null || credentials.length() == 0) {
                response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Authorization not found.");
                return;
            }

            if (!credentials.startsWith(CREDENTIALS_PREFIX)) {
                response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Authorization format incorrect.");
                return;
            }
            String authInfo = credentials.substring(CREDENTIALS_PREFIX.length());
            String decoded;
            try {
                decoded = new String(Base64.getDecoder().decode(authInfo));
            } catch (IllegalArgumentException e) {
                response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Authorization format incorrect.");
                return;
            }
            String[] spl = decoded.split(":", 2);
            if (spl.length < 2) {
                response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Authorization format incorrect.");
                return;
            }
            String signingSecret = secrets.get(spl[0]);
            if (signingSecret == null) {
                response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Username not found.");
                return;
            }
            if (signingSecret.equals(spl[1])) {
                chain.doFilter(request, response);
            } else {
                response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Incorrect username or password");
            }
        } catch (Exception e) {
            e.printStackTrace();
            try {
                response.sendError(HttpServletResponse.SC_INTERNAL_SERVER_ERROR);
            } catch (IOException e1) {
            }
        }
    }
}
```

Step 3 Register the mapping between filters and paths.

```
@Configuration
public class FilterConfig {
    @Bean
    public FilterRegistrationBean registBasicAuthFilter() {
        FilterRegistrationBean registration = new FilterRegistrationBean();
        registration.setFilter(new BasicAuthFilter());
        registration.addUrlPatterns("/basic");
        registration.setName("BasicAuthFilter");
        return registration;
```



```
    }
}
```

Step 4 Run the server to verify the code. Generate the Authorization header field of the basic authentication based on the username and password and send the header field to the request interface. If an incorrect username or password is used, the server returns **401**, which means authentication failure.

----End

1.4.2 Python

Scenarios

To use Python to sign backend requests, obtain the Python SDK, import the project, and verify the backend signature by referring to the example provided in this section.

This section uses IntelliJ IDEA 2018.3.5 as an example.

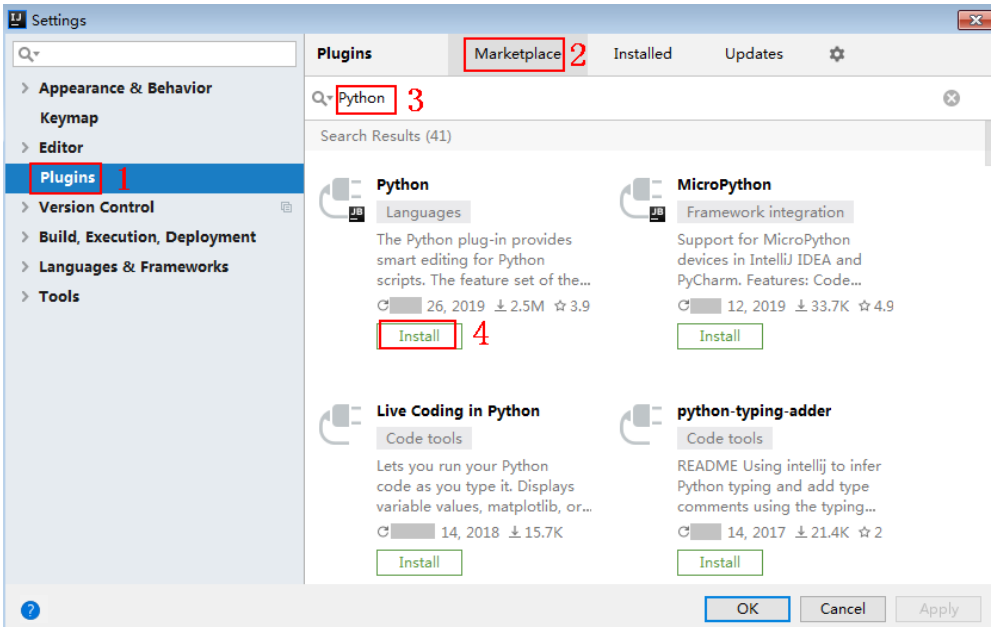
NOTE

The Python SDK supports only backend service signatures of the hmac type.

Preparing the Environment

- You have obtained the key and secret of the signature key to be used.
- A signature key has been created on the console and bound to an API. For details, see **Configuring Signature Verification for Backend Services**.
- You have obtained the backend signature SDK. To download the Python SDK, log in to the ROMA Connect console and choose **API Connect** > **API Calling**.
- You have installed Python 2.7 or 3.X. If not, download the Python installation package from the **Python official website** and install it.
- You have installed IntelliJ IDEA 2018.3.5 or later. If not, download IntelliJ IDEA from the **IntelliJ IDEA official website** and install it.
- You have installed the Python plug-in on IntelliJ IDEA. If not, install the Python plug-in according to **Figure 1-46**.

Figure 1-46 Installing the Python plug-in

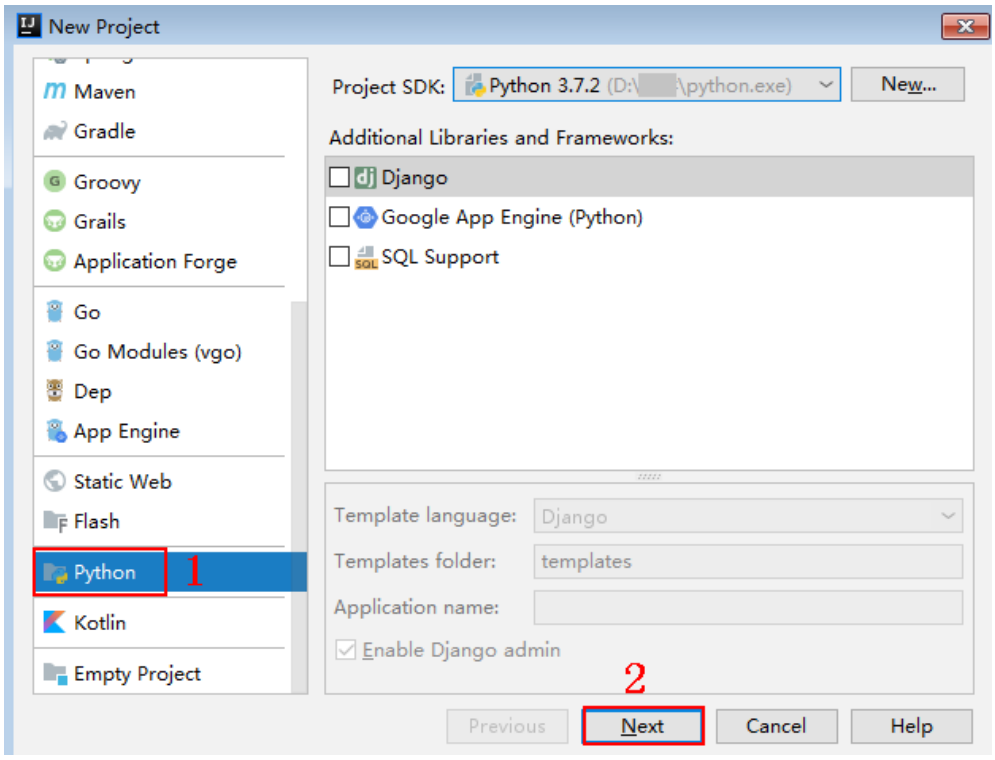


Importing a Project

Step 1 Start IntelliJ IDEA and choose **File** > **New** > **Project**.

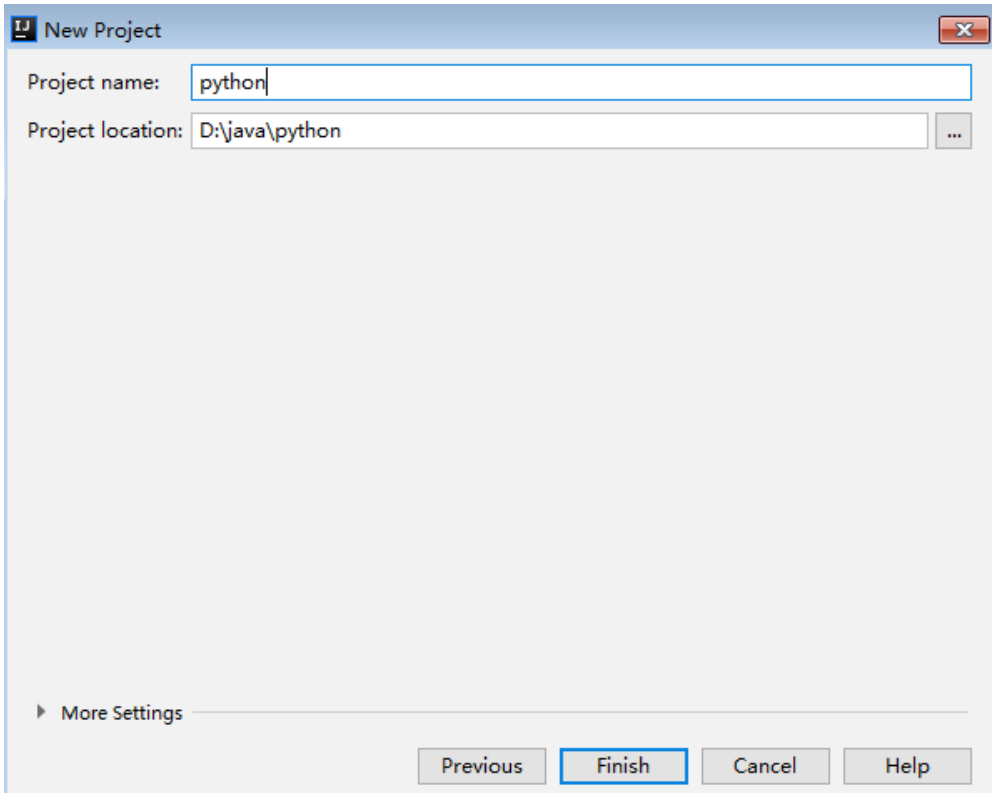
On the displayed **New Project** page, choose **Python** and click **Next**.

Figure 1-47 New Project



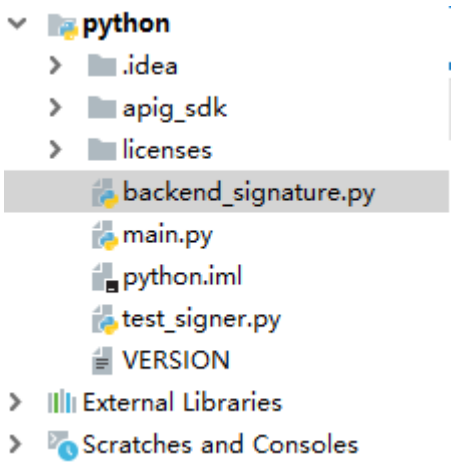
Step 2 Click **Next**. Click **...**, select the directory where the SDK is decompressed, and click **Finish**.

Figure 1-48 Selecting the SDK directory after decompression



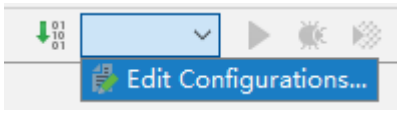
Step 3 View the directory structure of the project.

Figure 1-49 Directory structure



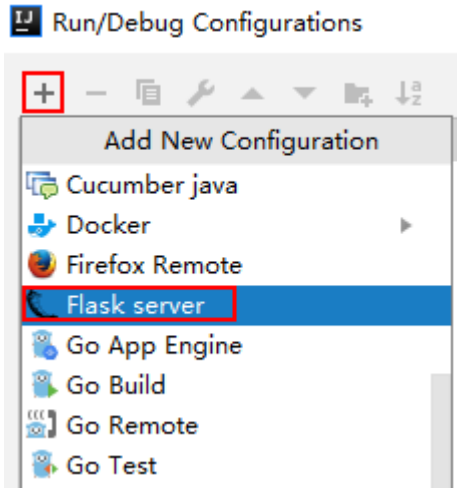
Step 4 Click **Edit Configurations**.

Figure 1-50 Edit Configurations

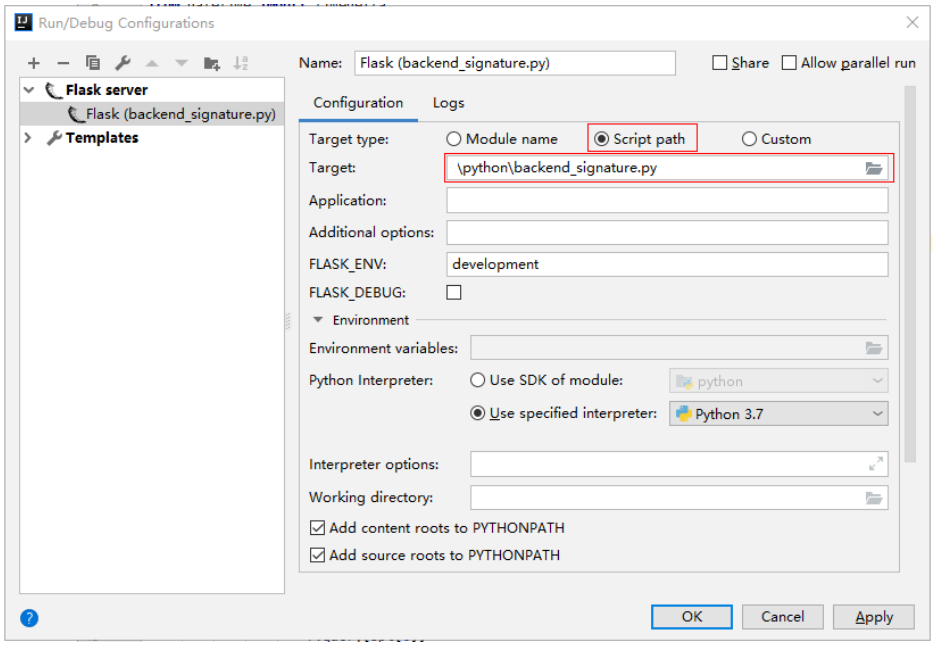


Step 5 Click **+** and choose **Flask server**.

Figure 1-51 Choosing Flask server



Step 6 Set **Target Type** to **Script path**, select **backend_signature.py** from the **Target** drop-down list box, and click **OK**.



----End

Backend Signature Verification Example

NOTE

- This example demonstrates how to write a Flask-based server as the backend of an API and implement a wrapper to verify the signature of requests sent from APIC.
- Signature information is added to requests sent to access the backend of an API only after a signature key is bound to the API.

Step 1 Compile an interface that returns **Hello World!** Configure the GET, POST, PUT, and DELETE methods and the **requires_apigateway_signature** wrapper.

```
app = Flask(__name__)
```



```
@app.route("/<id>", methods=['GET', 'POST', 'PUT', 'DELETE'])
@requires_apigateway_signature()
def hello(id):
    return "Hello World!"
```

Step 2 Implement **requires_apigateway_signature** by putting the signature key and secret in a **dict**.

```
def requires_apigateway_signature():
    def wrapper(f):

        secrets = {
            "signature_key1": "signature_secret1",
            "signature_key2": "signature_secret2",
        }
        authorizationPattern = re.compile(
            r'SDK-HMAC-SHA256\s+Access=([^,]+),\s?SignedHeaders=([^,]+),\s?Signature=(\w+)')
        BasicDateFormat = "%Y%m%dT%H%M%SZ"

        @wraps(f)
        def wrapped(*args, **kwargs):
            //Signature verification code
            ...

            return f(*args, **kwargs)
        return wrapped
    return wrapper
```

Step 3 Use a regular expression to parse the **Authorization** header. The key and signedHeaders are obtained. The wrapped function is used for signature verification.

```
if "authorization" not in request.headers:
    return 'Authorization not found.', 401
authorization = request.headers['authorization']
m = authorizationPattern.match(authorization)
if m is None:
    return 'Authorization format incorrect.', 401
signingKey = m.group(1)
signedHeaders = m.group(2).split(";")
```

For example, for **Authorization** header:

```
SDK-HMAC-SHA256 Access=signature_key1, SignedHeaders=host;x-sdk-date,
Signature=e11adf65a20d1b82c25419b5********8d0ba12fed1ceb13ed00
```

The parsing result is as follows:

```
signingKey=signature_key1
signedHeaders=host;x-sdk-date
```

Step 4 Find **secret** based on **key**. If **key** does not exist, the authentication failed.

```
if signingKey not in secrets:
    return 'Signing key not found.', 401
signingSecret = secrets[signingKey]
```

Step 5 Create an HttpRequest, and add the method, URL, query, and signedHeaders headers to the request. Determine whether the body needs to be set.

The body is read if there is no **x-sdk-content-sha256** header with value **UNSIGNED-PAYLOAD**.

```
r = signer.HttpRequest()
r.method = request.method
r.uri = request.path
r.query = {}
for k in request.query_string.decode('utf-8').split('&'):
    spl = k.split("=", 1)
    if len(spl) < 2:
```



```
        r.query[spl[0]] = ""
    else:
        r.query[spl[0]] = spl[1]
r.headers = {}
needbody = True
dateHeader = None
for k in signedHeaders:
    if k not in request.headers:
        return 'Signed header ' + k + ' not found', 401
    v = request.headers[k]
    if k.lower() == 'x-sdk-content-sha256' and v == 'UNSIGNED-PAYLOAD':
        needbody = False
    if k.lower() == 'x-sdk-date':
        dateHeader = v
    r.headers[k] = v
if needbody:
    r.body = request.get_data()
```

Step 6 Check whether the signature has expired. Obtain the time from the **X-Sdk-Date** header, and check whether the difference between this time and the server time is within 15 minutes. If **signedHeaders** does not contain **X-Sdk-Date**, the authentication failed.

```
if dateHeader is None:
    return 'Header x-sdk-date not found.', 401
t = datetime.strptime(dateHeader, BasicDateFormat)
if abs(t - datetime.utcnow()) > timedelta(minutes=15):
    return 'Signature expired.', 401
```

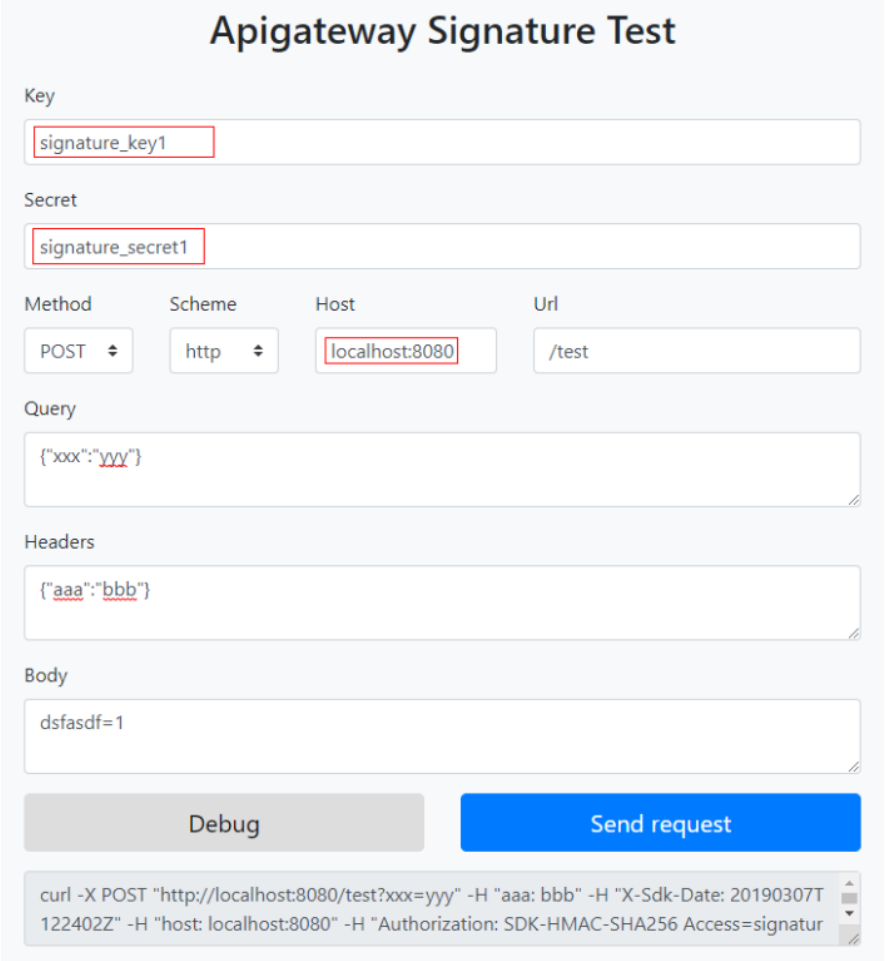
Step 7 Invoke the **verify** method to verify the signature of the request, and check whether the verification is successful.

```
sig = signer.Signer()
sig.Key = signingKey
sig.Secret = signingSecret
if not sig.Verify(r, m.group(3)):
    return 'Verify authroization failed.', 401
```

Step 8 Run the server to verify the code. The following example uses the HTML signature tool in the JavaScript SDK to generate a signature.

Set the parameters according to the following figure, and click **Send request**. Copy the generated curl command, execute it in the CLI, and check whether the server returns **200**.

If an incorrect key or secret is used, the server returns **401**, which means authentication failure.



----End

1.4.3 C#

Scenarios

To use C# to sign backend requests, obtain the C# SDK, import the project, and verify the backend signature by referring to the example provided in this section.

NOTE

The C# SDK supports only backend service signatures of the hmac type.

Preparing the Environment

- You have obtained the key and secret of the signature key to be used.
- A signature key has been created on the console and bound to an API. For details, see **Configuring Signature Verification for Backend Services**.
- You have obtained the backend signature SDK. To download the C# SDK, log in to the ROMA Connect console and choose **API Connect** > **API Calling**.
- You have installed Visual Studio 2019 version 16.8.4 or later. If not, download Visual Studio from the **Visual Studio official website** and install it.

Opening the Sample Project

Double-click **csharp.sln** in the SDK package to open the project. The project contains the following:

- **apigateway-signature**: Shared library that implements the signature algorithm. It can be used in the .Net Framework and .Net Core projects.
- **backend-signature**: Example of a backend signature. Modify the parameters as required. For details about the sample code, see **Backend Signature Verification Example**.
- **sdk-request**: Example of invoking the signature algorithm.

Backend Signature Verification Example

NOTE

- This example demonstrates how to write an ASP.Net Core–based server as the backend of an API and implement an IAuthorizationFilter to verify the signature of requests sent from APIC.
- Signature information is added to requests sent to access the backend of an API only after a signature key is bound to the API.

Step 1 Write a controller that provides the GET, POST, PUT, and DELETE interfaces, and add the **ApigatewaySignatureFilter** attribute.

```
// ValuesController.cs

namespace backend_signature.Controllers
{
    [Route("api/[controller]")]
    [ApiController]
    [ApigatewaySignatureFilter]
    public class ValuesController : ControllerBase
    {
        // GET api/values
        [HttpGet]
        public ActionResult<IEnumerable<string>> Get()
        {
            return new string[] { "value1", "value2" };
        }

        // POST api/values
        [HttpPost]
        public void Post([FromBody] string value)
        {
        }

        // PUT api/values/5
        [HttpPut("{id}")]
        public void Put(int id, [FromBody] string value)
        {
        }

        // DELETE api/values/5
        [HttpDelete("{id}")]
        public void Delete(int id)
        {
        }
    }
}
```

Step 2 Implement **ApigatewaySignatureFilter** by putting the signature key and secret in a **Dictionary**.


```
// ApigatewaySignatureFilter.cs

namespace backend_signature.Filters
{
    public class ApigatewaySignatureFilter : Attribute, IAuthorizationFilter
    {
        private Dictionary<string, string> secrets = new Dictionary<string, string>
        {
            {"signature_key1", "signature_secret1" },
            {"signature_key2", "signature_secret2" },
        };

        public void OnAuthorization(AuthorizationFilterContext context) {
          //Signature verification code
            ...
        }
    }
}
```

Step 3 Use a regular expression to parse the **Authorization** header. The key and signedHeaders are obtained. The OnAuthorization function is used for signature verification.

```
private Regex authorizationPattern = new Regex("SDK-HMAC-SHA256\\s+Access=([^,]+),\\s?
SignedHeaders=([^,]+),\\s?Signature=(\\w+)");

...

string authorization = request.Headers["Authorization"];
if (authorization == null)
{
    context.Result = new UnauthorizedResult();
    return;
}
var matches = authorizationPattern.Matches(authorization);
if (matches.Count == 0)
{
    context.Result = new UnauthorizedResult();
    return;
}
var groups = matches[0].Groups;
string key = groups[1].Value;
string[] signedHeaders = groups[2].Value.Split(';');
```

For example, for **Authorization** header:

```
SDK-HMAC-SHA256 Access=signature_key1, SignedHeaders=host;x-sdk-date,
Signature=e11adf65a20d1b82c25419b5********8d0ba12fed1ceb13ed00
```

The parsing result is as follows:

```
signingKey=signature_key1
signedHeaders=host;x-sdk-date
```

Step 4 Find **secret** based on **key**. If **key** does not exist, the authentication failed.

```
if (!secrets.ContainsKey(key))
{
    context.Result = new UnauthorizedResult();
    return;
}
string secret = secrets[key];
```

Step 5 Create an HttpRequest, and add the method, URL, query, and signedHeaders headers to the request. Determine whether the body needs to be set.

The body is read if there is no **x-sdk-content-sha256** header with value **UNSIGNED-PAYLOAD**.

```
HttpRequest sdkRequest = new HttpRequest();
sdkRequest.method = request.Method;
```



```
sdkRequest.host = request.Host.Value;
sdkRequest.uri = request.Path;
Dictionary<string, string> query = new Dictionary<string, string>();
foreach (var pair in request.Query)
{
    query[pair.Key] = pair.Value;
}
sdkRequest.query = query;
WebHeaderCollection headers = new WebHeaderCollection();
string dateHeader = null;
bool needBody = true;
foreach (var h in signedHeaders)
{
    var value = request.Headers[h];
    headers[h] = value;
    if (h.ToLower() == "x-sdk-date")
    {
        dateHeader = value;
    }
    if (h.ToLower() == "x-sdk-content-sha256" && value == "UNSIGNED-PAYLOAD")
    {
        needBody = false;
    }
}
sdkRequest.headers = headers;
if (needBody)
{
    request.EnableRewind();
    using (MemoryStream ms = new MemoryStream())
    {
        request.Body.CopyTo(ms);
        sdkRequest.body = Encoding.UTF8.GetString(ms.ToArray());
    }
    request.Body.Position = 0;
}
```

Step 6 Check whether the signature has expired. Obtain the time from the **X-Sdk-Date** header, and check whether the difference between this time and the server time is within 15 minutes. If **signedHeaders** does not contain **X-Sdk-Date**, the authentication failed.

```
private const string BasicDateFormat = "yyyyMMddTHHmmssZ";

...

if(dateHeader == null)
{
    context.Result = new UnauthorizedResult();
    return;
}
DateTime t = DateTime.ParseExact(dateHeader, BasicDateFormat, CultureInfo.CurrentCulture);
if (Math.Abs((t - DateTime.Now).Minutes) > 15)
{
    context.Result = new UnauthorizedResult();
    return;
}
```

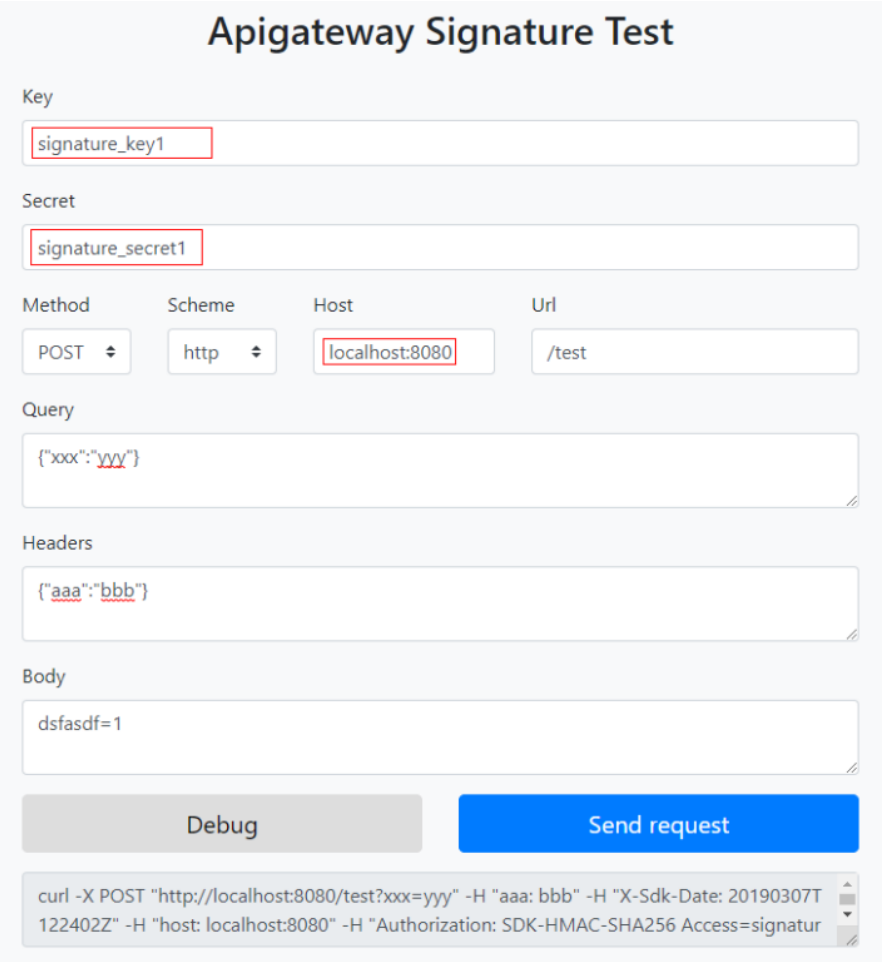
Step 7 Invoke the **verify** method to verify the signature of the request, and check whether the verification is successful.

```
Signer signer = new Signer();
signer.Key = key;
signer.Secret = secret;
if (!signer.Verify(sdkRequest, groups[3].Value))
{
    context.Result = new UnauthorizedResult();
}
```

Step 8 Run the server to verify the code. The following example uses the HTML signature tool in the JavaScript SDK to generate a signature.

Set the parameters according to the following figure, and click **Send request**. Copy the generated curl command, execute it in the CLI, and check whether the server returns **200**.

If an incorrect key or secret is used, the server returns **401**, which means authentication failure.



----End

1.5 Developing Function APIs

1.5.1 Function API Script Compilation Guide

This section describes how to compile the definition script when developing a function API on the custom backend.

A function API encapsulates multiple services into one service by compiling function scripts.

The script of a function API is compiled using JavaScript, which complies with the Java Nashorn standard and supports **ECMAScript Edition 5.1**. The JavaScript engine runs on the Java virtual machine and can invoke the **Java class** provided by the custom backend to implement specific functions.

Example 1: Helloworld

Define the execute function as an entry. The content returned by the execute function is used as the response body of the function API.

```
function execute(data) {
    return "Hello world!"
}
```

Example 2: Obtaining Request Parameters

The data parameter inputted by the execute function contains request parameters.

```
function execute(data) {
    data = JSON.parse(data)
    return {
        "method":data["method"],
        "uri":data["uri"],
        "headers":data["headers"],
        "param":data["param"],
        "body":data["body"],
    }
}
```

Example 3: Setting Response Parameters

The APIConnectResponse object is returned in the execute function. You can specify the HTTP status code, return header, and body returned by the API.

```
importClass(com.roma.apic.livedata.provider.v1.APIConnectResponse);
function execute(data) {
    return new APIConnectResponse(401, {"X-Type":"Demo"}, "unauthorized", false);
}
```

In this example, the HTTP status code returned when the function API is called is 401, the response header contains "X-Type: Demo", and the response body is "unauthorized".

Example 4: Invoking the Java Function

In the following example, the Java class is introduced using importClass and the functions in it are called. For details about all Java classes, see **APIConnectResponse**.

```
importClass(com.roma.apic.livedata.common.v1.Md5Utils);
function execute(data) {
    var sourceCode = "Hello world!";
    return Md5Utils.encode(sourceCode);
}
```

Referencing Public Configuration

1. Log in to the ROMA Connect console. On the **Instances** page, click **View Console** next to a specific instance.
2. In the navigation pane, choose **API Connect** > **Custom Backend**. On the **Configurations** tab page, click **Add Configuration**.
3. In the dialog box displayed, configure related information and click **OK**.

Table 1-2 Public reference configurations

Parameter	Description
Configuration Name	Enter a configuration name.
Configuration Type	Select a configuration type. The value can be **Template Variable**, **Password**, or **Certificate**.
Integration Application	Select the integration application to which the configuration belongs.
Configuration Value	This parameter is available only when **Configuration Type** is set to **Template variable** or **Password**. Enter the template variable or password.
Confirm Value	This parameter is available only when **Configuration Type** is set to **Password**. Enter the password again, which must be the same as the value of **Configuration Value**.
Certificate	This parameter is mandatory only when **Configuration Type** is set to **Certificate**. Enter the certificate in PEM format.
Private Key	This parameter is mandatory only when **Configuration Type** is set to **Certificate**. Enter the private key of the certificate in PEM format.
Password	This parameter is available only when **Configuration Type** is set to **Certificate**. Enter the password of the certificate private key.
Confirm Password	This parameter is mandatory only when **Configuration Type** is set to **Certificate**. Enter the password of the certificate private key again, which must be the same as the value of **Password**.
Description	Enter a description of the configuration.

4. Reference the configuration in the Java Script function script.

   If the configuration name is **example**, the reference format is as follows:

   - Template variable: #{example}
   - Password: CipherUtils.getPlainCipherText("example")
   - Certificate: CipherUtils.getPlainCertificate("example")

1.5.2 APIConnectResponse

Path

com.roma.apic.livedata.provider.v1.APIConnectResponse

Description

This class is used to specify the HTTP status code, header, and body to be returned after a function API is called. To achieve this, the class object must be returned in the execute function.

Example

```
importClass(com.roma.apic.livedata.provider.v1.APIConnectResponse);
function execute(data) {
    return new APIConnectResponse(401, {"X-Type":"Demo"}, "unauthorized", false);
}
```

In this example, the HTTP status code returned when the function API is called is 401, the response header contains "X-Type: Demo", and the response body is "unauthorized".

Constructor Details

- **public APIConnectResponse(Integer statusCode)**

  Constructs an APIConnectResponse.

  Parameter: **statusCode** indicates the response status code.

- **public APIConnectResponse(Integer statusCode, Map<String,String> headers)**

  Constructs an APIConnectResponse.

  Parameters: **statusCode** indicates the response status code, and **headers** indicates the response header.

- **public APIConnectResponse(Integer statusCode, Map<String,String> headers, Object body)**

  Constructs an APIConnectResponse.

  Parameters: **statusCode** indicates the response status code, **headers** indicates the response header, and **body** indicates the response body.

- **public APIConnectResponse(Integer statusCode, Map<String,String> headers, String body, Boolean base64Encoded)**

  Constructs an APIConnectResponse.

  Parameters: **statusCode** indicates the response status code, **headers** indicates the response header, **body** indicates the response body, and **base64Encoded** indicates whether the body is encoded using Base64.

Method List

Returned Type	Method and Description
Object	**getBody**() Obtain the response body.
Map<String,String>	**getHeaders**() Obtain the response header.
Integer	**getStatusCode**() Obtain the response status code.

Returned Type	Method and Description
Boolean	**isBase64Encoded**() Check whether the body is encoded using Base64.
void	**setBase64Encoded**(Boolean base64Encoded) Set whether the body is encoded using Base64.
void	**setBody**(Object body) Set the response body.
void	**setHeaders**(Map<String,String> headers) Set the response header.
void	**setStatusCode**(Integer statusCode) Set the response status code.

Method Details

- **public Object getBody()**

  Obtain the response body.

  Returns

  Response body.

- **public Map<String,String> getHeaders()**

  Obtain the response header.

  Returns

  Map set of the request header.

- **public Integer getStatusCode()**

  Obtain the response status code.

  Returns

  Response status code.

- **public Boolean isBase64Encoded()**

  Check whether the body is encoded using Base64.

  Returns

  - **true**: Base64 encoding has been performed.
  - **false**: Base64 encoding is not performed.

- **public void setBase64Encoded(Boolean base64Encoded)**

  Set whether the body is encoded using Base64.

  Input Parameter

  base64Encoded: If the value is **true**, Base64 encoding has been performed. If the value is **false**, Base64 encoding is not performed.

- **public void setBody(Object body)**

  Set the response body.

  Input Parameter

body indicates the body object.

- **public void setHeaders(Map<String,String> headers)**
  Set the response header.
  Input Parameter
  headers indicates the map set of headers.
- **public void setStatusCode(Integer statusCode)**
  Set the response status code.
  Input Parameter
  statusCode indicates the status code.

1.5.3 Base64Utils

Path

com.roma.apic.livedata.common.v1.Base64Utils

Description

This class is used to provide the Base64Utils encoding and decoding functions.

Example

```
importClass(com.roma.apic.livedata.common.v1.Base64Utils);
function execute(data) {
    var sourceCode = "Hello world!";
    return Base64Utils.encode(sourceCode);
}
```

Method List

Returned Type	Method and Description
static java.lang.String	**decode**(java.lang.String content) Perform Base64 decoding on a character string.
static java.lang.String	**decodeUrlSafe**(java.lang.String content) Perform Base64 decoding on a character string (using the character set compatible with the URL).
static java.lang.String	**encode**(byte[] content) Perform Base64 encoding on a byte array.
static java.lang.String	**encode**(java.lang.String content) Perform Base64 encoding on a character string.
static java.lang.String	**encodeUrlSafe**(byte[] content) Perform Base64 encoding on a byte array (using the character set compatible with the URL).

Returned Type	Method and Description
static java.lang.String	**encodeUrlSafe**(java.lang.String content) Perform Base64 encoding on a character string (using the character set compatible with the URL).

Method Details

- **public static java.lang.String decode(java.lang.String content)**

  Perform Base64 decoding on a character string.

  Input Parameter

  content indicates a character string encrypted by using Base64.

  Returns

  Decrypted character string.

  Throws

  java.lang.Exception
- **public static java.lang.String decodeUrlSafe(java.lang.String content)**

  Perform Base64 decoding on a byte array (using the character set compatible with the URL).

  Input Parameter

  content indicates a character string encrypted by using Base64.

  Returns

  Decrypted character string.

  Throws

  java.lang.Exception
- **public static java.lang.String encode(byte[] content)**

  Perform Base64 encoding on a byte array.

  Input Parameter

  content indicates a byte array to be encrypted.

  Returns

  Encrypted character string.
- **public static java.lang.String encode(java.lang.String content)**

  Perform Base64 encoding on a character string.

  Input Parameter

  content indicates a character string to be encrypted.

  Returns

  Encrypted character string.

  Throws

  java.lang.Exception
- **public static java.lang.String encodeUrlSafe(byte[] content)**

Perform Base64 encoding on a byte array (using the character set compatible with the URL).

Input Parameter

content indicates a byte array to be encrypted.

Returns

Encrypted character string.

- **public static java.lang.String encodeUrlSafe(java.lang.String content)**

  Perform Base64 encoding on a character string (using the character set compatible with the URL).

  Input Parameter

  content indicates a character string to be encrypted.

  Returns

  Encrypted character string.

  Throws

  java.lang.Exception

1.5.4 CacheUtils

Path

com.huawei.livedata.lambdaservice.util.CacheUtils

Description

This class is used to save and obtain cache information.

Method List

Returned Type	Method and Description
static boolean	**putCache**(String key, String value) Save cache information.
static boolean	**putCache**(String key, String value, int time) Save the cache information with the timeout interval.
static String	**getCache**(String key) Obtain cache information.
static long	**removeCache**(String key) Remove cache information.
static String	**get**(String key) Obtain dictionary cache information.

Method Details

- **public static boolean putCache(String key, String value)**
  Save cache information.
  Input Parameter
  - **key** indicates the key value of cache information.
  - **value** indicates the cache information.

  Returns
  Corresponding boolean value.
- **public static boolean putCache(String key, String value, int time)**
  Save the cache information with the timeout interval.
  Input Parameter
  - **key** indicates the key value of cache information.
  - **value** indicates the cache information.
  - **time** indicates the timeout interval.

  Returns
  Corresponding boolean value.
- **public static String getCache(String key)**
  Obtain cache information.
  Input Parameter
  key indicates the key value of cache information.
  Returns
  Cache information corresponding to the key value.
- **public static long removeCache(String key)**
  Remove cache information.
  Input Parameter
  key indicates the key value of cache information to be removed.
  Returns
  Execution result.
- **public static String get(String key)**
  Obtain dictionary cache information.
  Input Parameter
  key indicates the key value of dictionary cache information.
  Returns
  Dictionary cache information corresponding to the key value.

1.5.5 CipherUtils

Path

com.huawei.livedata.lambdaservice.security.CipherUtils

Description

This class is used to decrypt the key value of the password in the password box.

NOTE

When obtaining the key value of a common password in the decryption password box, protect sensitive information from being disclosed.

Method List

Returned Type	Method and Description
static String	**getPlainCipherText**(String key) Decrypt the key value of a common password in the password box.
static Response	**getPlainCertificate**(String key) Decrypt the key value of a certificate password in the password box.

Method Details

- **public static String getPlainCipherText(String key)**

  Decrypt the key value of a common password in the password box.

  Input Parameter

  key indicates the key value of a common password.

  Returns

  Decrypted password.

- **public static Response getPlainCertificate(String key)**

  Decrypt the key value of a certificate password in the password box.

  Input Parameter

  key indicates the key value of a certificate password.

  Returns

  Message body of the decrypted certificate password. The message body format is as follows:

```
{
"cipherType": "CERTIFICATE",
"passphrase": "xxx",
"privateKey": "xx",
"privateKey": "xx",
}
```

1.5.6 ConnectionConfig

Path

com.roma.apic.livedata.config.v1.ConnectionConfig

Description

This class is used with **RabbitMqConfig** and **RabbitMqProducer** to configure the connection to a RabbitMQ client.

Constructor Details

public ConnectionConfig(String host, int port, String userName, String pw)

Constructs a RabbitMQ client connection configuration.

1.5.7 DataSourceClient

Path

com.roma.apic.livedata.client.v1.DataSourceClient

Description

This class is used to connect to data sources and run SQL statements, stored procedures, or NoSQL query statements.

Example

SQL data source example:

```
importClass(com.roma.apic.livedata.client.v1.DataSourceClient);
importClass(com.roma.apic.livedata.config.v1.DataSourceConfig);
function execute(data){
    var config = new DataSourceConfig()
    config.setType("mysql")
    config.setUrl("jdbc:mysql://127.0.0.1:3306/db?allowPublicKeyRetrieval=true")
    config.setUser("username")
    config.setPassword("password")
    var ds = new DataSourceClient(config)
    return ds.execute("SELECT * FROM person where name = ? and age = ?", "Tom", 20);
}
```

NoSQL data source example:

```
importClass(com.roma.apic.livedata.client.v1.DataSourceClient);
importClass(com.roma.apic.livedata.config.v1.DataSourceConfig);
function execute(data){
    var config = new DataSourceConfig()
    config.setType("redis")
    config.setUrl("127.0.0.1:6379")
    config.setPassword("password")
    var ds = new DataSourceClient(config)
    return ds.execute("GET key");
}
```

Constructor Details

public DataSourceClient(DataSourceConfig config)

Import the data source configuration and construct a data source connector.

Method List

Returned Type	Method and Description
Object	execute(String sql, Object... prepareValue) Run SQL statements, stored procedures, or NoSQL query statements.

Method Details

- **public Object execute(String sql, Object... prepareValue)**

  Run SQL statements, stored procedures, or NoSQL query statements.

  Input Parameter

  – **prepareValue**: This parameter is valid only in SQL statements and is used to replace "?" in SQL statements to prevent SQL injection.

  Returns

  Statement execution results

  Throws

  Exception

1.5.8 DataSourceConfig

Path

com.roma.apic.livedata.config.v1.DataSourceConfig

Description

This class is used with **DataSourceClient** to configure data sources.

Constructor Details

public DataSourceConfig()

Constructs a DataSourceConfig without parameters.

public DataSourceConfig(String type, String url, String user, String password)

Enter the data source type, connection string, username, and password to construct a DataSourceConfig.

Method List

Returned Type	Method and Description
String	**getType**() Obtain the data source type.

Returned Type	Method and Description
String	**getUrl**() Obtain the connection string.
String	**getUser**() Obtain the username.
String	**getMaxPassword**() Obtain the password.
void	**setType**() Set the data source type. The value can be **mysql**, **mssql**, **oracle**, **postgresql**, **hive**, **redis**, or **mongodb**.
void	**setUrl**() Set the data source connection string.
void	**setUser**() Set the data source username.
void	**setPassword**() Set the data source password.

Method Details

- **public String getType()**
  Obtain the data source type.
  Returns
  Data source type.
- **public String getUrl()**
  Obtain the connection string.
  Returns
  Connection string.
- **public String getUser()**
  Obtain the username.
  Returns
  Username.
- **public String getPassword()**
  Obtain the password.
  Returns
  Password.
- **public void setType(String type)**
  Set the data source type. The value can be **mysql**, **mssql**, **oracle**, **postgresql**, **hive**, **redis**, or **mongodb**.
  Input Parameter

  - **type**: specifies the data source type.
- **public void setUrl(String url)**

  Set the data source connection string.

  If **type** is **mysql**, **mssql**, **oracle**, **postgresql**, or **hive**, set this parameter to the jdbc connection string. For example, "jdbc:mysql://127.0.0.1:8888/db?useUnicode=true&characterEncoding=utf8".

  If **type** is **redis**, the format is "127.0.0.1:6379@0", in which @0 indicates the Redis database ID and can be omitted.

  If **type** is **mongodb**, the format is "127.0.0.1:27017@db", in which db indicates the database name.

  Input Parameter

  - **url** indicates the connection string.
- **public void setUser(String user)**

  Set the data source username. If **type** is **redis**, you do not need to set this parameter.

  Input Parameter

  - **user** indicates the username.
- **public void setPassword(String password)**

  Set the data source password.

  Input Parameter

  - **password** indicates the password.

1.5.9 ExchangeConfig

Path

com.roma.apic.livedata.config.v1.ExchangeConfig

Description

This class is used with **RabbitMqConfig** and **RabbitMqProducer** to configure an exchange.

Constructor Details

public ExchangeConfig(String exchange, String type, boolean durable, boolean autoDelete, boolean internal, Map<String, Object> arguments)

Constructs an exchange configuration.

Parameters:

- **exchange** indicates the exchange name.
- **type** indicates the exchange type.
- **durable** indicates whether persistency is supported. The value **true** indicates persistency is supported, and the value **false** indicates that persistency is not supported.
- **autoDelete** indicates whether automatic deletion is supported. The value **true** indicates that automatic deletion is supported. The prerequisite for

automatic deletion is that at least one queue or exchange is bound to the exchange to be deleted. After automatic deletion, all queues or exchanges bound to the deleted exchange are unbound.

- **internal** indicates whether the exchange is a built-in exchange. The value **true** indicates that the exchange is a built-in exchange. The client cannot directly send messages to the exchange, but sending messages to another exchange first, which will forward the messages to the destination exchange.
- **arguments** indicates other attributes.

1.5.10 HttpClient

Path

- com.roma.apic.livedata.client.v1.HttpClient
- com.huawei.livedata.lambdaservice.livedataprovider.HttpClient

Description

This class is used to send HTTP requests.

Example

- com.roma.apic.livedata.client.v1.HttpClient

```
importClass(com.roma.apic.livedata.client.v1.HttpClient);
importClass(com.roma.apic.livedata.provider.v1.APIConnectResponse);
function execute(data) {
    var httpClient = new HttpClient();
    var resp = httpClient.request('GET', 'http://apigdemo.exampleRegion.com/api/echo', {}, null,
'application/json');
    myHeaders = resp.headers();
    proxyHeaders = {};
    for (var key in myHeaders) {
        proxyHeaders[key] = myHeaders.get(key);
    }
    return new APIConnectResponse(resp.code(), proxyHeaders, resp.body().string(), false);
}
```

- com.huawei.livedata.lambdaservice.livedataprovider.HttpClient

```
importClass(com.huawei.livedata.lambdaservice.livedataprovider.HttpClient);
function excute(data) {
    var httpExecutor = new HttpClient();
    var obj = JSON.parse(data);
    var host = 'xx.xx.xxx.xx:xxxx';
    var headers = {
        'clientapp' : 'FunctionStage'
    };
    var params = {
        'employ_no' :'00xxxxxx'
    };
    var result = httpExecutor.callGETAPI(host,'/livews/rest/apiservice/iData/personInfo/
batch',JSON.stringify(params),JSON.stringify(headers));
    return result;
}
```

Constructor Details

- com.roma.apic.livedata.client.v1.HttpClient

  public HttpClient()

  Constructs an HttpClient without parameters.

public HttpClient(HttpConfig config)

Constructs an HttpClient that contains the **HttpConfig** configuration information.

Parameter: **config** indicates the HttpConfig configuration information.

- com.huawei.livedata.lambdaservice.livedataprovider.HttpClient

  public HttpClient()

  Constructs an HttpClient without parameters.

Method List

- com.roma.apic.livedata.client.v1.HttpClient

Returned Type	Method and Description
okhttp3.Response	**request**(**HttpConfig** config) Send REST requests.
okhttp3.Response	**request**(String method, String url) Send a REST request by specifying the request method and path.
okhttp3.Response	**request**(String method, String url, Map<String,String> headers) Send a REST request by specifying the request method, path, and header.
okhttp3.Response	**request**(String method, String url, Map<String,String> headers, String body) Send a REST request by specifying the request method, path, header, and body.
okhttp3.Response	**request**(String method, String url, Map<String,String> headers, String body, String contentType) Send a REST request by specifying the request method, path, header, body, and content type.

- com.huawei.livedata.lambdaservice.livedataprovider.HttpClient

Returned Type	Method and Description
String	**callGETAPI**(String url) Use the get method to invoke the HTTP or HTTPS service.
String	**callGETAPI**(String host, String service, String params, String header) Use the get method to invoke the HTTP or HTTPS service.
Response	**get**(String url, String header) Use the get method to invoke the HTTP or HTTPS service.

Returned Type	Method and Description
String	**callPostAPI**(String host, String service, String content, String header, String contentType) Use the post method to invoke the HTTP or HTTPS service.
String	**callPostAPI**(String url, String header, String requestBody, String type) Use the post method to invoke the HTTP or HTTPS service.
Response	**post**(String url, String header, String content, String type) Use the post method to invoke the HTTP or HTTPS service.
String	**callFormPost**(String url, String header, String/Map param) Invoke the HTTP or HTTPS service in the formdata format.
Response	**callFormPost**(String url, String header, String param, FormDataMultiPart form) Invoke the HTTP or HTTPS service in the formdata format.
String	**callDelAPI**(String url, String header, String content, String type) Use the delete method to invoke the HTTP or HTTPS service.
String	**callPUTAPI**(String url, String header, String content, String type) Use the put method to invoke the HTTP or HTTPS service.
String	**callPatchAPI**(String url, String header, String content, String type) Use the patch method to invoke the HTTP or HTTPS service.
Response	**put**(String url, String header, String content, String type) Use the put method to invoke the HTTP or HTTPS service.

Method Details

- com.roma.apic.livedata.client.v1.HttpClient
  - **public okhttp3.Response request(HttpConfig config)**

    Send REST requests.

    Input Parameter

    config indicates the **HttpConfig** configuration information.

    Returns

    Response body.
  - **public okhttp3.Response request(String method, String url)**

    Send a REST request by specifying the request method and path.

    Input Parameter

- **method** indicates a request method.
- **url** indicates a request URL.

Returns

Response body.

- **public okhttp3.Response request(String method, String url, Map<String,String> headers)**

  Send a REST request by specifying the request method, path, and header.

  Input Parameter

  - **method** indicates a request method.
  - **url** indicates a request URL.
  - **headers** indicates the request header information of the map type.

  Returns

  Response body.

- **public okhttp3.Response request(String method, String url, Map<String,String> headers, String body)**

  Send a REST request by specifying the request method, path, header, and body.

  Input Parameter

  - **method** indicates a request method.
  - **url** indicates a request URL.
  - **headers** indicates the request header information of the map type.
  - **body** indicates the request body.

  Returns

  Response body.

- **public okhttp3.Response request(String method, String url, Map<String,String> headers, String body, String contentType)**

  Send a REST request by specifying the request method, path, header, body, and content type.

  Input Parameter

  - **method** indicates a request method.
  - **url** indicates a request URL.
  - **headers** indicates the request header information of the map type.
  - **body** indicates the request body.
  - **contentType** indicates the content type of the request body.

  Returns

  Response body.

- com.huawei.livedata.lambdaservice.livedataprovider.HttpClient
  - **public String callGETAPI(String url)**

    Use the get method to invoke the HTTP or HTTPS service.

    Input Parameter

    url indicates the service address.

    Returns

    Response body.
  - **public String callGETAPI(String host, String service, String params, String header)**

    Use the get method to invoke the HTTP or HTTPS service.

    Input Parameter

    - **host** indicates the service address.
    - **service** indicates the service path.
    - **params** indicates the HTTP parameter information.
    - **header** indicates the HTTP header information.

    Returns

    Response body.
  - **public Response get(String url, String header)**

    Use the get method to invoke the HTTP or HTTPS service.

    Input Parameter

    - **url** indicates the service address.
    - **header** indicates the request header information.

    Returns

    Response body.
  - **public String callPostAPI(String host, String service, String content, String header, String contentType)**

    Use the post method to invoke the HTTP or HTTPS service.

    Input Parameter

    - **host** indicates the service address.
    - **service** indicates the service path.
    - **content** indicates the message body.
    - **header** indicates the request header information.
    - **contentType** indicates the content type.

    Returns

    Response body.
  - **public String callPostAPI(String url, String header, String requestBody, String type)**

Use the post method to invoke the HTTP or HTTPS service.

Input Parameter

- **url** indicates the service address.
- **header** indicates the request header information.
- **requestBody** indicates the message body.
- **type** indicates the MIME type.

Returns

Response body.

- **public Response post(String url, String header, String content, String type)**

  Use the post method to invoke the HTTP or HTTPS service.

  Input Parameter

  - **url** indicates the service address.
  - **header** indicates the request header information.
  - **content** indicates the message body.
  - **type** indicates the MIME type.

  Returns

  Response body.

- **public String callFormPost(String url, String header, String/Map param)**

  Invoke the HTTP or HTTPS service in the formdata format.

  Input Parameter

  - **url** indicates the service address.
  - **header** indicates the request header information.
  - **param** indicates the parameter information.

  Returns

  Response body.

- **public Response callFormPost(String url, String header, String param, FormDataMultiPart form)**

  Invoke the HTTP or HTTPS service in the formdata format.

  Input Parameter

  - **url** indicates the service address.
  - **header** indicates the request header information.
  - **param** indicates the parameter information.
  - **form** indicates the body parameter.

Returns

Response body.

- **public String callDelAPI(String url, String header, String content, String type)**

  Use the delete method to invoke the HTTP or HTTPS service.

  Input Parameter

  - **url** indicates the service address.
  - **header** indicates the request header information.
  - **content** indicates the message body.
  - **type** indicates the MIME type.

  Returns

  Response body.

- **public String callPUTAPI(String url, String header, String content, String type)**

  Use the put method to invoke the HTTP or HTTPS service.

  Input Parameter

  - **url** indicates the service address.
  - **header** indicates the request header information.
  - **content** indicates the message body.
  - **type** indicates the MIME type.

  Returns

  Response body.

- **public String callPatchAPI(String url, String header, String content, String type)**

  Use the patch method to invoke the HTTP or HTTPS service.

  Input Parameter

  - **url** indicates the service address.
  - **header** indicates the request header information.
  - **content** indicates the message body.
  - **type** indicates the MIME type.

  Returns

  Response body.

- **public Response put(String url, String header, String content, String type)**

  Use the put method to invoke the HTTP or HTTPS service.

  Input Parameter

- **url** indicates the service address.
- **header** indicates the request header information.
- **content** indicates the message body.
- **type** indicates the MIME type.

Returns

Response body.

1.5.11 HttpConfig

Path

com.roma.apic.livedata.config.v1.HttpConfig

Description

This class is used together with **HttpClient** to configure HTTP requests.

Example

```
importClass(com.roma.apic.livedata.client.v1.HttpClient);
importClass(com.roma.apic.livedata.config.v1.HttpConfig);
function execute(data) {
    var requestConfig = new HttpConfig();

    requestConfig.setAccessKey("071fe245-9cf6-4d75-822d-c29945a1e06a");
    requestConfig.setSecretKey("c6e52419-2270-****-****-ae7fdd01dcd5");

    requestConfig.setMethod('POST');
    requestConfig.setUrl("https://30030113-3657-4fb6-a7ef-90764239b038.apigw.exampleRegion.com/
app1");
    requestConfig.setContent("body");
    requestConfig.setContentType('application/json');

    var client = new HttpClient();
    var resp =  client.request(requestConfig);
    return resp.body().string()
}
```

Constructor Details

public HttpConfig()

Constructs an HttpConfig without parameters.

Method List

Returned Type	Method and Description
void	**addHeaderToSign**(String headerName) Add a request header to be signed.

Returned Type	Method and Description
String	**getAccessKey**() Obtain the AccessKey. Requests for which AccessKey and SecretKey are set use the AK/SK signature algorithm for signing.
String	**getCaCertData**() Obtain a CA certificate.
String	**getCharset**() Obtain the HTTP request encoding format.
String	**getClientCertData**() Obtain a client certificate.
String	**getClientKeyAlgo**() Obtain the encryption algorithm of the client private key.
String	**getClientKeyData**() Obtain a client private key.
String	**getClientKeyPassphrase**() Obtain the password of a client private key.
int	**getConnectionTimeout**() Obtain the connection timeout interval.
int	**getConnectTimeout**() Obtain the connection timeout interval.
Object	**getContent**() Obtain the content of an HTTP request.
String	**getContentType**() Obtain the content format of an HTTP request.
String	**getHeader**(String name) Obtain the HTTP request header with a specified name.
Set<String>	**getHeaderNames**() Obtain the name of the HTTP request header.
Map<String,String[]>	**getHeaders**() Obtain all request headers.
String[]	**getHeaders**(String name) Obtain all HTTP request headers with a specified name.
Set<String>	**getHeadersToSign**() Obtain a request header to be signed.

Returned Type	Method and Description
String	**getHttpProxy**() Obtain the HTTP proxy.
String	**getHttpsProxy**() Obtain the HTTPS proxy.
int	**getMaxConcurrentRequests**() Obtain the maximum number of concurrent requests.
int	**getMaxConcurrentRequests...**() Obtain the maximum number of concurrent requests per host.
String	**getMethod**() Obtain the HTTP method.
String[]	**getNoProxy**() Obtain a list of IP addresses that do not use the proxy.
String	**getParameter**(String name) Obtain the HTTP request parameters with a specified name.
Set<String>	**getParameterNames**() Obtain all HTTP request parameter names.
Map<String,String>	**getParameters**() Obtain the HTTP request parameters.
String	**getProxyPassword**() Obtain the proxy password.
String	**getProxyUsername**() Obtain the proxy username.
RequestConfig	**getRequestConfig**() Obtain request configuration information.
String	**getRequestId**() Obtain the request ID.
int	**getRequestTimeout**() Obtain the request timeout.
long	**getRollingTimeout**() Obtain the rolling timeout interval.
long	**getScaleTimeout**() Obtain the scaling timeout interval.

Returned Type	Method and Description
String	**getSecretKey**() Obtain the SecretKey of the request signature. Requests for which AccessKey and SecretKey are set use the AK/SK signature algorithm for signing.
okhttp3.TlsVersion[]	**getTlsVersions**() Obtain the TLS version.
String	**getUrl**() Obtain the URL.
String	**getUserAgent**() Obtain the user agent.
long	**getWebsocketPingInterval**() Obtain the WebSocket heartbeat interval.
long	**getWebsocketTimeout**() Obtain the WebSocket timeout interval.
boolean	**isRedirects**() Allow redirection or not.
boolean	**isSsl**() Check whether HTTPS is used. The default value is **false**.
boolean	**isSslRedirects**() Check whether to obtain the value of sslRedirects. The options are **true** and **false**.
boolean	**isTrustCerts**() Check whether all certificates are trusted. The options are **true** and **false**.
void	**setAccessKey**(String accessKey) Set the AccessKey of the request signature. Requests for which AccessKey and SecretKey are set use the https://support.huaweicloud.com/en-us/devg-apisign/api-sign-algorithm.html for signing.
void	**setBodyForm**(Map<String,String> content) Set the HTTP request content of the map type.
void	**setBodyText**(String content) Set the HTTP request content of the string type.
void	**setCaCertData**(String caCertData) Set the CA certificate.

Returned Type	Method and Description
void	**setCharset**(String charset) Set the HTTP request encoding format.
void	**setClientCertData**(String clientCertData) Set a client certificate.
void	**setClientKeyAlgo**(String clientKeyAlgo) Set the encryption algorithm of the client private key.
void	**setClientKeyData**(String clientKeyData) Set a client private key.
void	**setClientKeyPassphrase**(String clientKeyPassphrase) Set the password of a client private key.
void	**setConnectionTimeout**(int connectionTimeout) Set the connection timeout interval.
void	**setConnectTimeout**(int connectTimeout) Set the connection timeout interval.
void	**setContent**(Object content) Set the HTTP request content in object format.
void	**setContentType**(String contentType) Set the content type of an HTTP request.
void	**setHeader**(String name, String value) Set the request header with the specified name and value.
void	**setHeader**(String name, String[] value) Set the request header with the specified name and value.
void	**setHeaders**(Map<String,String> headers) Set the request header.
void	**setHeaderValues**(Map<String,String[]> headers) Set the request header.
void	**setHttpProxy**(String httpProxy) Set the HTTP proxy.
void	**setHttpsProxy**(String httpsProxy) Set the HTTPS proxy.
void	**setMaxConcurrentRequests**(int maxConcurrentRequests) Set the maximum number of concurrent requests.

Returned Type	Method and Description
void	**setMaxConcurrentRequests...**(int maxConcurrentRequestsPer-Host) Set the maximum number of concurrent requests per host.
void	**setMethod**(String method) Set the HTTP method.
void	**setNoProxy**(String[] noProxy) Set a list of IP addresses that do not use the proxy.
void	**setParameter**(String name, String value) Set the HTTP request parameters.
void	**setParameters**(java.util.Map<String,String> parameters) Set the HTTP request parameters.
void	**setProxyPassword**(String proxyPassword) Set a proxy password.
void	**setProxyUsername**(String proxyUsername) Set a proxy username.
void	**setRedirects**(boolean redirects) Set whether redirection is allowed.
void	**setRequestId**(String requestId) Set the request ID.
void	**setRequestTimeout**(int requestTimeout) Set the request timeout interval.
void	**setRollingTimeout**(long rollingTimeout) Set the rolling timeout interval.
void	**setScaleTimeout**(long scaleTimeout) Set the scaling timeout interval.
void	**setSecretKey**(String secretKey) Set the SecretKey of the request signature. Requests for which AccessKey and SecretKey are set use the https://support.huaweicloud.com/en-us/devg-apisign/api-sign-algorithm.html for signing.
void	**setSsl**(boolean ssl) Set whether HTTPS is used.
void	**setSslRedirects**(boolean sslRedirects) Set the value of sslRedirects.

Returned Type	Method and Description
void	**setTlsVersions**(okhttp3.TlsVersion[] tlsVersions) Set the TLS version.
void	**setTrustCerts**(boolean trustCerts) Set whether all certificates are trusted.
void	**setUrl**(String url) Set the URL.
void	**setUserAgent**(String userAgent) Set the user agent.
void	**setWebsocketPingInterval**(long websocketPingInterval) Set the WebSocket heartbeat interval.
void	**setWebsocketTimeout**(long websocketTimeout) Set the WebSocket timeout interval.

Method Details

- **public void addHeaderToSign(String headerName)**

  Add the header to the signature.

  Input Parameter

  headerName indicates the request header name.

- **public String getAccessKey()**

  Obtain the AccessKey of the request signature. Requests for which AccessKey and SecretKey are set use the https://support.huaweicloud.com/en-us/devg-apisign/api-sign-algorithm.html for signing.

  Returns

  AccessKey of the request signature.

- **public String getCaCertData()**

  Obtain a CA certificate.

  Returns

  CA certificate.

- **public String getCharset()**

  Obtain the HTTP request encoding format.

  Returns

  HTTP request encoding format.

- **public String getClientCertData()**

  Obtain a client certificate.

  Returns

  Client certificate.

- **public String getClientKeyAlgo()**
  Obtain the encryption algorithm of the client private key.
  Returns
  Encryption algorithm of the client private key.
- **public String getClientKeyData()**
  Obtain a client private key.
  Returns
  Client private key.
- **public String getClientKeyPassphrase()**
  Obtain the password of a client private key.
  Returns
  Password of a client private key.
- **public int getConnectionTimeout()**
  Obtain the connection timeout interval.
  Returns
  Connection timeout interval.
- **public int getConnectTimeout()**
  Obtain the connection timeout interval.
  Returns
  Connection timeout interval.
- **public Object getContent()**
  Obtain the content of an HTTP request.
  Returns
  HTTP request content.
- **public String getContentType()**
  Obtain the content format of an HTTP request.
  Returns
  Content format of an HTTP request.
- **public String getHeader(String name)**
  Obtain the HTTP request header with a specified name.
  Input Parameter
  name indicates the request header name.
  Returns
  Request header information with a specified name.
- **public Set<String> getHeaderNames()**
  Obtain the name of the HTTP request header.
  Returns
  Name of the HTTP request header.
- **public Map<String,String[]> getHeaders()**
  Obtain all request headers.
  Returns

All request headers.

- **public String[] getHeaders(String name)**
  Obtain all HTTP request headers with a specified name.
  Input Parameter
  name indicates the request header name.
  Returns
  All HTTP request headers with a specified name.
- **public Set<String> getHeadersToSign()**
  Obtain the request header in a signature.
  Returns
  Request header in a signature.
- **public String getHttpProxy()**
  Obtain the HTTP proxy.
  Returns
  HTTP proxy.
- **public String getHttpsProxy()**
  Obtain the HTTPS proxy.
  Returns
  HTTPS proxy.
- **public int getMaxConcurrentRequests()**
  Obtain the maximum number of concurrent requests.
  Returns
  Maximum number of concurrent requests.
- **public int getMaxConcurrentRequestsPerHost()**
  Obtain the maximum number of concurrent requests per host.
  Returns
  Maximum number of concurrent requests per host.
- **public String getMethod()**
  Obtain the HTTP method.
  Returns
  HTTP method.
- **public String[] getNoProxy()**
  Obtain a list of IP addresses that do not use the proxy.
  Returns
  A list of IP addresses that do not use the proxy.
- **public String getParameter(String name)**
  Obtain the HTTP request parameters with a specified name.
  Input Parameter
  name indicates the HTTP name.
  Returns
  HTTP request parameters with a specified name.

- **public Set<String> getParameterNames()**
  Obtain the HTTP request parameters.
  Returns
  HTTP request parameters.
- **public Map<String,String> getParameters()**
  Obtain the HTTP request parameters.
  Returns
  HTTP request parameters.
- **public String getProxyPassword()**
  Obtain a proxy password.
  Returns
  Proxy password.
- **public String getProxyUsername()**
  Obtain a proxy username.
  Returns
  Proxy username.
- **public RequestConfig getRequestConfig()**
  Obtain the request configuration.
  Returns
  Boolean value of sslRedirects.
- **public String getRequestId()**
  Obtain the request ID.
  Returns
  Request ID.
- **public int getRequestTimeout()**
  Obtain the request timeout interval.
  Returns
  Request timeout interval.
- **public long getRollingTimeout()**
  Obtain the rolling timeout interval.
  Returns
  Rolling timeout interval.
- **public long getScaleTimeout()**
  Obtain the scaling timeout interval.
  Returns
  Scaling timeout interval.
- **public String getSecretKey()**
  Obtain the SecretKey of the request signature. Requests for which AccessKey and SecretKey are set use the https://support.huaweicloud.com/en-us/devg-apisign/api-sign-algorithm.html for signing.
  Returns

SecretKey of the request signature.

- **public okhttp3.TlsVersion[] getTlsVersions()**
  Obtain the TLS version.
  Returns
  TLS version.
- **public String getUrl()**
  Obtain the URL.
  Returns
  URL.
- **public String getUserAgent()**
  Obtain the user agent.
  Returns
  User agent.
- **public long getWebsocketPingInterval()**
  Obtain the WebSocket heartbeat interval.
  Returns
  WebSocket heartbeat interval.
- **public long getWebsocketTimeout()**
  Obtain the WebSocket timeout interval.
  Returns
  WebSocket timeout interval.
- **public boolean isRedirects()**
  Allow redirection or not.
  Returns
  true or false
- **public boolean isSsl()**
  Check whether HTTPS is used. The default value is **false**.
  Returns
  true or false
- **public boolean isSslRedirects()**
  Check whether to obtain the value of sslRedirects. The options are **true** and **false**.
  Returns
  Value of sslRedirects.
- **public boolean isTrustCerts()**
  Check whether all certificates are trusted.
  Returns
  All trusted certificates
- **public void setAccessKey(String accessKey)**
  Set the AccessKey of the request signature. Requests for which AccessKey and SecretKey are set use the https://support.huaweicloud.com/en-us/devg-apisign/api-sign-algorithm.html for signing.

Input Parameter

accessKey indicates the AccessKey of the request signature.

- **public void setBodyForm(Map<String,String> content)**
  Set the HTTP request content of the map type.
  Input Parameter
  content indicates the HTTP request content.
- **public void setBodyText(String content)**
  Set the HTTP request content of the string type.
  Input Parameter
  content indicates the HTTP request content.
- **public void setCaCertData(String caCertData)**
  Set the CA certificate.
  Input Parameter
  caCertData indicates the CA certificate.
- **public void setCharset(String charset)**
  Set the HTTP request encoding format.
  Input Parameter
  charset indicates the encoding format of the HTTP request.
- **public void setClientCertData(String clientCertData)**
  Set a client certificate.
  Input Parameter
  clientCertData indicates a client certificate.
- **public void setClientKeyAlgo(String clientKeyAlgo)**
  Set the encryption algorithm of the client private key.
  Input Parameter
  clientKeyAlgo indicates the encryption algorithm of the client private key.
- **public void setClientKeyData(String clientKeyData)**
  Set a client private key.
  Input Parameter
  clientKeyData indicates a client private key.
- **public void setClientKeyPassphrase(String clientKeyPassphrase)**
  Set the password of a client private key.
  Input Parameter
  clientKeyPassphrase indicates the password of a client private key.
- **public void setConnectionTimeout(int connectionTimeout)**
  Set the connection timeout interval.
  Input Parameter
  connectionTimeout indicates the connection timeout interval.
- **public void setConnectTimeout(int connectTimeout)**
  Set the connection timeout interval.
  Input Parameter

connectTimeout indicates the connection timeout interval.

- **public void setContent(Object content)**
  Set the HTTP request content of the string and file types.
  Input Parameter
  content indicates the HTTP request content.
- **public void setContentType(String contentType)**
  Set the content type of an HTTP request.
  Input Parameter
  contentType indicates the content type of an HTTP request.
- **public void setHeader(String name, String value)**
  Set the request header.
  Input Parameter
  – **name** indicates the request header name.
  – **value** indicates the request header value.
- **public void setHeader(String name, String[] value)**
  Set the request header.
  Input Parameter
  – **name** indicates the request header name.
  – **value** indicates the request header value.
- **public void setHeaders(Map<String,String> headers)**
  Set the request header.
  Input Parameter
  headers indicates the request header information.
- **public void setHeaderValues(Map<String,String[]> headers)**
  Set the request header.
  Input Parameter
  headers indicates the request header information.
- **public void setHttpProxy(String httpProxy)**
  Set the HTTP proxy.
  Input Parameter
  httpProxy indicates the HTTP proxy.
- **public void setHttpsProxy(String httpsProxy)**
  Set the HTTPS proxy.
  Input Parameter
  httpsProxy indicates the HTTPS proxy.
- **public void setMaxConcurrentRequests(int maxConcurrentRequests)**
  Set the maximum number of concurrent requests.
  Input Parameter
  maxConcurrentRequests:
- **public void setMaxConcurrentRequestsPerHost(int maxConcurrentRequestsPerHost**

Set the maximum number of concurrent requests per host.

Input Parameter

maxConcurrentRequestsPerHost:

- **public void setMethod(String method)**
  Set the HTTP method.
  Input Parameter
  method indicates the HTTP method.
- **public void setNoProxy(String[] noProxy)**
  Set a list of IP addresses that do not use the proxy.
  Input Parameter
  noProxy indicates a list of IP addresses that do not use the proxy.
- **public void setParameter(String name, String value)**
  Set the HTTP request parameters.
  Input Parameter
  - **name** indicates the name of an HTTP request parameter.
  - **value** indicates the value of an HTTP request parameter.
- **public void setParameters(Map<String,String> parameters)**
  Set the HTTP request parameters.
  Input Parameter
  parameters indicates the HTTP request parameters.
- **public void setProxyPassword(String proxyPassword)**
  Set a proxy password.
  Input Parameter
  proxyPassword indicates the proxy password.
- **public void setProxyUsername(String proxyUsername)**
  Set a proxy username.
  Input Parameter
  proxyUsername indicates the proxy username.
- **public void setRedirects(boolean redirects)**
  Set whether redirection is allowed.
  Input Parameter
  redirects indicates whether redirection is allowed.
- **public void setRequestId(String requestId)**
  Set the request ID.
  Input Parameter
  requestId indicates the request ID.
- **public void setRequestTimeout(int requestTimeout)**
  Set the request timeout interval.
  Input Parameter
  requestTimeout indicates the request timeout interval.

- **public void setRollingTimeout(long rollingTimeout)**

  Set the rolling timeout interval.

  Input Parameter

  rollingTimeout indicates the rolling timeout interval.
- **public void setScaleTimeout(long scaleTimeout)**

  Set the scaling timeout interval.

  Input Parameter

  scaleTimeout indicates the scale timeout interval.
- **public void setSecretKey(String secretKey)**

  Set the SecretKey of the request signature. Requests for which AccessKey and SecretKey are set use the https://support.huaweicloud.com/en-us/devg-apisign/api-sign-algorithm.html for signing.

  Input Parameter

  secretKey indicates the SecretKey of the request signature.
- **public void setSsl(boolean ssl)**

  Set whether HTTPS is used.

  Input Parameter

  ssl indicates whether HTTPS is used.
- **public void setSslRedirects(boolean sslRedirects)**

  Set whether to obtain the value of sslRedirects. The options are **true** and **false**.

  Input Parameter

  sslRedirects indicates whether sslRedirects is set.
- **public void setTlsVersions(okhttp3.TlsVersion[] tlsVersions)**

  Set the TLS version.

  Input Parameter

  tlsVersions indicates the TLS version.
- **public void setTrustCerts(boolean trustCerts)**

  Set whether all certificates are trusted.

  Input Parameter

  trustCerts indicates whether all certificates are trusted.
- **public void setUrl(String url)**

  Set the URL.

  Input Parameter

  url indicates the URL.
- **public void setUserAgent(String userAgent)**

  Set the user agent.

  Input Parameter

  userAgent indicates the user agent.
- **public void setWebsocketPingInterval(long websocketPingInterval)**

  Set the WebSocket heartbeat interval.

Input Parameter

websocketPingInterval indicates the WebSocket heartbeat interval.

- **public void setWebsocketTimeout(long websocketTimeout)**

  Set the WebSocket timeout interval.

  Input Parameter

  websocketTimeout indicates the WebSocket timeout interval.

1.5.12 JedisConfig

Path

com.roma.apic.livedata.config.v1.JedisConfig

Description

This class is used together with **RedisClient** to configure the Redis connection.

Example

```
importClass(com.roma.apic.livedata.client.v1.RedisClient);
importClass(com.roma.apic.livedata.config.v1.JedisConfig);
function execute(data) {
    var config = new JedisConfig();
    config.setIp(["1.1.1.1"]);
    config.setPort(["6379"]);
    config.setMode("SINGLE");
    var redisClient = new RedisClient(config);
    var count = redisClient.get("visit_count")
    if (!count)
    {
        redisClient.put("visit_count", 1);
    }else {
        redisClient.put("visit_count", parseInt(count) + 1);
    }
    return redisClient.get("visit_count");
}
```

Constructor Details

public JedisConfig()

Constructs a JedisConfig without parameters.

Method List

Returned Type	Method and Description
int	**getDatabase**() Obtain the Jedis database. The default value is **0**.
String[]	**getIp**() Obtain the IP address list of the Redis.

Returned Type	Method and Description
String	**getMaster**() Obtain the master name of the Jedis. This parameter is valid when **mode** is set to **MASTER_SLAVE**.
int	**getMaxAttempts**() Obtain the number of retry times of the Jedis. The default value is **10000**.
int	**getMaxIdel**() Obtain the maximum number of idle connections in the Jedis connection pool. The default value is **5**.
int	**getMaxWait**() Obtain the upper limit of the waiting time when the Jedis connection pool is exhausted. The default value is **60**.
String	**getMode**() Obtain the Jedis type. The value can be **SINGLE**, **CLUSTER**, or **MASTER_SLAVE**.
String	**getPassPhrase**() Obtain the password of the Jedis.
String[]	**getPort**() Obtain all port numbers.
int	**getSoTimeout**() Obtain the read timeout interval of the Jedis. The default value is **600**.
int	**getTimeout**() Obtain the timeout interval of the Jedis. The default value is **1000**.
void	**setDatabase**(int database) Set the database of the Jedis.
void	**setIp**(String[] ip) Set the IP address.
void	**setMaster**(String master) Set the master name of the Jedis. This parameter is valid when **mode** is set to **MASTER_SLAVE**.
void	**setMaxAttempts**(int maxAttempts) Set the number of retries of the Jedis. The default value is **10000**.

Returned Type	Method and Description
void	**setMaxIdel**(int maxIdel) Set the maximum number of idle connections in the Jedis connection pool. The default value is **5**.
void	**setMaxWait**(int maxWait) Set the upper limit of the waiting time when the Jedis connection pool is exhausted. The default value is **60**.
void	**setMode**(String mode) Set the Jedis type. The value can be **SINGLE**, **CLUSTER**, or **MASTER_SLAVE**.
void	**setPassPhrase**(String passPhrase) Set the password of the Jedis.
void	**setPort**(String[] port) Set the port number.
void	**setSoTimeout**(int soTimeout) Set the read timeout interval of the Jedis.
void	**setTimeout**(int timeout) Set the timeout interval of the Jedis.

Method Details

- **public int getDatabase()**

  Obtain the Redis database. The default value is **0**.

  Returns

  Database.
- **public String[] getIp()**

  Obtain all IP addresses.

  Returns

  String array of IP addresses.
- **public String getMaster()**

  Obtain the master name of the Redis. This parameter is valid when **mode** is set to **MASTER_SLAVE**.

  Returns

  Master name.
- **public int getMaxAttempts()**

  Obtain the number of retry times of the Redis. The default value is **10000**.

  Returns

  Number of retry times.
- **public int getMaxIdel()**

Obtain the maximum number of idle connections in the Jedis connection pool. The default value is **5**.

Returns

Maximum number of idle connections in the connection pool.

- **public int getMaxWait()**

  Obtain the upper limit of the waiting time when the Jedis connection pool is exhausted. The default value is **60**.

  Returns

  Upper limit of the waiting time when the connection pool is exhausted.

- **public String getMode()**

  Obtain the Redis type. The value can be **SINGLE**, **CLUSTER**, or **MASTER_SLAVE**.

  Returns

  Redis type.

- **public String getPassPhrase()**

  Obtain the password of the Redis.

  Returns

  Redis password.

- **public String[] getPort()**

  Obtain all port numbers.

  Returns

  String array of port numbers.

- **public int getSoTimeout()**

  Obtain the read timeout interval of the Jedis. The default value is **600**.

  Returns

  Value of soTimeout.

- **public int getTimeout()**

  Obtain the timeout interval of the Jedis. The default value is **1000**.

  Returns

  Timeout interval.

- **public void setDatabase(int database)**

  Set the database of the Redis.

  Input Parameter

  database indicates a database.

- **public void setIp(String[] ip)**

  Set the IP address.

  Input Parameter

  ip indicates an IP address.

- **public void setMaster(String master)**

  Set the master name of the Redis. This parameter is valid when **mode** is set to **MASTER_SLAVE**.

  Input Parameter

master indicates the master name of the Redis.

- **public void setMaxAttempts(int maxAttempts)**

  Set the number of retries of the Jedis.

  Input Parameter

  maxAttempts indicates the number of retries.

- **public void setMaxIdel(int maxIdel)**

  Set the maximum number of idle connections in the Jedis connection pool. The default value is **5**.

  Input Parameter

  maxIdel indicates the maximum number of idle connections in the connection pool.

- **public void setMaxWait(int maxWait)**

  Set the upper limit of the waiting time when the Jedis connection pool is exhausted. The default value is **60**.

  Input Parameter

  maxWait indicates the upper limit of the waiting time when the connection pool is exhausted.

- **public void setMode(String mode)**

  Set the Redis type. The value can be **SINGLE**, **CLUSTER**, or **MASTER_SLAVE**.

  Input Parameter

  mode indicates the type.

- **public void setPassPhrase(String passPhrase)**

  Set the password of the Redis.

  Input Parameter

  passPhrase indicates the password.

- **public void setPort(String[] port)**

  Set the port number.

  Input Parameter

  port indicates the port number.

- **public void setSoTimeout(int soTimeout)**

  Set the read timeout interval of the Jedis. The default value is **600**.

  Input Parameter

  soTimeout indicates the read timeout interval.

- **public void setTimeout(int timeout)**

  Set the timeout interval of the Jedis.

  Input Parameter

  timeout indicates the timeout interval.

1.5.13 JSON2XMLHelper

Path

com.huawei.livedata.util.JSON2XMLHelper

Description

This class is used to perform conversion between JSON and XML.

Method List

Returned Type	Method and Description
static String	**JSON2XML**(String json, boolean returnFormat) Convert from JSON to XML.
static String	**XML2JSON**(String xml) Convert from XML to JSON.

Method Details

- **public static String JSON2XML(String json, boolean returnFormat)**

  Convert from JSON to XML.

  Input Parameter

  – **json** indicates a character string in JSON format.

  – **returnFormat** indicates the return format.

  Returns

  Character string in the XML format.

- **public static String XML2JSON(String xml)**

  Convert from XML to JSON.

  Input Parameter

  xml indicates a character string in XML format.

  Returns

  Character string in the XML format.

1.5.14 JSONHelper

Path

com.huawei.livedata.lambdaservice.util.JSONHelper

Description

This class is used to perform conversion between JSON and XML and between JSON and Map.

Method List

Returned Type	Method and Description
static String	**json2Xml**(String json) Convert from JSON to XML.
static String	**xml2Json**(String xml) Convert from XML to JSON.
static String	**json2XmlWithoutType**(String json) Convert from JSON to XML.
static HashMap	**jsonToMap**(String json) Convert from JSON to Map.

Method Details

- **public static String json2Xml(String json)**

  Convert from JSON to XML.

  Input Parameter

  json indicates a character string in JSON format.

  Returns

  Character string in the XML format.
- **public static String xml2Json(String xml)**

  Convert from XML to JSON.

  Input Parameter

  xml indicates a character string in XML format.

  Returns

  Character string in the JSON format.
- **public static String json2XmlWithoutType(String json)**

  Convert from JSON to XML.

  Input Parameter

  json indicates a character string in JSON format.

  Returns

  Character string in the XML format.
- **public static HashMap jsonToMap(String json)**

  Convert from JSON to Map.

  Input Parameter

  json indicates a character string in JSON format.

  Returns

  Character string in the Map format.

1.5.15 JsonUtils

Path

com.roma.apic.livedata.common.v1.JsonUtils

Description

This class is used to provide the conversion between JSON and objects and between JSON and XML.

Example

```
importClass(com.roma.apic.livedata.common.v1.JsonUtils);
function execute(data) {
    return JsonUtils.convertJsonToXml('{"a":1}')
}
```

Method List

Returned Type	Method and Description
static String	**convertJsonToXml**(String json) Convert JSON into XML.
static String	**convertJsonToXml**(String json, String rootName) Convert JSON into XML.
static <T> T	**toBean**(String json, Class<T> clazz) Convert JSON into an object.
static String	**toJson**(Object object) Convert an object to a character string in JSON format.
static String	**toJson**(Object object, Map<String,Object> config) Convert an object to a character string in JSON format and use the configuration in the config file. For example, you can set "date-format" in config to "yyyy-MM-dd HH:mm:ss".
static Map<String,Object>	**toMap**(String json) Convert JSON into MAP.

Method Details

- **public static String convertJsonToXml(String json)**

  Convert JSON into XML.

  Input Parameter

  json indicates a character string in JSON format.

Returns

Character string in XML format

Throws

java.lang.Exception

- **public static String convertJsonToXml(String json, String rootName)**

  Convert JSON into XML.

  Input Parameter

  – **json** indicates a character string in JSON format.

  – **rootName** indicates the root node name of the XML file.

  Returns

  Character string in XML format

  Throws

  java.lang.Exception

- **public static <T> T toBean(String json, Class<T> clazz)**

  Convert JSON into an object.

  Input Parameter

  – **json** indicates a character string in JSON format.

  – **clazz** indicates the class.

  Returns

  Class object.

  Throws

  java.lang.Exception

- **public static String toJson(Object object)**

  Convert an object to a character string in JSON format.

  Input Parameter

  object indicates an object.

  Returns

  Character string in JSON format obtained after conversion.

  Throws

  java.lang.Exception

- **public static String toJson(Object object, Map<String,Object> config)**

  Convert an object to a character string in JSON format and use the configuration in the config file.

  For example, you can set "date-format" in config to "yyyy-MM-dd HH:mm:ss".

  Input Parameter

  – **object** indicates an object.

  – **config** indicates the configuration used for conversion.

  Returns

  Character string in JSON format obtained after conversion.

  Throws

  java.lang.Exception

- **public static Map<String,Object> toMap(String json)**
  Convert JSON into MAP.
  Input Parameter
  json indicates a character string in JSON format.
  Returns
  Character string in MAP format.
  Throws
  java.lang.Exception

1.5.16 JWTUtils

Path

com.huawei.livedata.util.JWTUtils

Description

This class is used to generate an SHA256 signature.

Method List

Returned Type	Method and Description
static String	createToken(String appId, String appKey, String timestamp) Generate SHA256 signature.

Method Details

public static String createToken(String appId, String appKey, String timestamp)

Generate SHA256 signature.

Input Parameter

- **appId** indicates the integration application ID.
- **appKey** indicates the key of the integration application.
- **timestamp** indicates the timestamp.

Returns

SHA256 signature.

1.5.17 KafkaConsumer

Path

com.roma.apic.livedata.client.v1.KafkaConsumer

Description

This class is used to consume Kafka messages.

Example

```
importClass(com.roma.apic.livedata.client.v1.KafkaConsumer);
importClass(com.roma.apic.livedata.config.v1.KafkaConfig);

var kafka_brokers = '1.1.1.1:26330,2.2.2.2:26330'
var topic = 'YourKafkaTopic'
var group = 'YourKafkaGroupId'

function execute(data) {
    var config = KafkaConfig.getConfig(kafka_brokers, group)
    var consumer = new KafkaConsumer(config)
    var records = consumer.consume(topic, 5000, 10);
    var res = []
    var iter = records.iterator()
    while (iter.hasNext()) {
        res.push(iter.next())
    }
    return JSON.stringify(res);
}
```

Constructor Details

public KafkaConsumer(Map configs)

Constructs a Kafka message consumer.

Parameter: **configs** indicates configuration information of the Kafka.

Method List

Returned Type	Method and Description
List<String>	**consume**(String topic, long timeout, long maxItems) Consume messages.

Method Details

- **public List<String> consume(String topic, long timeout, long maxItems)**

  Consume messages.

  Input Parameter

  - **topic** indicates a message queue.
  - **timeout** indicates the read timeout interval.
  - **maxItems** indicates the maximum number of messages that can be read.

  Returns

  Message array that has been consumed by Kafka. The content of multiple messages forms an array.

1.5.18 KafkaProducer

Path

com.roma.apic.livedata.client.v1.KafkaProducer

Description

This class is used to produce Kafka messages.

Example

```
importClass(com.roma.apic.livedata.client.v1.KafkaProducer);
importClass(com.roma.apic.livedata.config.v1.KafkaConfig);

var kafka_brokers = '1.1.1.1:26330,2.2.2.2:26330'
var topic = 'YourKafkaTopic'

function execute(data) {
    var config = KafkaConfig.getConfig(kafka_brokers, null)
    var producer = new KafkaProducer(config)
    var record = producer.produce(topic, "hello, kafka.")
    return {
        offset: record.offset(),
        partition: record.partition(),
        code: 0,
        message: "OK"
    }
}
```

Constructor Details

public KafkaProducer(Map configs)

Constructs a Kafka message producer.

Parameter: **configs** indicates configuration information of the Kafka.

Method List

Returned Type	Method and Description
org.apache.kafka.clients.producer.RecordMetadata	produce(String topic, String message) Produce messages.

NOTE

The produce(String topic, String message) method cannot be directly returned. Otherwise, the returned information is empty. For example, do not use the **return record** statement directly in the preceding example. Otherwise, the returned information is empty.

Method Details

- **public org.apache.kafka.clients.producer.RecordMetadata produce(String topic, String message)**

Produce messages.

Input Parameter

- **topic** indicates a message queue.
- **message** indicates the message content.

Returns

Message record.

1.5.19 KafkaConfig

Path

com.roma.apic.livedata.config.v1.KafkaConfig

extends

java.util.Properties

Description

This class is used together with **KafkaProducer** or **KafkaConsumer** to configure a Kafka client.

Constructor Details

public KafkaConfig()

Constructs a KafkaConfig without parameters.

Method List

Returned Type	Method and Description
static **KafkaConfig**	**getConfig**(String servers, String groupId) Obtain a configuration for accessing Kafka provided by MQS (with sasl_ssl disabled). For details, see **MQS Developer Guide**.
static **KafkaConfig**	**getSaslConfig**(String servers, String groupId, String username, String password) Obtain a configuration for accessing Kafka provided by MQS (with sasl_ssl enabled). For details, see **MQS Developer Guide**.

Method Details

- **public static KafkaConfig getConfig(String servers, String groupId)**

  Access Kafka provided by MQS (with sasl_ssl disabled). For details, see **MQS Developer Guide**.

  Input Parameter

  - **servers** indicates the bootstrap server information in kafkaConfig.
  - **groupId** indicates the group ID in kafkaConfig.

  Returns

  KafkaConfig object.

- **public static KafkaConfig getSaslConfig(String servers, String groupId, String username, String password)**

  Access Kafka provided by MQS (with sasl_ssl enabled). For details, see **MQS Developer Guide**.

  Input Parameter

  - **servers** indicates the bootstrap server information in kafkaConfig.
  - **groupId** indicates the group ID in kafkaConfig.
  - **username** indicates the username.
  - **password** indicates the password.

  Returns

  KafkaConfig object.

1.5.20 MD5Encoder

Path

com.huawei.livedata.lambdaservice.util.MD5Encoder

Description

This class is used to calculate the MD5 value.

Method List

Returned Type	Method and Description
static String	md5(String source) Calculate the MD5 value of a character string.

Method Details

public static String md5(String source)

Calculate the MD5 value of a character string.

Input Parameter

source indicates the character string for which the MD5 value needs to be calculated.

Returns

MD5 value of a character string.

1.5.21 Md5Utils

Path

com.roma.apic.livedata.common.v1.Md5Utils

Description

This class is used to calculate the MD5 value.

Example

```
importClass(com.roma.apic.livedata.common.v1.Md5Utils);
function execute(data) {
    var sourceCode = "Hello world!";
    return Md5Utils.encode(sourceCode);
}
```

Method List

Returned Type	Method and Description
static String	**encode**(String content) Calculate the MD5 value of a character string.

Method Details

- **public static String encode(String content)**

  Calculate the MD5 value of a character string.

  Input Parameter

  content: character string whose MD5 is to be calculated.

  Returns

  MD5 value of a character string.

1.5.22 ObjectUtils

Path

com.roma.apic.livedata.common.v1.ObjectUtils

Description

This class is used to serialize a Java object into a byte array or deserialize a Java object from a byte array.

Example

```
importClass(com.roma.apic.livedata.common.v1.ObjectUtils);
function execute(data) {
    var sourceCode = "Hello world";
    var bytes = ObjectUtils.getBytes(sourceCode);
```



```
    return ObjectUtils.getObjectFromBytes(bytes)
}
```

Method List

Returned Type	Method and Description
static byte[]	**getBytes**(Object obj) Serialize objects into byte arrays.
static Object	**getObjectFromBytes**(byte[] objBytes) Deserialize byte arrays into objects.
static int	**size**(Object obj) Obtains the size of an object.

Method Details

- **public static byte[] getBytes(Object obj)**
  Serialize objects into byte arrays.
  Input Parameter
  obj indicates an object.
  Returns
  Byte array serialized from an object.
  Throws
  java.io.IOException
- **public static Object getObjectFromBytes(byte[] objBytes)**
  Deserialize byte arrays into objects.
  Input Parameter
  objBytes indicates a byte array.
  Returns
  Serialized object.
  Throws
  java.io.IOException
- **public static int size(Object obj)**
  Obtain the size of an object.
  Input Parameter
  obj indicates an object.
  Returns
  Size of the object.

1.5.23 QueueConfig

Path

com.roma.apic.livedata.config.v1.QueueConfig

Description

This class is used with **RabbitMqConfig** and **RabbitMqProducer** to configure a queue.

Constructor Details

public QueueConfig(String queueName, boolean durable, boolean exclusive, boolean autoDelete, Map<String, Object> arguments)

Constructs a queue configuration.

Parameters:

- **queueName** indicates the queue name.
- **durable** indicates whether persistency is supported. The value **true** indicates persistency is supported, and the value **false** indicates that persistency is not supported.
- **exclusive** indicates whether a queue is exclusive. The value **true** indicates that a queue is exclusive, that is, a queue can be consumed by only one consumer.
- **autoDelete** indicates whether automatic deletion is supported. The value **true** indicates that automatic deletion is supported.
- **arguments** indicates other attributes.

1.5.24 RabbitMqConfig

Path

com.roma.apic.livedata.config.v1.RabbitMqConfig

Description

This class is used with **ConnectionConfig**, **QueueConfig**, **ExchangeConfig**, and **RabbitMqProducer** to configure a RabbitMQ client.

Constructor Details

public RabbitMqConfig(ConnectionConfig connectionConfig, QueueConfig queueConfig, ExchangeConfig exchangeConfig)

Constructs a RabbitMQ client configuration.

Parameters:

- **connectionConfig** indicates the client connection configuration.
- **queueConfig** indicates the queue configuration.

- **exchangeConfig** indicates the switch configuration.

1.5.25 RabbitMqProducer

Path

com.roma.apic.livedata.client.v1.RabbitMqProducer

Description

This class is used to produce RabbitMQ messages. If no exception occurs during message sending, messages are sent successfully. If an exception occurs during message sending, messages fail to be sent.

Example

- Use the direct switch to generate messages and route the messages to the queue in which the bindingKey and routingKey are fully matched.

```
importClass(com.roma.apic.livedata.client.v1.RabbitMqProducer);
importClass(com.roma.apic.livedata.config.v1.RabbitMqConfig);
importClass(com.roma.apic.livedata.config.v1.QueueConfig);
importClass(com.roma.apic.livedata.config.v1.ExchangeConfig);
importClass(com.roma.apic.livedata.config.v1.ConnectionConfig);

function execute(data) {
    var connectionConfig = new ConnectionConfig("10.10.10.10", 5672, "admin", "123456");
    var queueConfig = new QueueConfig("directQueue", false, false, false, null);
    var exchangeConfig = new ExchangeConfig("directExchange", "direct", true, false, false, null);
    var config = new RabbitMqConfig(connectionConfig, queueConfig, exchangeConfig);

    var producer = new RabbitMqProducer(config);
    producer.produceWithDirectExchange("direct.exchange", "PERSISTENT_TEXT_PLAIN", "direct
exchange message");

    return "produce successful.";
}
```

- Use the topic switch to generate messages and route the messages to the queue in which the bindingKey and routingKey are matched in fuzzy mode.

```
importClass(com.roma.apic.livedata.client.v1.RabbitMqProducer);
importClass(com.roma.apic.livedata.config.v1.RabbitMqConfig);
importClass(com.roma.apic.livedata.config.v1.QueueConfig);
importClass(com.roma.apic.livedata.config.v1.ExchangeConfig);
importClass(com.roma.apic.livedata.config.v1.ConnectionConfig);

function execute(data) {
    var connectionConfig = new ConnectionConfig("10.10.10.10", 5672, "admin", "123456");
    var queueConfig = new QueueConfig ("topicQueue", false, false, false, null);
    var exchangeConfig = new ExchangeConfig("topicExchange", "topic", true, false, false, null);
    var config = new RabbitMqConfig(connectionConfig, queueConfig, exchangeConfig);

    var producer = new RabbitMqProducer(config);
   producer.produceWithTopicExchange("topic.#", "topic.A", null, "message");
    return "produce successful.";
}
```

- Use the fanout switch to generate messages and route all messages sent to the exchange to all the queues bound to it.

```
importClass(com.roma.apic.livedata.client.v1.RabbitMqProducer);
importClass(com.roma.apic.livedata.config.v1.RabbitMqConfig);
importClass(com.roma.apic.livedata.config.v1.QueueConfig);
importClass(com.roma.apic.livedata.config.v1.ExchangeConfig);
importClass(com.roma.apic.livedata.config.v1.ConnectionConfig);
```



```
function execute(data) {
    var connectionConfig = new ConnectionConfig("10.10.10.10", 5672, "admin", "123456");
    var queueConfig = new QueueConfig ("fanoutQueue", false, false, false, null);
    var exchangeConfig = new ExchangeConfig ("fanoutExchange", "fanout", true, false, null)
    var config = new RabbitMqConfig(connectionConfig, queueConfig, exchangeConfig);

    var producer = new RabbitMqProducer(config);
    producer.produceWithFanoutExchange(null, "message")

    return "produce successfull"
}
```

Constructor Details

public RabbitMqProducer(RabbitMqConfig rabbitMqConfig)

Constructs a RabbitMQ message producer.

Parameter: **rabbitMqConfig** indicates configuration information of rabbitMqConfig.

Method List

Returned Type	Method and Description
void	**produceWithDirectExchange**(String routingKey, String props, String message) Use the direct switch to generate messages and route the messages to the queue in which the bindingKey and routingKey are fully matched.
void	**produceWithTopicExchange**(String bindingKey, String routingKey, String props, String message) Use the topic switch to generate messages and route the messages to the queue in which the bindingKey and routingKey are matched in fuzzy mode.
void	**produceWithFanoutExchange**(String props, String message) Use the fanout switch to generate messages and route all messages sent to the exchange to all the queues bound to it.

Method Details

- **public void produceWithDirectExchange(String routingKey, String props, String message)**

  Use the direct switch to generate messages and route the messages to the queue in which the bindingKey and routingKey are fully matched.

  Input Parameters

  - **routingKey** indicates the message routing key.
  - **props** indicates the message persistency setting, which is optional.
  - **message** indicates the message content.

- **public void produceWithTopicExchange(String bindingKey, String routingKey, String props, String message)**

  Use the topic switch to generate messages and route the messages to the queue in which the bindingKey and routingKey are matched in fuzzy mode.

  Input Parameters

  - **bindingKey** indicates the queue binding key.
  - **routingKey** indicates the message routing key.
  - **props** indicates the message persistency setting, which is optional.
  - **message** indicates the message content.

- **produceWithFanoutExchange(String props, String message)**

  Use the fanout switch to generate messages and route all messages sent to the exchange to all the queues bound to it.

  Input Parameters

  - **props** indicates the message persistency setting, which is optional.
  - **message** indicates the message content.

1.5.26 RedisClient

Path

com.roma.apic.livedata.client.v1.RedisClient

Description

This class is used to connect to the Redis or read the Redis cache. If JedisConfig is not specified, connect to the default Redis provided by the function API of the custom backend.

Example

```
importClass(com.roma.apic.livedata.client.v1.RedisClient);
function execute(data) {
    var redisClient = new RedisClient;
    var count = redisClient.get("visit_count")
    if (!count)
    {
        redisClient.put("visit_count", 1);
    }else {
        redisClient.put("visit_count", parseInt(count) + 1);
    }
    return redisClient.get("visit_count");
}
```

Constructor Details

public RedisClient()

Constructs a RedisClient and connects it to the default Redis provided by the function API (livedata) of the custom backend.

public RedisClient(JedisConfig jedisConfig)

Constructs a RedisClient by using jedisConfig.

Parameter: jedisConfig

Method List

Returned Type	Method and Description
String	**get**(String key) Obtain the value corresponding to the key in the Redis cache.
String	**put**(String key, int expireTime, String value) Update the Redis cache content and expiration time, and return the execution result.
String	**put**(String key, String value) Update the Redis cache content and return the execution result.
Long	**remove**(String key) Delete cached messages of a specified key value.

Method Details

- **public String get(String key)**

  Obtain the value corresponding to the key in the Redis cache.

  Input Parameter

  key indicates the key value.

  Returns

  Obtain the value corresponding to the key in the Redis cache.

- **public String put(String key, int expireTime, String value)**

  Update the Redis cache content and expiration time, and return the execution result.

  Input Parameter

  - **key** indicates the key value of the cache to be updated.
  - **expireTime** indicates the expiration time of the cache content to be updated.
  - **value** indicates the value of the cache to be updated.

  Returns

  Execution result.

- **public String put(String key, String value)**

  Update the Redis cache content and return the execution result.

  Input Parameter

  - **key** indicates the key value of the cache to be updated.
  - **value** indicates the value of the cache to be updated.

  Returns

Execution result.

- **public Long remove(String key)**
  Delete cached messages of a specified key value.
  Input Parameter
  key indicates the key value of the cache to be deleted.
  Returns
  Execution result.

1.5.27 RomaWebConfig

Path

com.huawei.livedata.lambdaservice.config.RomaWebConfig

Description

This class is used to obtain the ROMA configuration.

Method List

Returned Type	Method and Description
static String	getAppConfig(String key) Obtain the configuration of an integration application based on the config key.

Method Details

public

Obtain configurations based on the config key.

Input Parameter

key indicates the key of the integration application.

Returns

Configuration of the integration application.

1.5.28 RSAUtils

Path

com.roma.apic.livedata.common.v1.RSAUtils

Description

This class is used to provide the RSA encryption and decryption methods.

Constructor Details

public RSAUtils()

Constructs an RSAUtils without parameters.

Method List

Returned Type	Method and Description
static byte[]	**decodeBase64**(String base64) Decode a Base64 character string to binary data.
static byte[]	**decrypt**(java.security.PrivateKey privateKey, byte[] encryptData) Decrypt data using the RSA algorithm.
static String	**decrypt**(String source, java.security.interfaces.RSAPrivateKey privateKey) Decrypt data using the RSA algorithm.
static String	**encodeBase64**(byte[] bytes) Encode binary data to a Base64 character string.
static byte[]	**encrypt**(java.security.PublicKey publicKey, byte[] source) Encrypt data using the RSA algorithm.
static String	**encrypt**(String source, java.security.PublicKey publicKey) Encrypt data using the RSA algorithm.
static org.bouncycastle.jce.provider.BouncyCastleProvider	**getInstance**() Obtain the encryption algorithm provider.
static java.security.interfaces.RSAPrivateKey	**getPrivateKey**(byte[] privateKeyByte) Create the RSA private key by using the private key of the x509 format.
static java.security.interfaces.RSAPrivateKey	**getPrivateKey**(String privateKeyByte) Create the RSA private key by using the private key of the x509 format.
static java.security.interfaces.RSAPrivateKey	**getPrivateKey**(String modulus, String exponent) Create an RSA private key by using the modulus and exponent.
static java.security.interfaces.RSAPublicKey	**getPublicKey**(byte[] publicKeyByte) Create the RSA public key by using the private public of the x509 format.

Returned Type	Method and Description
static java.security.interfaces.RSAPublicKey	**getPublicKey**(String publicKeyByte) Create the RSA public key by using the private public of the x509 format.
static java.security.PublicKey	**getPublicKey**(String modulus, String exponent) Create an RSA public key by using the modulus and exponent.

Method Details

- **public static byte[] decodeBase64(String base64)**

  Decode a Base64 character string to binary data.

  Input Parameter

  base64 indicates the data encoded using Base64.

  Returns

  Data decoded by using Base64

  Throws

  Exception

- **public static byte[] decrypt(java.security.PrivateKey privateKey, byte[] encryptData)**

  Decrypt data using the RSA algorithm.

  Input Parameter

  - **privateKey** indicates a private key.
  - **encryptData** indicates the data to be decrypted.

  Returns

  Decrypted data.

  Throws

  - javax.crypto.IllegalBlockSizeException
  - javax.crypto.BadPaddingException
  - java.security.InvalidKeyException
  - java.security.NoSuchAlgorithmException
  - javax.crypto.NoSuchPaddingException

- **public static String encrypt(String source, java.security.interfaces.RSAPrivateKey privateKey)**

  Encrypt data using the RSA algorithm.

  Input Parameter

  - **source** indicates data to be encrypted.
  - **privateKey** indicates a private key.

  Returns

  Encrypted data.

- **public static String encodeBase64(byte[] bytes)**

  Encode binary data to a Base64 character string.

  Input Parameter

  bytes indicates data to be encoded.

  Returns

  Base64 encoding.

  Throws

  Exception

- **public static byte[] encrypt(java.security.PublicKey publicKey, byte[] source)**

  Encrypt data using the RSA algorithm.

  Input Parameter

  – **publicKey** indicates a public key.

  – **source** indicates data to be decrypted.

  Returns

  Encrypted data content.

  Throws

  Exception

- **public static String encrypt(String source, java.security.PublicKey publicKey)**

  Encrypt data using the RSA algorithm.

  Input Parameter

  – **source** indicates the content to be encrypted.

  – **publicKey** indicates a public key.

  Returns

  Encrypted data content.

  Throws

  Exception

- **public static org.bouncycastle.jce.provider.BouncyCastleProvider getInstance()**

  Obtain the encryption algorithm provider.

  Returns

  Encryption algorithm provider.

- **public static java.security.interfaces.RSAPrivateKey getPrivateKey(byte[] privateKeyByte)**

  Create the RSA private key by using the private key of the x509 format.

  Input Parameter

  privateKeyByte indicates the private key encoded in x509 format

  Returns

  Private key.

  Throws

  - java.security.spec.InvalidKeySpecException
  - java.security.NoSuchAlgorithmException
- **public static java.security.interfaces.RSAPrivateKey getPrivateKey(String privateKeyByte)**

  Create the RSA private key by using the private key of the x509 format.

  Input Parameter

  privateKeyByte indicates the private key encoded in x509 format

  Returns

  Private key.

  Throws

  Exception
- **public static java.security.interfaces.RSAPrivateKey getPrivateKey(String modulus, String exponent)**

  Create an RSA private key by using the modulus and exponent.

  Input Parameter

  - **modulus** indicates the modulus required for generating a private key.
  - **exponent** indicates the exponent required for generating a private key.

  Returns

  RSA private key.
- **public static java.security.interfaces.RSAPublicKey getPublicKey(byte[] publicKeyByte)**

  Create the RSA public key by using the private public encoded in x509 format.

  Input Parameter

  publicKeyByte indicates the public key encoded in x509 format.

  Returns

  Public key.

  Throws

  - java.security.NoSuchAlgorithmException
  - java.security.spec.InvalidKeySpecException
- **public static java.security.PublicKey getPublicKey(String modulus, String exponent)**

  Create an RSA public key by using the modulus and exponent.

  Input Parameter

  - **modulus** indicates the modulus required for generating a public key.
  - **exponent** indicates the exponent required for generating a public key.

  Returns

  RSA public key.

1.5.29 SapRfcClient

Path

com.roma.apic.livedata.client.v1.SapRfcClient

Description

This class is used to access SAP functions in RFC mode.

Example

```
importClass(com.roma.apic.livedata.client.v1.SapRfcClient);
importClass(com.roma.apic.livedata.config.v1.SapRfcConfig);

function execute(data) {
    var config = new SapRfcConfig();
    config.put("jco.client.ashost", "10.95.152.107");//Server
    config.put("jco.client.sysnr", "00"); //Instance ID
    config.put("jco.client.client", "400"); //SAP group
    config.put("jco.client.user", "SAPIDES");//SAP username
    config.put("jco.client.passwd", "****");//Password
    config.put("jco.client.lang", "zh");//Login language
    config.put("jco.destination.pool_capacity", "3");//Maximum number of connections
    config.put("jco.destination.peak_limit", "10");//Maximum number of connection threads
    var client = new SapRfcClient(config);
    var res = client.executeFunction("FUNCTION1", {
        "A":"200",
        "B":"2",
    })
    return res
}
```

Constructor Details

public SapRfcClient(SapRfcConfig config)

Constructs a SapRfcClient that contains the **SapRfcConfig** configuration information.

Parameter: **config** indicates the SapRfcClient configuration information.

Method List

Returned Type	Method and Description
Map<String, Object>	**executeFunction**(String functionName, Map<String, Object> params) Access SAP functions in RFC mode.

Method Details

- **executeFunction(String functionName, Map<String, Object> params)**

  Access SAP functions in RFC mode.

  Input Parameter

  - **functionName** indicates a function name.
  - **params** indicates the input parameters of the SAP function.

  Returns

  Output parameters of the SAP function.

1.5.30 SapRfcConfig

Path

com.roma.apic.livedata.config.v1.SapRfcConfig

extends

java.util.Properties

Description

This class is used together with **SapRfcClient** to configure the SAP client.

Method List

Returned Type	Method and Description
Object	**put**(String key, Object value) Set configuration parameters.

Method Details

- **public Object put(String key, Object value)**

  Set configuration parameters.

  Input Parameter

  - **key** indicates the key in configuration information.
  - **value** indicates the key value in configuration information.

    The following configurations are supported:

    - jco.client.ashost: SAP server IP address
    - jco.client.sysnr: system ID
    - jco.client.client: SAP group
    - jco.client.user: SAP username
    - jco.client.passwd: password
    - jco.client.lang: login language
    - jco.destination.pool_capacity: maximum number of connections
    - jco.destination.peak_limit: maximum number of connection threads
    - apic.async: indicates whether asynchronous calling is used. The value **true** indicates asynchronous calling, and the value **false** indicates synchronous calling. The default value is **false**.

  Returns

  Key values.

1.5.31 SoapClient

Path

com.roma.apic.livedata.client.v1.SoapClient

Example

```
importClass(com.roma.apic.livedata.client.v1.SoapClient);
importClass(com.roma.apic.livedata.config.v1.SoapConfig);
importClass(com.roma.apic.livedata.common.v1.XmlUtils);

function execute(data) {
    var soap = new SoapConfig();
    soap.setUrl("http://test.webservice.com/ws");
    soap.setNamespace("http://spring.io/guides/gs-producing-web-service");
    soap.setOperation("getCountryRequest");

    soap.setNamespacePrefix("ser");
    soap.setBodyPrefix("ser");
    soap.setEnvelopePrefix("soapenv");
    var content = {
        "getCountryRequest": {
            "ser:name": "Spain"
        },
    };
    soap.setContent(content);

    var client = new SoapClient(soap);
    var result = client.execute();
    var body = result.getBody();

    return XmlUtils.toJson(body);
}
```

Constructor Details

SoapClient(SoapConfig soapCfg)

public SoapClient(**SoapConfig** soapCfg):

Method List

Returned Type	Method and Description
okhttp3.Response	**request**(**HttpConfig** config) Sends REST requests.

1.5.32 SoapConfig

Path

com.roma.apic.livedata.config.v1.SoapConfig

Constructor Details

public SoapConfig()

Constructs a SoapConfig without parameters.

Method List

Returned Type	Method and Description
String	**buildSoapMessage**() Construct a SOAP request packet.
String	**getBodyPrefix**() Obtain the node prefix of a request packet.
String	**getCharset**() Obtain the HTTP request encoding format.
int	**getConnectTimeout**() Obtain the connection timeout interval.
Object	**getContent**() Obtain the request content.
String	**getContentType**() Obtain the packet parameter type.
String	**getEnvelopePrefix**() Obtain the envelope prefix.
String	**getHeader**(String name) Obtain the request header value based on the request header name.
Map<String,String>	**getHeaders**() Obtain request header information.
String	**getMethod**() Obtain the request method.
String	**getNamespace**() Obtain the namespace.
String	**getNamespacePrefix**() Obtain the namespace prefix.
String	**getOperation**() Obtain the operation name.
String	**getParameter**(String name) Obtain SOAP request parameters based on the specified name.

Returned Type	Method and Description
Map<String,String>	**getParameters**() Obtains the SOAP request parameters.
String	**getProtocol**() Obtain the request protocol.
int	**getReadTimeout**() Obtain the read timeout.
String	**getSoapAction**() Obtain the operation request address.
String	**getUrl**() Obtain the request address.
boolean	**isRedirects**() Allow redirection or not.
void	**setBodyPrefix**(String bodyPrefix) Set the node prefix of a request packet.
void	**setCharset**(String charset) Set the HTTP request encoding format.
void	**setConnectTimeout**(int connectTimeout) Set the connection timeout interval.
void	**setContent**(Object content) Set the request content.
void	**setContentType**(String contentType) Set the packet parameter type.
void	**setEnvelopePrefix**(String envelopePrefix) Set the envelope prefix.
void	**setHeader**(String name, String value) Set request header information.
void	**setHeaders**(Map<String,String> headers) Set request header information.
void	**setMethod**(String method) Set the request method.
void	**setNamespace**(String namespace) Set the namespace.
void	**setNamespacePrefix**(String namespacePrefix) Set the namespace prefix.

Returned Type	Method and Description
void	**setOperation**(String operation) Set the operation name.
void	**setParameter**(String name, String value) Set a SOAP request parameter.
void	**setParameters**(Map<String,String> parameters) Set the SOAP request parameters.
void	**setProtocol**(String protocol) Set the request protocol.
void	**setReadTimeout**(int readTimeout) Set the read timeout.
void	**setRedirects**(boolean redirects) Set whether to redirect.
void	**setSoapAction**(String soapAction) Set the operation request address.
void	**setUrl**(String url) Set the request address.

Method Details

- **public String buildSoapMessage()**
  Construct a SOAP request packet.
  Returns
  SOAP request packet.
  Throws
  Exception
- **public String getBodyPrefix()**
  Obtain the node prefix of a request packet.
  Returns
  Node prefix of a request packet.
- **public String getCharset()**
  Obtain the HTTP request encoding format.
  Returns
  HTTP request encoding format.
- **public int getConnectTimeout()**
  Obtain the connection timeout interval.
  Returns
  Connection timeout.

- **public Object getContent()**
  Obtain the request content.
  Returns
  Request content.
- **public String getContentType()**
  Obtain the packet parameter type.
  Returns
  Packet parameter type.
- **public String getEnvelopePrefix()**
  Obtain the envelope prefix.
  Returns
  Envelope prefix.
- **public String getHeader(String name)**
  Obtain the request header value based on the request header name.
  Input Parameter
  name indicates the request header name.
  Returns
  Request header value corresponding to the request header name
- **public Map<String,String> getHeaders()**
  Obtain request header information.
  Returns
  Request header information.
- **public String getMethod()**
  Obtain the request method.
  Returns
  Request method.
- **public String getNamespace()**
  Obtain the namespace.
  Returns
  Namespace.
- **public String getNamespacePrefix()**
  Obtain the namespace prefix.
  Returns
  Namespace prefix.
- **public String getOperation()**
  Obtain the operation name.
  Returns
  Operation name.
- **public String getParameter(String name)**
  Obtain SOAP request parameters based on the specified name.
  Input Parameter

name indicates the name of a SOAP request parameter.

Returns

SOAP request parameter.

- **public Map<String,String> getParameters()**

  Obtain the SOAP request parameters.

  Returns

  SOAP request parameters.

- **public String getProtocol()**

  Obtain the request protocol.

  Returns

  Request protocol.

- **public int getReadTimeout()**

  Obtain the read timeout.

  Returns

  Read timeout.

- **public String getSoapAction()**

  Obtain the operation request address.

  Returns

  Operation request address.

- **public String getUrl()**

  Obtain the request address.

  Returns

  Request address.

- **public boolean isRedirects()**

  Allow redirection or not.

  Returns

  true or false

- **public void setBodyPrefix(String bodyPrefix)**

  Set the node prefix of a request packet.

  Input Parameter

  bodyPrefix indicates the node prefix of a request packet.

- **public void setCharset(String charset)**

  Set the HTTP request encoding format.

  Input Parameter

  charset indicates the encoding foramt of the HTTP request.

- **public void setConnectTimeout(int connectTimeout)**

  Set the connection timeout interval.

  Input Parameter

  Connection timeout indicates the connection timeout interval.

- **public void setContent(Object content)**

  Set the request content.

Input Parameter

content indicates the request content.

- **public void setContentType(String contentType)**

  Set the packet parameter type.

  Input Parameter

  contentType indicates the packet parameter type.

- **public void setEnvelopePrefix(String envelopePrefix)**

  Set the envelope prefix.

  Input Parameter

  envelopePrefix indicates the envelope prefix.

- **public void setHeader(String name, String value)**

  Set request header information.

  Input Parameter

  - **name** indicates the request header name.
  - **value** indicates the request header value.

- **public void setHeaders(Map<String,String> headers)**

  Set request header information.

  Input Parameter

  headers indicates the request header information.

- **public void setMethod(String method)**

  Set the request method.

  Input Parameter

  method indicates a request method.

- **public void setNamespace(String namespace)**

  Set the namespace.

  Input Parameter

  namespace indicates the namespace.

- **public void setNamespacePrefix(String namespacePrefix)**

  Set the namespace prefix.

  Input Parameter

  namespacePrefix indicates the namespace prefix.

- **public void setOperation(String operation)**

  Set the operation name.

  Input Parameter

  operation indicates the operation name.

- **public void setParameter(String name, String value)**

  Set the SOAP request parameters.

  Input Parameter

  - **name** indicates the name of a SOAP request parameter.
  - **value** indicates the value of a SOAP request parameter.

- **public void setParameters(Map<String,String> parameters)**
  Set the SOAP request parameters.
  Input Parameter
  parameters indicates the SOAP request parameters.
- **public void setProtocol(String protocol)**
  Set the request protocol.
  Input Parameter
  protocol indicates the request protocol.
- **public void setReadTimeout(int readTimeout)**
  Set the read timeout.
  Input Parameter
  readTimeout indicates the read timeout interval.
- **public void setRedirects(boolean redirects)**
  Set whether to redirect.
  Input Parameter
  redirects indicates whether to redirect.
- **public void setSoapAction(String soapAction)**
  Set the operation request address.
  Input Parameter
  soapAction indicates the operation request address.
- **public void setUrl(String url)**
  Set the request address.
  Input Parameter
  url indicates the request URL.

1.5.33 StringUtils

Path

com.roma.apic.livedata.common.v1.StringUtils

Description

This class is used to convert character strings.

Example

```
importClass(com.roma.apic.livedata.common.v1.StringUtils);
function execute(data){
    return StringUtils.toString([97,96,95,94,93,92], "UTF-8")
}
```


Method List

Returned Type	Method and Description
static String	**toString**(byte[] bytes, String encoding) Convert a byte array into a string.
static String	**toString**(byte[] bytes) Convert a byte array into a UTF-8 encoded string.
static String	**toHexString**(byte[] data) Convert a byte array into a hexadecimal lowercase string.
static byte[]	**hexToByteArray**(String hex) Convert a hexadecimal string into a byte array.

Method Details

- **public static String toString(byte[] bytes, String encoding)**

  Converts a byte array into a string.

  Input Parameter

  – **bytes** indicates the byte array to be converted.

  – **encoding** indicates encoding.

  Returns

  String after conversion.

- **public static String toString(byte[] bytes)**

  Converts a byte array into a UTF-8 encoded string.

  Input Parameter

  bytes indicates the byte array to be converted.

  Returns

  String after conversion.

- **public static String toHexString(byte[] data)**

  Converts a byte array into a hexadecimal lowercase string.

  Input Parameter

  data indicates the byte array to be converted.

  Returns

  Hexadecimal character string after conversion.

- **public static byte[] hexToByteArray(String hex)**

  Converts a hexadecimal string into a byte array.

  Input Parameter

  hex indicates the hexadecimal character string to be converted.

  Returns

  Byte array after conversion.

1.5.34 TextUtils

Path

com.roma.apic.livedata.common.v1.TextUtils

Description

This class is used to provide the formatting function.

Method List

Returned Type	Method and Description
static Map<String,String>	**encodeByUrlEncoder**(Map<String,String> map) Encode the key and value in the map.
static boolean	**parseBoolean**(String value, boolean defaultValue) Convert a character string into a Boolean type.
static String	**toHttpParameters**(Map<String,String> map) Convert the map content to parameters in HTTP URL.

Method Details

- **public static Map<String,String> encodeByUrlEncoder(Map<String,String> map)**

  Encode the key and value in the map.

  Input Parameter

  map indicates the map containing URL parameters.

  Returns

  Map after the URL encoding.

  Throws

  java.io.UnsupportedEncodingException

- **public static boolean parseBoolean(String value, boolean defaultValue)**

  Convert a character string into a Boolean type.

  Input Parameter

  - **value** indicates the character content to be converted.
  - **defaultValue** indicates the default Boolean value. It is used when **value** is invalid.

  Returns

  Boolean value.

- **public static String toHttpParameters(Map<String,String> map)**

  Convert the content in the map to the parameters in the HTTP URL.

  Input Parameter

map indicates the map containing URL parameters.

Returns

Parameters in the HTTP URL.

1.5.35 XmlUtils

Path

com.roma.apic.livedata.common.v1.XmlUtils

Description

This class is used to provide the XML conversion function.

Example

```
importClass(com.roma.apic.livedata.common.v1.XmlUtils);
function execute(data) {
    var xml = '<a><id>2</id><name>1</name></a>'
    return XmlUtils.toMap(xml)
}
```

Method List

Returned Type	Method and Description
static String	**toJson**(String xml) Convert a character string in the XML format into a JSON file.
static Map<String,Object>	**toMap**(String xml) Convert XML into Map.
static String	**toXml**(Object object) Convert an object into an XML file.
static String	**toXml**(Object object, Map<String,Object> config) Convert an object into an XML file.

Method Details

- **public static String toJson(String xml)**

  Convert a character string in the XML format into a JSON file.

  Input Parameter

  xml indicates the character string in XML format.

  Returns

  Character string in JSON format.

  Throws

  org.json.JSONException

- **public static Map<String,Object> toMap(String xml)**

  Convert XML into Map.

  Input Parameter

  xml indicates the character string in XML format.

  Returns

  Character string in MAP format.
- **public static String toXml(Object object)**

  Convert an object into an XML file.

  Input Parameter

  object indicates the object to be converted.

  Returns

  Character string in XML format.

  Throws

  java.lang.Exception
- **public static String toXml(Object object, Map<String,Object> config)**

  Convert an object into XML.

  Input Parameter

  – **object** indicates the object to be converted.

  – **config** indicates the conversion configuration.

  Returns

  Character string in XML format.

  Throws

  java.lang.Exception

1.6 Developing Data API Statements

SQL Syntax

The SQL syntax differences between a data API and each database are as follows:

- To transfer parameters carried in a backend request to an SQL statement, use *${parameter name}* to mark the parameters. Parameters of the String type must be enclosed in single quotation marks, whereas parameters of the int type do not need to be enclosed.

  In the following example, **name** is a parameter of the String type and **id** is a parameter of the int type.

  ```
  select * from table01 where name='${name}' and id=${id}
  ```
- Parameters can be transferred in the headers, parameters, or body of backend requests.
- If the character string in an SQL statement contains keywords, you must escape the character string.

  For example, if a field name is **delete**, the SQL statement must be written in the following format:

  ```
  select `delete` from table01
  ```


NOTE

If an SQL statement references backend request parameters of multiple data types, ROMA Connect converts the input parameters to the String type by default. Therefore, when the SQL statement is executed, ROMA Connect needs to invole the corresponding function to convert the data type of the non-String parameters.

For example, if both the **name** (String type) and **id** (int type) parameters are transferred to an SQL statement, the **id** parameter will be converted to the String type. Therefore, you need to use a conversion function to convert the **id** parameter back to the int type in the SQL statement. The following uses the cast() function as an example. The conversion function varies depending on the database type in use.

```
select * from table01 where name='${name}' and id=cast('${id}' as int)
```

SQL query examples (similar to the **update** and **insert** commands):

- Full query
  ```
  select * from table01;
  ```
- Query with parameters specified

  Transfer parameters (Headers, Parameters, or Body) carried in backend requests to SQL statements to provide flexible conditional query or data processing capabilities for the SQL statements.

  - For APIs using the GET or DELETE method, obtain parameters from the request URL.
  - For APIs using the POST or PUT method, obtain parameters from the request body. Note: The body is in application/x-www-form-urlencoded format.

  ```
  select * from table01 where 1=1 and col01 = ${param01};
  ```
- Query with optional parameters
  ```
  select * from table01 where 1=1 [and col01 = ${param01}] [and col02 = ${param02}]
  ```
- IN query
  ```
  select * from table01 where 1=1 and col01 in ('${param01}','${param02}');
  ```
- UNION query

  By default, duplicate data will be deleted. To return all data, use the keywords **union all**.

  ```
  select * from table01
  union [all | distinct]
  select * from table02;
  ```
- Nested query
  ```
  select * from table01 where 1=1 and col01 in (select col02 from table02 where col03 is not null);
  ```

Native commands compatible with NoSQL (such as MongoDB and Redis):

- Command formats supported by the Redis data source:

  GET, HGET, HGETALL, LRANGE, SMEMBERS, ZRANGE, ZREVRANGE, SET, LPUSH, SADD, ZADD, HMSET, DEL
- Command formats supported by the MongoDB data source:

  find

NoSQL examples:

- Insert a key of the String type. The value is obtained from the request parameter.
  ```
  set hello ${parm01}
  ```
- Query the key of the String type.
  ```
  get hello
  ```


Stored Procedure Calling

Currently, a data API cannot create stored procedures, but can execute stored procedures of MySQL, Oracle, and PostgreSQL data sources. The following uses the Oracle database as an example.

- **Data source description**

  Assume that the database contains a table. The table structure is as follows:

  ```
  create table sp_test(id number,name varchar2(50),sal number);
  ```

  Insert data into the table.

  Table 1-3 sp_test table data set

ID	NAME	SAL
1	ZHANG	5000
2	LI	6000
3	ZHAO	7000
4	WANG	8000

  The Oracle database contains a stored procedure for querying the value of **sal** based on **name**.

  ```
  create or replace procedure APICTEST.sb_test(nname in varchar, nsal out number) as
  begin
     select sal into nsal from sp_test where name = nname;
  end;
  ```

- **Statements in a data API**

  When a data API invokes a stored procedure, parameters can be transferred through Headers, Parameters, or Body of a backend request. The syntax of a parameter name is as follows: *{Parameter name}.{Data type}.{Transmission type}*.

  – The data type can be **String** or **int**.

  – *Transmission type* indicates whether the parameter is an input parameter or output parameter. **in** indicates an input parameter, and **out** indicates an output parameter.

  The following is an example statement used for invoking the stored procedure in the data API:

  ```
  call sb_test(${nname.String.in},${nsal.int.out})
  ```

  In the example script, **nname** is an input parameter of the String type and the parameter name is **nname.String.in**. The value is the parameter to be queried. **nsal** is an output parameter of the numeric type and the parameter name is **nsal.int.out**. Due to the format restriction, the value of the output parameter must be set. You can set it to any value that meets the data type requirements, which does not affect the output result.

NOTE

- The data API uses String and int to distinguish character strings and values when invoking a stored procedure. Single quotation marks are not required. This is different from the SQL requirement.
- The parameter names defined in Headers, Body, or Parameters of a backend request must be different. Otherwise, they will be overwritten.

– The following is an example of transferring parameters in Body:

Body of the backend request:

```
{
  "nname.String.in": "zhang",
  "nsal": 0
}
```

Response result:

```
{
  "test": [
    5000
  ]
}
```

– The following is an example of transferring parameters in Parameters:

Parameters of the backend request:

```
https://example.com?nname.String.in=zhang&nsal=0
```

Response result:

```
{
  "test": [
    5000
  ]
}
```

Data Source Orchestration

A data API can contain multiple data sources. Therefore, an API request can involve multiple data sources. For example, the query result of the first data source can be used as the parameter of the second data source.

MySQL is used as an example. Assume that the data API contains data source 1 and data source 2, user01 is the data table of data source 1, and user02 is the data table of data source 2. The structures of the two tables are as follows:

Table 1-4 Table structures

Data Source	Table Name	Parameter
Data source 1	user01	• id (int) • name (varchar)
Data source 2	user02	• user_id (int) • user_name (varchar) • user_age (int) • user_sex (varchar)

The data source SQL statement is designed as follows:

For data source 1, query the ID of the data record whose name is **zhang** in table user01.

```
select id from user01 where name='zhang';
```

For data source 2, find the corresponding data record in table user02 based on the ID found in table user01, and change the value of **user_name** in the record to **zhang**.

```
update user02 set user_name='zhang' where user_id=${result1[0].id};
```

Usage of Optional Parameters

In a data API, the square brackets ([]) are used to mark optional parameters. An example SQL statement is as follows:

```
select * from table01 where id=${id} [or sex='${sex}']
```

The statement enclosed in square brackets ([]) indicates that the parameter takes effect only when the backend request carries the ${sex} parameter. If ${sex} is not carried, the statement enclosed in [] is ignored during execution.

- If the backend request carries the id=88 parameter but does not carry the optional parameter sex, run the following SQL statement:
  ```
  select * from table01 where id=88;
  ```
- If the backend request carries both id=88 and sex=female, run the following SQL statement:
  ```
  select * from table01 where id=88 or sex='female';
  ```


2 Developer Guide for Message Integration

2.1 Overview and Network Environment Preparation

Overview

ROMA MQS is fully compatible with the Kafka protocol and can be directly connected to the **open-source Kafka client**. If the SASL authentication mode is used, use a certificate file provided by the cloud service on the basis of the open-source Kafka client.

This guide describes how to collect MQS connection information, such as the MQS connection address and port, certificate used by the SASL connection, and public network access information. It also provides connection examples in Java and Python languages.

The examples in this guide present only API calls of Kafka. For details about production and consumption APIs, see the **Kafka official website**.

Network Environment of the Client

The client can access MQS in any of the following ways:

- Subnet address in a VPC

  If the client is an ECS on the cloud and located in the same VPC in a region as MQS, the client can directly access the subnet address in the VPC provided by MQS.

- VPC peer-to-peer connection

  If the client is an ECS on the cloud and located in a different VPC but the same region as MQS, the client can access the subnet address in the VPC provided by MQS after establishing a VPC peer-to-peer connection.

- Public network

  If the client is located in another network environment or is in a different region from MQS, the client accesses the public network address of MQS.

For public access of the instance, you need to modify the security group bound to the ROMA Connect instance and add inbound rules to allow access from the external network through ports 9094, 9095, and 9096.

NOTE

In different network environments, client configurations are the same except the connection address. Therefore, this guide describes how to set up the client development environment by using the subnet address in the same VPC as an example.

If the connection times out or fails, check whether the network connection is normal. You can use Telnet to check the IP address and port number of the instance.

2.2 Collecting Connection Information

Preparing MQS Information

- Instance connection address and port

  On the **Instance Information** page, click the **Basic Information** tab and view the MQS connection addresses.

  - **MQS Intranet Address**: used for a Kafka client to communicate with the MQS intranet.
  - **MQS Public Address**: used for a Kafka client to communicate with the MQS public network.
  - **Message RESTful API**: used to connect MQS through a RESTful API.

- Topic name

  On the ROMA Connect console, choose **Message Queue Service** > **Topic Management** and view the topic name.

- SASL authentication information

  If MQS SASL_SSL is enabled for the ROMA Connect instance, you need to obtain the username, password, and client certificate.

  - Username and password

    On the **Integration Applications** page of the ROMA Connect console, click the name of the integration application to which the topic belongs. In the **Basic Information** area of the **Overview** tab page, you can view the values of **Key** and **Secret**, that is, the username and password.

  - Client certificate

    On the ROMA Connect console, choose **Message Queue Service** > **Topic Management**, and click **Download SSL Certificate** to download the client certificate.

2.3 Connecting to MQS in Client Mode

2.3.1 Recommendations for Client Usage

Applicability for Consumers

- Ensure that the owner thread does not exit abnormally. Otherwise, the client may fail to initiate consumption requests and the consumption will be blocked.
- Ensure that the commit operation is performed after messages are processed. This is to avoid the failure of processing service messages and the failure to retrieve the message that fails to be processed.
- A consumer cannot frequently join or leave a group. Otherwise, the consumer will frequently perform rebalancing, which blocks consumption.
- The number of consumers cannot be greater than the number of partitions in the topic. Otherwise, some consumers may fail to poll for messages.
- Ensure that the consumer polls at regular intervals to keep sending heartbeats to the server. If the consumer stops sending heartbeats for long enough, the consumer session will time out and the consumer will be considered to have stopped. This will also block consumption.
- Ensure that there is a limitation on the size of messages buffered locally to avoid an out-of-memory (OOM) situation.
- The timeout interval of the consumer session is set to 30 seconds, and **session.timeout.ms** is set to **30000**. This prevents the consumer from performing rebalance due to frequent timeout. Frequent timeout will block consumption.
- ROMA Connect may consume repeated messages. The service side must ensure the idempotency of message processing.
- Always close the consumer before exiting. Otherwise, consumers in the same group may block the **session.timeout.ms** time.

Applicability for Producers

- Synchronous replication: Set **acks** to **all**.
- Retry message sending: Set **retries** to **3**.
- Message sending optimization: Set **linger.ms** to **0**.
- Ensure that the producer has sufficient JVM memory to avoid blockages.

Applicability of Topics

- Recommended topic configurations: Use 3 replicas, enable synchronous replication, and set the minimum number of in-sync replicas to 2. The number of in-sync replicas cannot be the same as the number of replicas of the topic. Otherwise, if one replica is unavailable, messages cannot be produced.
- You can enable or disable automatic topic creation. If it is enabled, a topic will be automatically created with 3 partitions and 3 replicas when a message is created in or retrieved from a topic that does not exist.
- The recommended maximum number of partitions for a topic is 20.
- Each topic can have 3 replicas (the number of replicas cannot be modified once configured).

Other Suggestions

- Maximum number of connections: 3000
- Maximum size of a message: 10 MB
- Access ROMA Connect using SASL_SSL. Ensure that your DNS service is capable of resolving an IP address to a domain name. Alternatively, map all ROMA Connect broker IP addresses to host names in the **hosts** file. Prevent Kafka clients from performing reverse resolution. Otherwise, connections may fail to be established.
- Apply for a disk space size that is more than twice the size of service data multiplied by the number of replicas. In other words, keep 50% of the disk space idle.
- Avoid frequent full GC in JVM. Otherwise, message production and consumption will be blocked.

NOTE

- If both SASL_SSL and intra-VPC plaintext access are enabled for MQS of the ROMA Connect instance, the SASL mode cannot be used for connecting to MQS topics in the VPC.
- If the SASL mode is used for connecting to MQS topics, you are advised to configure the mapping between the host and IP address in the **/etc/hosts** file on the host where the client is located. Otherwise, network delay will occur.

  Set the IP address to the connection address of MQS and set the host to the name of each instance host. Ensure that the name of each host is unique. Example:

  10.10.10.11 host01

  10.10.10.12 host02

  10.10.10.13 host03

2.3.2 Setting Parameters for Clients

This section provides recommendations on configuring common parameters for Kafka producers and consumers.

Table 2-1 Producer parameters

Parameter	Default Value	Recommended Value	Description
acks	1	**all** (if high reliability mode is selected) **1** (if high throughput mode is selected)	Number of acknowledgments the producer requires the server to return before considering a request complete. This controls the durability of records that are sent. Options: • **0**: The producer will not wait for any acknowledgment from the server at all. The record will be immediately added to the socket buffer and considered sent. No guarantee can be made that the server has received the record, and the retries configuration will not take effect (as the client generally does not know of any failures). The offset given back for each record will always be set to –1. • **1**: The leader will write the record to its local log but will respond without waiting until receiving full acknowledgment from all followers. • **all**: The leader will wait for the full set of replicas to acknowledge the record. This is the strongest available guarantee because the record will not be lost even if there is just one replica that works.
retries	0	Set as required.	Number of times that the client resends a message. Setting this parameter to a value greater than zero will cause the client to resend any record that failed to be sent. Note that these retries are no different than those the client perform upon receiving a message sending error. Allowing retries will potentially change the message order. For example, if two messages are sent to the same partition, and the first fails and is retried but the second succeeds, then the second message may appear first.
request.timeout.ms	30000	Set as required.	Maximum amount of time the client will wait for the response of a request. If the response is not received before the timeout elapses, the client will throw a timeout exception. Setting this parameter to a large value, for example, **120000** (120s), can prevent records from failing to be sent in high-concurrency scenarios.

Parameter	Default Value	Recommended Value	Description
block.on.buffer.full	TRUE	TRUE	Setting this parameter to **TRUE** indicates that when buffer memory is exhausted, the producer must stop receiving new message records or throw an exception. By default, this parameter is set to **TRUE**. However, in some cases, non-blocking usage is desired and it is better to throw an exception immediately. Setting this parameter to **FALSE** will cause the producer to instead throw "BufferExhaustedException" when buffer memory is exhausted.
batch.size	16384	262144	Default maximum number of bytes of messages that can be processed at a time. The producer will attempt to batch process the message records to reduce the number of requests. This improves the performance between the client and the server. No attempt will be made to batch records larger than this size. Requests sent to brokers will contain multiple batches, one for each partition with data available to be sent. A smaller batch size will make batching less common and may reduce throughput (a batch size of zero will disable batching entirely). A larger batch size may use more memory as a buffer of the specified batch size will always be allocated in anticipation of additional records.
buffer.memory	33554432	67108864	Total bytes of memory the producer can use to buffer records waiting to be sent to the server. If the data generation speed is greater than the speed of sending data to the broker, the producer blocks or throws an exception, which is indicated by block.on.buffer.full. This setting should correspond roughly to the total memory the producer will use, but is not a rigid bound since not all memory the producer uses is used for buffering. Some additional memory will be used for compression (if compression is enabled) as well as for maintaining in-flight requests.

Table 2-2 Consumer parameters

Parameter	Default Value	Recommended Value	Description
auto.commit.enable	TRUE	FALSE	If this parameter is set to **TRUE**, the offset of messages already fetched by the consumer will be periodically committed to ZooKeeper. This committed offset will be used when the process fails as the position from which the new consumer will begin. Constraints: If this parameter is set to **FALSE**, to avoid message loss, an offset must be committed to ZooKeeper after the messages are successfully consumed.
auto.offset.reset	latest	earliest	Indicates what to do when there is no initial offset in ZooKeeper or if the current offset has been deleted. Options: **earliest**: The offset is automatically reset to the smallest offset. **latest**: Automatically reset to the largest offset. **none**: The system throws an exception to the consumer if no offset is available. **anything else**: The system throws an exception to the consumer.
connections.max.idle.ms	600000	30000	Indicates the timeout interval for an idle connection. The server closes the idle connection after this period of time ends. Setting this parameter to 30000 can reduce the server response failures when the network condition is poor.

2.3.3 Setting Up the Java Development Environment

Based on information in **Collecting Connection Information**, assume that you have obtained information related to the instance connection and the network environment of the client. This section uses the demo for producing and sending messages as an example to describe the environment configuration of the Kafka client.

Preparations

- Maven

  Download Apache Maven 3.0.3 or later from the **Maven official website** and install it.

- JDK

  Download Java Development Kit 1.8.111 or later from the **Oracle official website** and install it.

  After the installation, configure Java environment variables.
- Download IntelliJ IDEA 2018.3.5 or later from the **IntelliJ IDEA official website** and install it.

Procedure

Step 1 Download the demo package.

On the ROMA Connect console, choose **Message Queue Service** > **Topic Management**. In the upper right corner of the page, choose **User Guide** > **Download Kafka Client Java Demo Package** to download the demo.

The following files are obtained after decompression:

Table 2-3 Kafka demo file list

File Name	Path	Description
MqsConsumer.java	.\src\main\java\com\mqs\consumer	API for consuming messages.
MqsProducer.java	.\src\main\java\com\mqs\producer	API for producing messages.
mqs.sdk.consumer.properties	.\src\main\resources	Configuration information of consumption messages.
mqs.sdk.producer.properties	.\src\main\resources	Configuration information of production messages.
client.truststore.jks	.\src\main\resources	SSL certificate, which is used for SASL connection.
MqsConsumerTest.java	.\src\test\java\com\mqs\consumer	Test code of consumption messages.
MqsProducerTest.java	.\src\test\java\com\mqs\producer	Test code of production messages.
pom.xml	.\	Maven configuration file, including the Kafka client reference.

Step 2 Open IntelliJ IDEA and import the Demo file.

The demo is a Java project constructed by the Maven. Therefore, you need to configure the JDK environment and the Maven plug-in of the IDEA.

Figure 2-1 Choose **Import Project**.

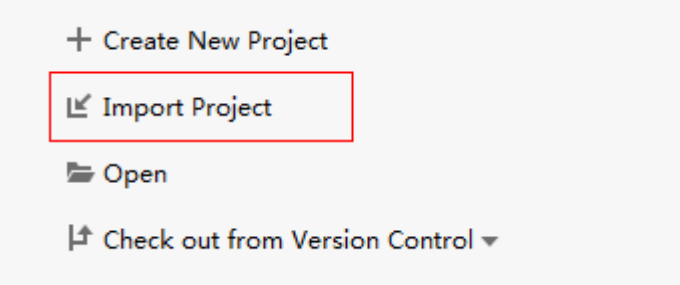


Figure 2-2 Choose **Maven**.

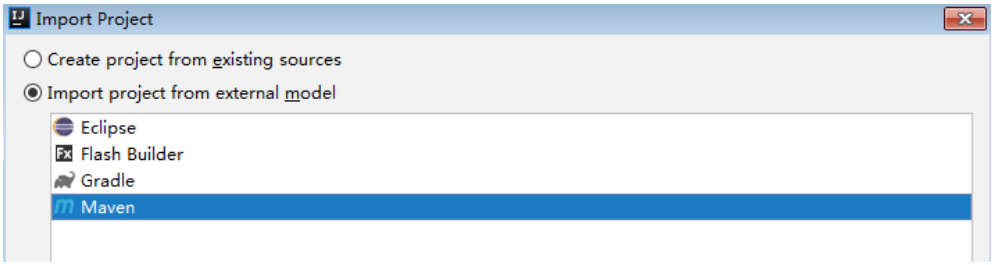
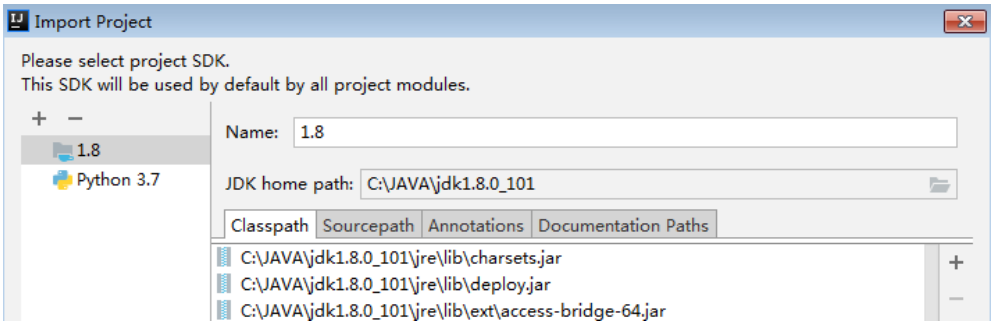
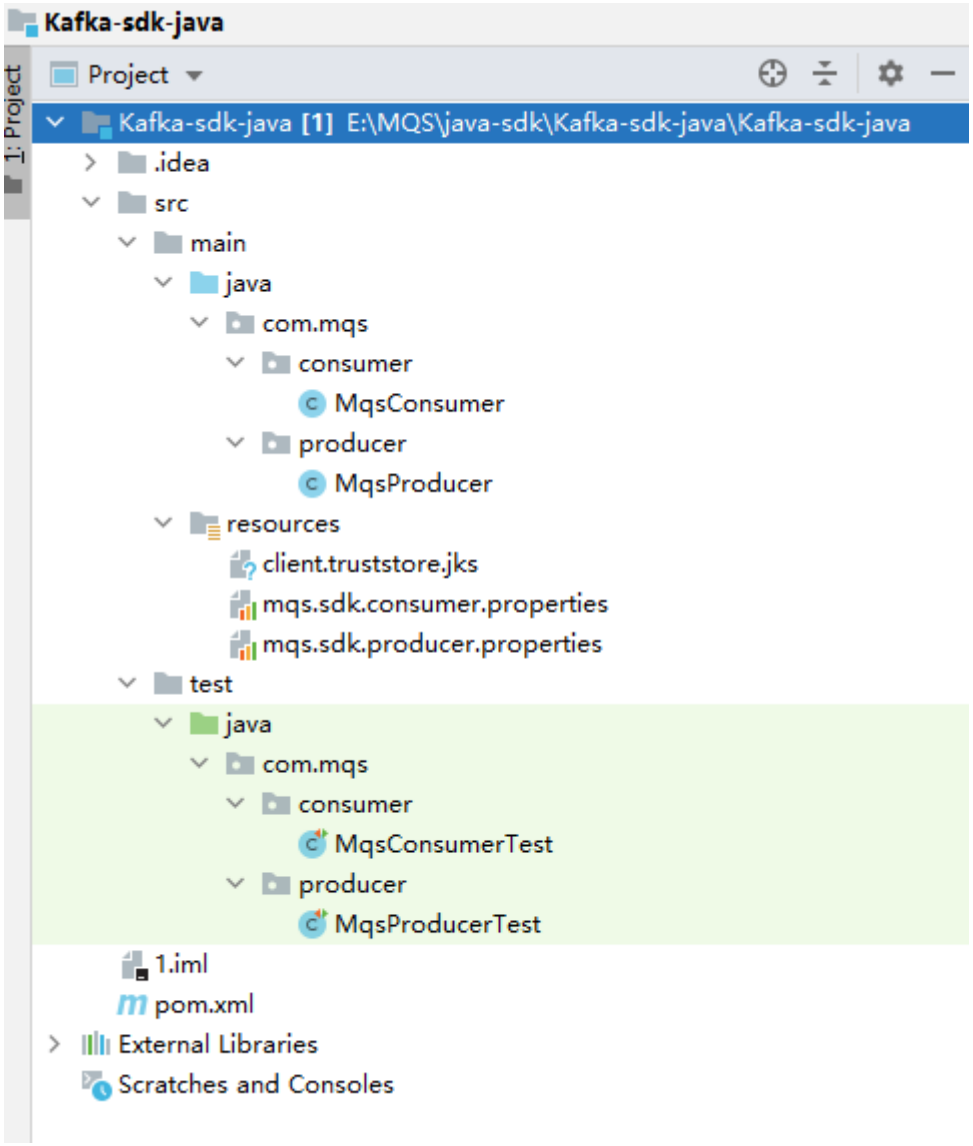


Figure 2-3 Selecting the Java environment



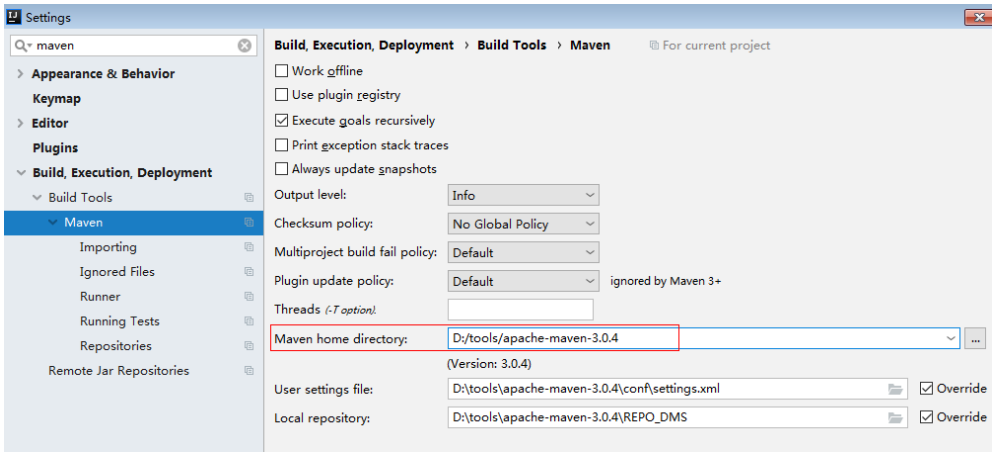
You can select other options or retain the default settings. Then, click **Finish**.

The demo project after the import is as follows:



Step 3 Configure the path to the Maven.

Choose **File** > **Settings**, find the Maven home directory information item, and select the correct Maven path for **Maven home directory** and select the **settings.xml** file required by the Maven.



Step 4 Modify client configuration information.

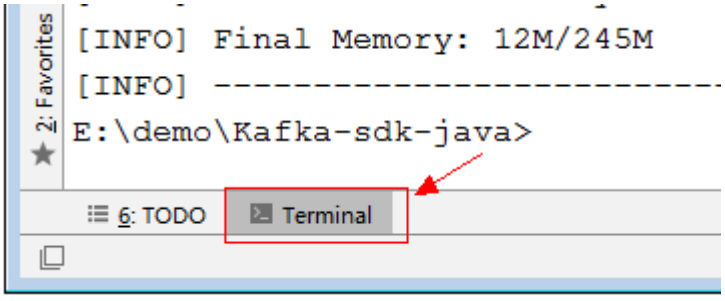
Take a production message as an example. The following information must be configured, among which the information in bold must be modified.

```
#The following information in bold is specific to different MQSs and must be modified. Other parameters of the client can also be added.
#The topic name is in the specific production and consumption code.
########################
#You can obtain the broker information from the console.
#For example, bootstrap.servers=192.168.0.196:9095,192.168.0.196:9096,192.168.0.196:9094.
bootstrap.servers=ip1:port1,ip2:port2,ip3:port3
#Send acknowledgment parameters.
acks=all
#Sequence mode of the key.
key.serializer=org.apache.kafka.common.serialization.StringSerializer
#Sequence mode of the value.
value.serializer=org.apache.kafka.common.serialization.StringSerializer
#Total bytes of memory the producer can use to buffer records waiting to be sent to the server.
buffer.memory=33554432
#Number of retries.
retries=0
########################
#If SASL authentication is not used, comment out the following parameters:
########################
#Set the jaas username and password on the console.
sasl.jaas.config=org.apache.kafka.common.security.plain.PlainLoginModule required \
   username="username" \
   password="password";
#SASL authentication mode.
sasl.mechanism=PLAIN
#Encryption protocol. Currently, the SASL_SSL protocol is supported.
security.protocol=SASL_SSL
#Location of the SSL truststore file. The certificate file is in the \src\main\resources directory of the demo package.
ssl.truststore.location=E:\\temp\\client.truststore.jks
#Password of the SSL truststore file.
ssl.truststore.password=dms@kafka
ssl.endpoint.identification.algorithm=
```

Step 5 Open the Terminal window of the IDEA, and then run the **mvn test** command to experience the demo.

By default, the Terminal window is in the lower left corner of the IDEA tool.

Figure 2-4 Position of the Terminal window of the IDEA



The following information is displayed for production messages:

```
-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running com.mqs.producer.MqsProducerTest
produce msg:The msg is 0
produce msg:The msg is 1
```



```
produce msg:The msg is 2
produce msg:The msg is 3
produce msg:The msg is 4
produce msg:The msg is 5
produce msg:The msg is 6
produce msg:The msg is 7
produce msg:The msg is 8
produce msg:The msg is 9
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 138.877 sec
```

The following information is displayed for consumption messages:

```
-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running com.mqs.consumer.MqsConsumerTest
the numbers of topic:0
the numbers of topic:0
the numbers of topic:6
ConsumerRecord(topic = topic-0, partition = 2, offset = 0, CreateTime = 1557059377179, serialized key size = -1, serialized value size = 12, headers = RecordHeaders(headers = [], isReadOnly = false), key = null, value = The msg is 2)
ConsumerRecord(topic = topic-0, partition = 2, offset = 1, CreateTime = 1557059377195, serialized key size = -1, serialized value size = 12, headers = RecordHeaders(headers = [], isReadOnly = false), key = null, value = The msg is 5)
```

----End

2.3.4 Configuring Kafka Clients in Java

This section describes how to use the Maven to introduce the Kafka client for MQS, connect clients, and produce and consume messages. For details about how to view the demo details, see **Setting Up the Java Development Environment**.

All configuration information, such as the MQS connection address, topic name, and user information, mentioned in the following parts can be obtained in **Collecting Connection Information**.

Adding Kafka Clients in Maven

MQS is based on Kafka 1.1.0 and 2.3.0. Use the Kafka client of the same version. You can view the Kafka version information in the **MQS Information** area on the **Instance Information** page of the ROMA Connect console.

If the client of the 1.1.0 version is used, set the version parameter to **1.1.0**. If the client of the 2.3.0 version is used, set the version parameter to **2.3.0**. The following uses the client of the 2.3.0 version as an example.

```
<dependency>
  <groupId>org.apache.kafka</groupId>
  <artifactId>kafka-clients</artifactId>
  <version>2.3.0</version>
</dependency>
```

Preparing Configuration Information

The following describes example producer and consumer configuration files. If SASL authentication is enabled for a ROMA Connect instance, you must configure SASL authentication information in the configuration file of the Java client. Otherwise, the connection fails. If SASL authentication is not enabled, comment out the related configuration.

- Producer configuration file (corresponding to the **mqs.sdk.producer.properties** file in the production message code)

  The information in bold is subject to different MQSs and must be modified based on site requirements. Other parameters of the client can be added as required. All configuration information, such as the MQS connection address, topic name, and user information, can be obtained in **Collecting Connection Information**.

```
#The topic name is in the specific production and consumption code.
########################
#You can obtain the broker information from the console.
#For example, bootstrap.servers=192.168.0.196:9095,192.168.0.196:9096,192.168.0.196:9094.
bootstrap.servers=ip1:port1,ip2:port2,ip3:port3
#Send acknowledgment parameters.
acks=all
#Sequence mode of the key.
key.serializer=org.apache.kafka.common.serialization.StringSerializer
#Sequence mode of the value.
value.serializer=org.apache.kafka.common.serialization.StringSerializer
#Total bytes of memory the producer can use to buffer records waiting to be sent to the server.
buffer.memory=33554432
#Number of retries.
retries=0
########################
#If SASL authentication is not used, comment out the following parameters:
########################
#Set the jaas username and password on the console.
sasl.jaas.config=org.apache.kafka.common.security.plain.PlainLoginModule required \
   username="username" \
   password="password";
#SASL authentication mode.
sasl.mechanism=PLAIN
#Encryption protocol. Currently, the SASL_SSL protocol is supported.
security.protocol=SASL_SSL
#Location of the SSL truststore file.
ssl.truststore.location=E:\\temp\\client.truststore.jks
#Password of the SSL truststore file. The value is fixed and cannot be changed.
ssl.truststore.password=dms@kafka
ssl.endpoint.identification.algorithm=
```

- Consumer configuration file (corresponding to the **mqs.sdk.consumer.properties** file in the consumption message code)

  The information in bold is subject to different MQSs and must be modified based on site requirements. Other parameters of the client can be added as required. All configuration information, such as the MQS connection address, topic name, and user information, can be obtained in **Collecting Connection Information**.

```
#The topic name is in the specific production and consumption code.
########################
#You can obtain the broker information from the console.
#For example, bootstrap.servers=192.168.0.196:9095,192.168.0.196:9096,192.168.0.196:9094.
bootstrap.servers=ip1:port1,ip2:port2,ip3:port3
#A character string that uniquely identifies the group to which the consumer process belongs. You can set it as required.
#If group id is set to the same value, the processes belong to the same consumer group.
group.id=1
#Sequence mode of the key.
key.deserializer=org.apache.kafka.common.serialization.StringDeserializer
#Sequence mode of the value.
value.deserializer=org.apache.kafka.common.serialization.StringDeserializer
#Offset mode.
auto.offset.reset=earliest
########################
#If SASL authentication is not used, comment out the following parameters:
########################
#Set the jaas username and password on the console.
```



```
sasl.jaas.config=org.apache.kafka.common.security.plain.PlainLoginModule required \
   username="username" \
   password="password";
#SASL authentication mode.
sasl.mechanism=PLAIN
#Encryption protocol. Currently, the SASL_SSL protocol is supported.
security.protocol=SASL_SSL
#Location of the SSL truststore file.
ssl.truststore.location=E:\\temp\\client.truststore.jks
#Password of the SSL truststore file.
ssl.truststore.password=dms@kafka
ssl.endpoint.identification.algorithm=
```

Producing Messages

- Test code:

```
package com.mqs.producer;

import org.apache.kafka.clients.producer.Callback;
import org.apache.kafka.clients.producer.RecordMetadata;
import org.junit.Test;

public class MqsProducerTest {
   @Test
   public void testProducer() throws Exception {
      MqsProducer<String, String> producer = new MqsProducer<String, String>();
      int partiton = 0;
      try {
         for (int i = 0; i < 10; i++) {
            String key = null;
            String data = "The msg is " + i;
            //Enter the name of the topic you created. There are multiple APIs for producing messages.
For details, see the Kafka official website or the following production message code.
            producer.produce("topic-0", partiton, key, data, new Callback() {
               public void onCompletion(RecordMetadata metadata,
                  Exception exception) {
                  if (exception != null) {
                     exception.printStackTrace();
                     return;
                  }
                  System.out.println("produce msg completed");
               }
            });
            System.out.println("produce msg:" + data);
         }
      } catch (Exception e) {
         //TODO: troubleshooting
         e.printStackTrace();
      } finally {
         producer.close();
      }
   }
}
```

- Production message code:

```
package com.mqs.producer;

import java.io.BufferedInputStream;
import java.io.FileInputStream;
import java.io.IOException;
import java.io.InputStream;
import java.net.URL;
import java.util.ArrayList;
import java.util.Enumeration;
import java.util.List;
import java.util.Properties;

import org.apache.kafka.clients.producer.Callback;
import org.apache.kafka.clients.producer.KafkaProducer;
```



```
import org.apache.kafka.clients.producer.Producer;
import org.apache.kafka.clients.producer.ProducerRecord;

public class MqsProducer<K, V> {
    //Introduce configuration information about production messages. For details, see the preceding
description.
    public static final String CONFIG_PRODUCER_FILE_NAME = "mqs.sdk.producer.properties";

    private Producer<K, V> producer;

    MqsProducer(String path)
    {
        Properties props = new Properties();
        try {
            InputStream in = new BufferedInputStream(new FileInputStream(path));
            props.load(in);
        }catch (IOException e)
        {
            e.printStackTrace();
            return;
        }
        producer = new KafkaProducer<K,V>(props);
    }
    MqsProducer()
    {
        Properties props = new Properties();
        try {
            props = loadFromClasspath(CONFIG_PRODUCER_FILE_NAME);
        }catch (IOException e)
        {
            e.printStackTrace();
            return;
        }
        producer = new KafkaProducer<K,V>(props);
    }

    /**
     * Production messages
     *
     * @param topic        topic object
     * @param partition    partition
     * @param key          message key
     * @param data         message data
     */
    public void produce(String topic, Integer partition, K key, V data)
    {
        produce(topic, partition, key, data, null, (Callback)null);
    }

    /**
     * Production messages
     *
     * @param topic        topic object
     * @param partition    partition
     * @param key          message key
     * @param data         message data
     * @param timestamp    timestamp
     */
    public void produce(String topic, Integer partition, K key, V data, Long timestamp)
    {
        produce(topic, partition, key, data, timestamp, (Callback)null);
    }
    /**
     * Production messages
     *
     * @param topic        topic object
     * @param partition    partition
     * @param key          message key
     * @param data         message data
```



```
     * @param callback    callback
     */
    public void produce(String topic, Integer partition, K key, V data, Callback callback)
    {
        produce(topic, partition, key, data, null, callback);
    }

    public void produce(String topic, V data)
    {
        produce(topic, null, null, data, null, (Callback)null);
    }

    /**
     * Production messages
     *
     * @param topic        topic object
     * @param partition    partition
     * @param key          message key
     * @param data         message data
     * @param timestamp    timestamp
     * @param callback    callback
     */
    public void produce(String topic, Integer partition, K key, V data, Long timestamp, Callback
callback)
    {
        ProducerRecord<K, V> kafkaRecord =
                timestamp == null ? new ProducerRecord<K, V>(topic, partition, key, data)
                        : new ProducerRecord<K, V>(topic, partition, timestamp, key, data);
        produce(kafkaRecord, callback);
    }

    public void produce(ProducerRecord<K, V> kafkaRecord)
    {
        produce(kafkaRecord, (Callback)null);
    }

    public void produce(ProducerRecord<K, V> kafkaRecord, Callback callback)
    {
        producer.send(kafkaRecord, callback);
    }

    public void close()
    {
        producer.close();
    }

    /**
     * get classloader from thread context if no classloader found in thread
     * context return the classloader which has loaded this class
     *
     * @return classloader
     */
    public static ClassLoader getCurrentClassLoader()
    {
        ClassLoader classLoader = Thread.currentThread()
                .getContextClassLoader();
        if (classLoader == null)
        {
            classLoader = MqsProducer.class.getClassLoader();
        }
        return classLoader;
    }

    /**
     *Load configuration information from classpath.
     *
     * @param configFileName configuration file name
     * @return configuration information
     * @throws IOException
```



```
     */
    public static Properties loadFromClasspath(String configFileName) throws IOException
    {
        ClassLoader classLoader = getCurrentClassLoader();
        Properties config = new Properties();

        List<URL> properties = new ArrayList<URL>();
        Enumeration<URL> propertyResources = classLoader
                .getResources(configFileName);
        while (propertyResources.hasMoreElements())
        {
            properties.add(propertyResources.nextElement());
        }

        for (URL url:properties)
        {
            InputStream is = null;
            try
            {
                is = url.openStream();
                config.load(is);
            }
            finally
            {
                if (is != null)
                {
                    is.close();
                    is = null;
                }
            }
        }

        return config;
    }
}
```

Consuming Messages

- Test code:

```
package com.mqs.consumer;

import org.apache.kafka.clients.consumer.ConsumerRecord;
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.junit.Test;
import java.util.Arrays;

public class MqsConsumerTest {
    @Test
    public void testConsumer() throws Exception {
        MqsConsumer consumer = new MqsConsumer();
        consumer.consume(Arrays.asList("topic-0"));
        try {
            for (int i = 0; i < 10; i++){
                ConsumerRecords<Object, Object> records = consumer.poll(1000);
                System.out.println("the numbers of topic:" + records.count());
                for (ConsumerRecord<Object, Object> record : records)
                {
                    System.out.println(record.toString());
                }
            }
        }catch (Exception e)
        {
            //TODO: troubleshooting
            e.printStackTrace();
        }finally {
            consumer.close();
        }
    }
}
```


- Consumption message code:

```
package com.mqs.consumer;

import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.apache.kafka.clients.consumer.KafkaConsumer;
import java.io.BufferedInputStream;
import java.io.FileInputStream;
import java.io.IOException;
import java.io.InputStream;
import java.net.URL;
import java.util.*;

public class MqsConsumer {

    public static final String CONFIG_CONSUMER_FILE_NAME = "mqs.sdk.consumer.properties";

    private KafkaConsumer<Object, Object> consumer;

    MqsConsumer(String path)
    {
        Properties props = new Properties();
        try {
            InputStream in = new BufferedInputStream(new FileInputStream(path));
            props.load(in);
        }catch (IOException e)
        {
            e.printStackTrace();
            return;
        }
        consumer = new KafkaConsumer<Object, Object>(props);
    }

    MqsConsumer()
    {
        Properties props = new Properties();
        try {
            props = loadFromClasspath(CONFIG_CONSUMER_FILE_NAME);
        }catch (IOException e)
        {
            e.printStackTrace();
            return;
        }
        consumer = new KafkaConsumer<Object, Object>(props);
    }
    public void consume(List topics)
    {
        consumer.subscribe(topics);
    }

    public ConsumerRecords<Object, Object> poll(long timeout)
    {
        return consumer.poll(timeout);
    }

    public void close()
    {
        consumer.close();
    }

    /**
     * get classloader from thread context if no classloader found in thread
     * context return the classloader which has loaded this class
     *
     * @return classloader
     */
    public static ClassLoader getCurrentClassLoader()
    {
        ClassLoader classLoader = Thread.currentThread()
                .getContextClassLoader();
```



```
        if (classLoader == null)
        {
            classLoader = MqsConsumer.class.getClassLoader();
        }
        return classLoader;
    }

    /**
     *Load configuration information from classpath.
     *
     * @param configFileName configuration file name
     * @return configuration information
     * @throws IOException
     */
    public static Properties loadFromClasspath(String configFileName) throws IOException
    {
        ClassLoader classLoader = getCurrentClassLoader();
        Properties config = new Properties();

        List<URL> properties = new ArrayList<URL>();
        Enumeration<URL> propertyResources = classLoader
                .getResources(configFileName);
        while (propertyResources.hasMoreElements())
        {
            properties.add(propertyResources.nextElement());
        }


        {
            InputStream is = null;
            try
            {
                is = url.openStream();
                config.load(is);
            }
            finally
            {
                if (is != null)
                {
                    is.close();
                    is = null;
                }
            }
        }

        return config;
    }
}
```

2.3.5 Configuring Kafka Clients in Python

This section uses the Linux Centos environment as an example to describe how to connect a Python Kafka client to MQS, including Kafka client installation, message production, and message consumption.

NOTE

Before getting started, ensure that you have collected the information listed in **Collecting Connection Information**.

Preparing the Environment

- Python:

  Generally, the Python has been installed in the system. Enter **python** in a CLI. If the following information is displayed, Python 3.7.1 has already been installed:


```
[root@ecs-test python-kafka]# python3
Python 3.7.1 (default, Jul  5 2020, 14:37:24)
[GCC 4.8.5 20150623 (Red Hat 4.8.5-39)] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

If Python has not been installed, run the following command:

```
yum install python
```

- Kafka clients in Python:

  Run the following command to install kafka-python of the recommended version:

  ```
  pip install kafka-python
  ```

Producing Messages

- SASL authentication mode

  ```
  from kafka import KafkaProducer
  import ssl
  ##Connection information
  conf = {
      'bootstrap_servers': ["ip1:port1","ip2:port2","ip3:port3"],
      'topic_name': 'topic_name',
      'sasl_plain_username': 'username',
      'sasl_plain_password': 'password'
  }

  context = ssl.create_default_context()
  context = ssl.SSLContext(ssl.PROTOCOL_SSLv23)
  context.verify_mode = ssl.CERT_REQUIRED
  ##Certificate file
  context.load_verify_locations("phy_ca.crt")

  print('start producer')
  producer = KafkaProducer(bootstrap_servers=conf['bootstrap_servers'],
                           sasl_mechanism="PLAIN",
                           ssl_context=context,
                           security_protocol='SASL_SSL',
                           sasl_plain_username=conf['sasl_plain_username'],
                           sasl_plain_password=conf['sasl_plain_password'])

  data = bytes("hello kafka!", encoding="utf-8")
  producer.send(conf['topic_name'], data)
  producer.close()
  print('end producer')
  ```

- Non-SASL authentication mode

  Replace the information in bold with the actual values.

  ```
  from kafka import KafkaProducer

  conf = {
      'bootstrap_servers': ["ip1:port1","ip2:port2","ip3:port3"],
      'topic_name': 'topic-name',
  }

  print('start producer')
  producer = KafkaProducer(bootstrap_servers=conf['bootstrap_servers'])

  data = bytes("hello kafka!", encoding="utf-8")
  producer.send(conf['topic_name'], data)
  producer.close()
  print('end producer')
  ```


Consuming Messages

- SASL authentication mode

```
from kafka import KafkaConsumer
import ssl
##Connection information
conf = {
    'bootstrap_servers': ["ip1:port1","ip2:port2","ip3:port3"],
    'topic_name': 'topic_name',
    'sasl_plain_username': 'username',
    'sasl_plain_password': 'password',
    'consumer_id': 'consumer_id'
}

context = ssl.create_default_context()
context = ssl.SSLContext(ssl.PROTOCOL_SSLv23)
context.verify_mode = ssl.CERT_REQUIRED
##Certificate file
context.load_verify_locations("phy_ca.crt")

print('start consumer')
consumer = KafkaConsumer(conf['topic_name'],
                         bootstrap_servers=conf['bootstrap_servers'],
                         group_id=conf['consumer_id'],
                         sasl_mechanism="PLAIN",
                         ssl_context=context,
                         security_protocol='SASL_SSL',
                         sasl_plain_username=conf['sasl_plain_username'],
                         sasl_plain_password=conf['sasl_plain_password'])

for message in consumer:
    print("%s:%d:%d: key=%s value=%s" % (message.topic, message.partition,message.offset,
message.key,message.value))

print('end consumer')
```

- Non-SASL authentication mode

  Replace the information in bold with the actual values.

```
from kafka import KafkaConsumer

conf = {
    'bootstrap_servers': ["ip1:port1","ip2:port2","ip3:port3"],
    'topic_name': 'topic-name',
    'consumer_id': 'consumer-id'
}

print('start consumer')
consumer = KafkaConsumer(conf['topic_name'],
                         bootstrap_servers=conf['bootstrap_servers'],
                         group_id=conf['consumer_id'])

for message in consumer:
    print("%s:%d:%d: key=%s value=%s" % (message.topic, message.partition,message.offset,
message.key,message.value))

print('end consumer')
```

2.3.6 Configuring Kafka Clients in Other Languages

MQS is fully compatible with Kafka open-source clients. If you use other languages, you can obtain the clients from the **Kafka official website** and connect the clients to MQS based on the connection description provided by the Kafka official website.

2.3.7 Appendix: Methods for Improving the Message Processing Efficiency

The reliability in sending and retrieving messages is the result of joint efforts from ROMA Connect, message producers, and message consumers. The following lists the best practices for ROMA Connect producers and consumers.

Optimizing the Acknowledgment Process of Message Production and Consumption

Message Production

The producer decides whether to re-send the message based on the ROMA Connect response.

Each time the producer sends a message, it waits for an API response to confirm that the message is successfully sent. If an exception occurs when sending the message, the producer will not receive a success response and must decide whether to re-send the message. If a success response is received, it indicates that the message has been stored in ROMA Connect.

Message Consumption

The consumer acknowledges successful message retrieval.

Messages are stored in ROMA Connect in the order that they are created. During message retrieval, the consumer obtains messages stored in ROMA Connect in the order that they are stored. After the consumer retrieves the messages, the message retrieval status is recorded as successful or failed. The status is then submitted to ROMA Connect. Based on the retrieval status, ROMA Connect determines whether to retrieve the next batch of messages or retrieve the messages that failed to be retrieved.

During this process, the message retrieval status may not be successfully submitted due to an exception. In this case, the corresponding messages will be re-obtained by the consumer in the next message retrieval request.

Idempotent Transferring of Message Production and Consumption

ROMA Connect provides a series of reliability measures to ensure that messages are not lost. For example, the message synchronization storage mechanism is used to prevent the system and server from being abnormally restarted or powered off. The ACK mechanism is used to solve the exceptions that occur during message transmission.

Considering the extreme conditions such as network exceptions, you need to use ROMA Connect to design message sending and consumption in addition to confirming message production and consumption.

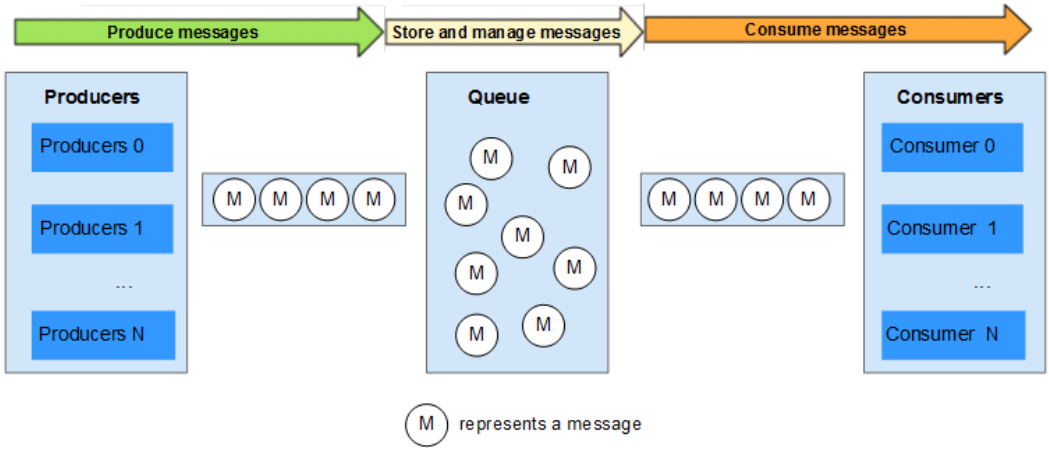
- If the message sending cannot be confirmed, the producer needs to send the message to ROMA Connect repeatedly.
- After consuming a message that has been processed, the consumer needs to notify that ROMA Connect consumption is successful and ensure that the message is not processed repeatedly.

Producing and Consuming Messages in Batches

To improve the message sending and consumption efficiency, consumers are advised to use the batch message sending and consumption mode. Generally, messages are consumed in batches by default, and messages are sent in batches if possible, which effectively reduces the number of API calls.

Refer to the following two figures.

Figure 2-5 Producing and consuming messages in batches

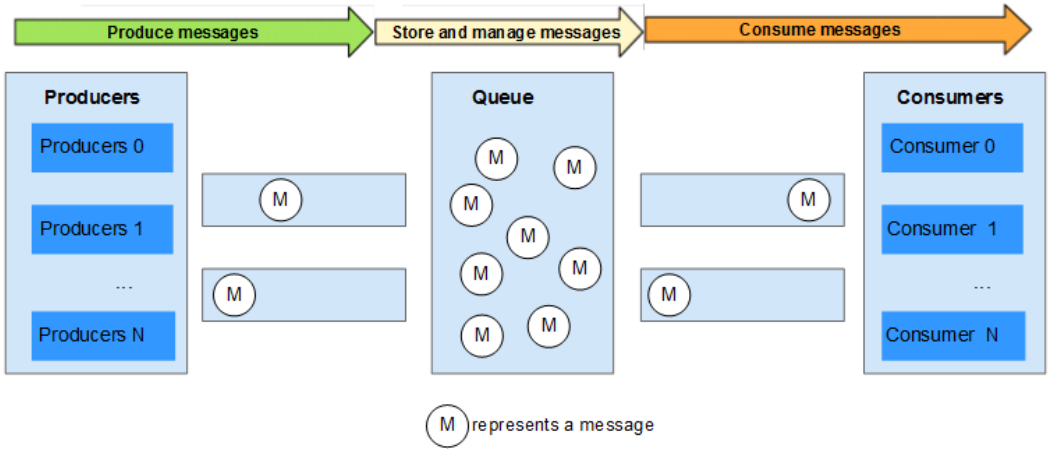


NOTICE

A maximum of 10 messages can be sent in batches. The total size cannot exceed 512 KB.

Message production (sending) in batches can be flexibly used. When there are a large number of concurrent messages, the messages are sent in batches. When the number of concurrent messages is small, the messages are sent one by one. This is done to reduce the number of API calls and ensure real-time message sending.

Figure 2-6 Producing and consuming messages one by one



When consuming messages in batches, consumers need to process and confirm messages in the sequence of receiving messages. Therefore, when a message in the batch fails to be consumed, the consumer does not need to consume the rest messages, and directly submit consumption confirmations of the successfully consumed messages to ROMA Connect.

Using Consumer Groups to Assist O&M

You can use ROMA Connect as a message management system. Reading message content from queues is helpful to fault locating and service debugging.

When problems occur during message production and consumption, you can create different consumer groups to locate and analyze problems or debug services for interconnecting with other services. To ensure that other services can continue to process messages in topics, you can create a new consumer group to retrieve and analyze the messages.

2.3.8 Appendix: Restrictions on Spring Kafka Interconnection

Overview

Spring Kafka is compatible with open-source Kafka clients. For details about the version mapping between Spring Kafka and open-source Kafka clients, see the **Spring official website**. Spring Kafka is mainly compatible with Kafka client 2.x.x, whereas the Kafka server version used by ROMA Connect MQS is 1.1.0 or 2.3.0. Therefore, when Spring Kafka is used to connect to ROMA Connect in the Spring Boot project, ensure that the Kafka client version is the same as the Kafka server version.

If the ROMA Connect instance connected to Spring Kafka uses Kafka 1.1.0, most functions can be used, and only a few new functions are not supported. If you encounter problems not listed in the following, contact technical support. The following lists the functions that are not supported:

Unsupported zstd Compression Type

Kafka 2.1.0 supports the zstd compression type, but the Kafka server in version 1.1.0 does not support.

- Configuration file:

  src/main/resources/application.yml

- Configuration item:

```
spring:
  kafka:
    producer:
      compression-type: xxx
```

- Restriction:

  Do not set **compression-type** to **zstd**.

Static Members Not Supported for Consumers

The parameter **group.instance.id** is added to the Kafka client in version 2.3. Consumers with this ID are considered as static members.

- Configuration file:

  src/main/resources/application.yml
- Configuration item:

```
spring:
  kafka:
    consumer:
      properties:
        group.instance.id: xxx
```

- Restriction:

  Do not add the **group.instance.id** parameter.

2.4 Connecting to MQS Using RESTful APIs

2.4.1 Java Demo Usage Instruction

In addition to the native Kafka client described in the preceding sections, MQS (Kafka) instances can also be accessed in HTTP RESTful mode, including sending messages to specified topics, consuming messages, and acknowledging message consumption.

This mode is used to adapt to the original service system architecture and facilitate unified access using the HTTP protocol.

Using the RESTful Mode

1. Collect connection information.

   The connection information includes the MQS connection address and port, topic name, and SASL username and password. For details, see **Collecting Connection Information**.

   NOTE

   - If both SASL_SSL and intra-VPC plaintext access are enabled for MQS of the ROMA Connect instance, the SASL mode cannot be used for connecting to MQS topics in the VPC.
   - If the SASL mode is used for connecting to MQS topics, you are advised to configure the mapping between the host and IP address in the **/etc/hosts** file on the host where the client is located. Otherwise, network delay will occur.

     Set the IP address to the connection address of MQS and set the host to the name of each instance host. Ensure that the name of each host is unique. For example:

     10.10.10.11 host01

     10.10.10.12 host02

     10.10.10.13 host03
2. Assemble an API request, including the signature of the API request, by referring to the sample code.

   API request signature: The SASL username and password are used as a key pair to sign the request URL and message header timestamp for backend service verification.
3. For details about the structure of response messages returned when a demo project is used to create, retrieve, and confirm messages in a specified topic, see **Message Production API**, **Message Consumption API**, and **Message Retrieval Confirmation API**.

Sample Project Setup

This section provides an example of sending RESTful API requests in Java.

The following is a Maven project developed in IntelliJ IDEA. If you want to use the project in the local environment, install and configure the following environments (Windows 10 is used as an example):

- Maven

  Apache Maven 3.0.3 or later can be downloaded from the **Maven official website**.

- JDK

  Java Development Kit1.8.111 or later can be downloaded from the **Oracle official website**.

  After the installation, configure Java environment variables.

- IntelliJ IDEA tool

  IntelliJ IDEA 2018.3.5 or later can be downloaded from the **IntelliJ IDEA official website**.

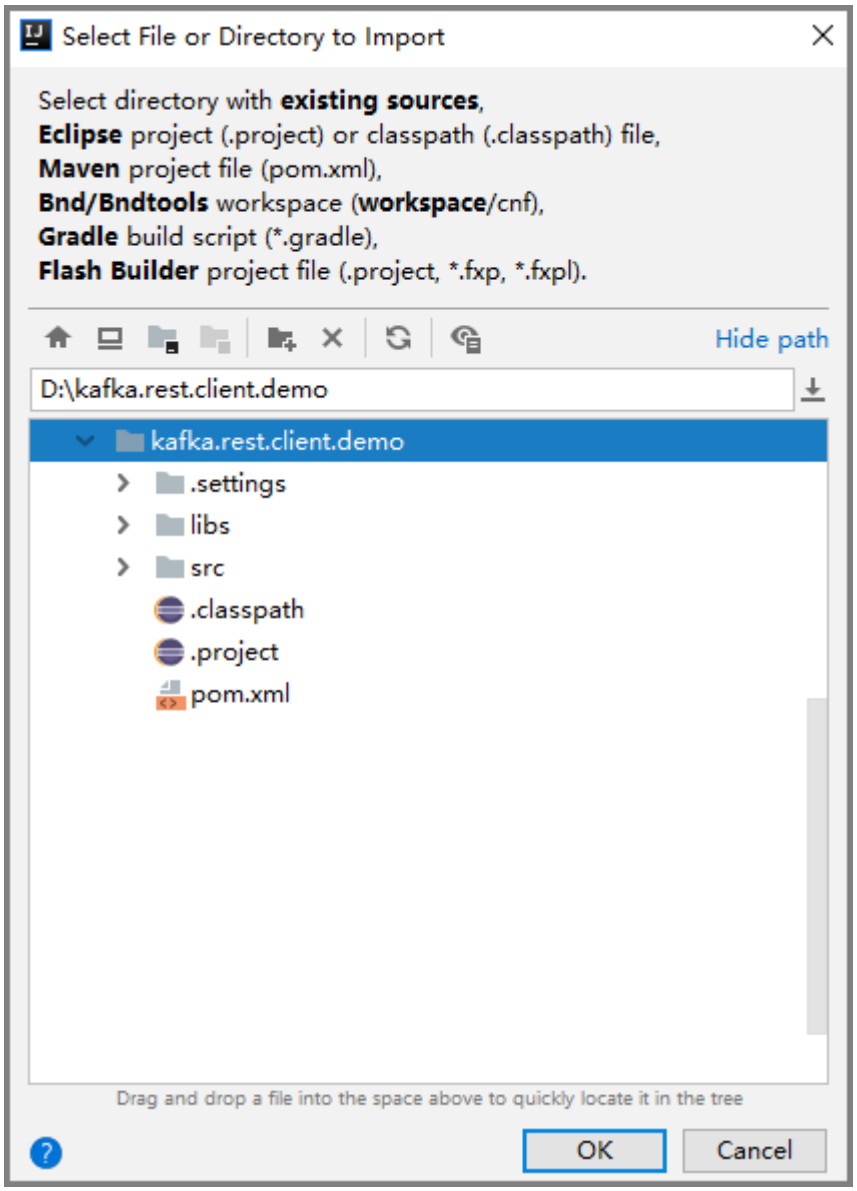
- Demo

  On the ROMA Connect console, choose **Message Queue Service** > **Topic Management**. In the upper right corner of the page, choose **User Guide** > **Download RESTful API Java Demo Package** to download the demo.

Step 1 Start IntelliJ IDEA and choose **Import Project**.

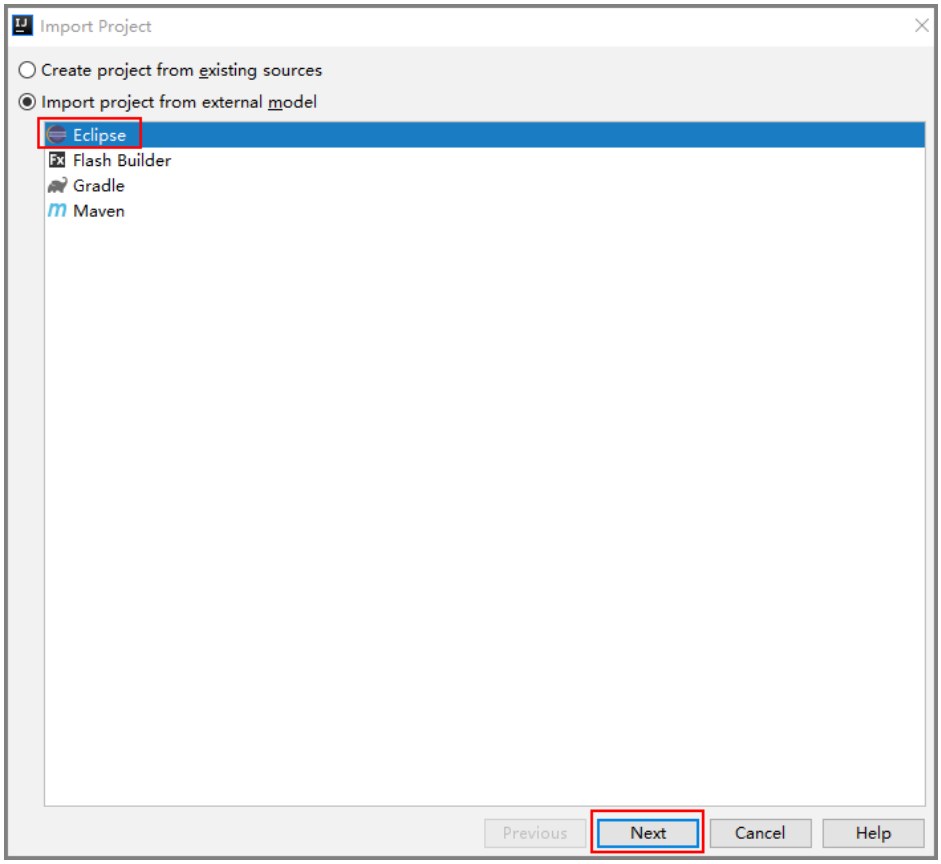
The **Select File or Directory to Import** dialog box is displayed.

Step 2 Select the directory where the RESTful API Java demo is decompressed and click **OK**.



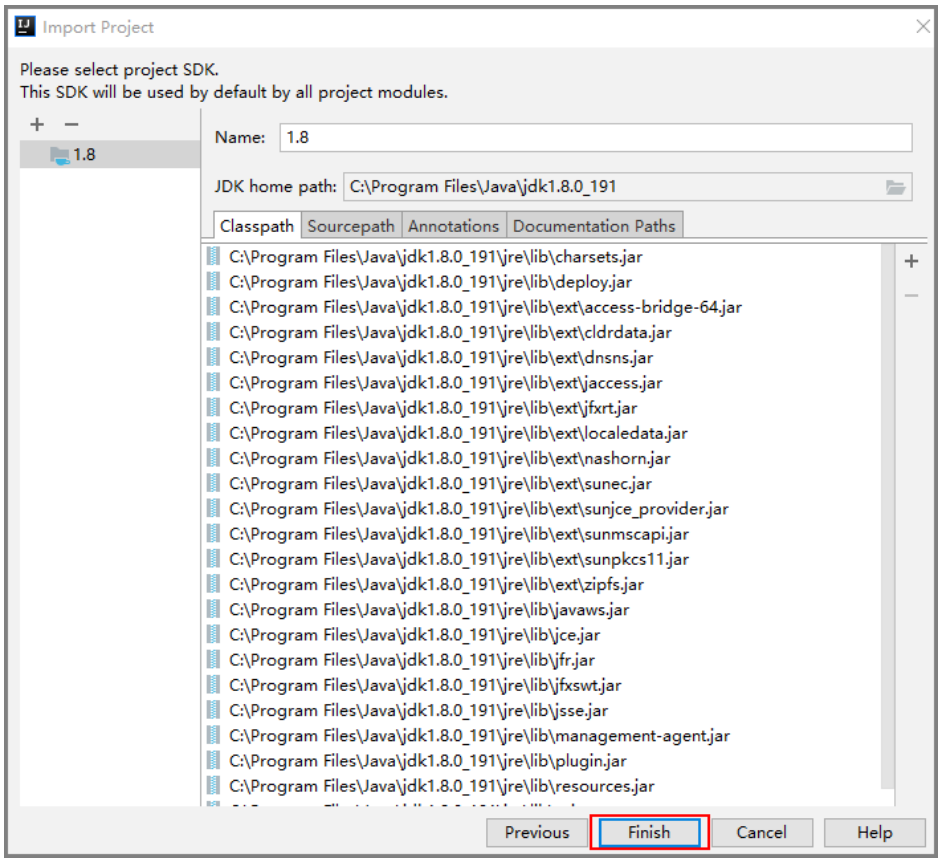
Step 3 Select **Eclipse** for **Import project from external model** and click **Next**. Retain the default settings and click **Next** until the **Please select project SDK** page is displayed.

Figure 2-7 Import Project dialog box



Step 4 Click **Finish**.

Figure 2-8 Finish



Step 5 Edit the **rest-config.properties** file.

The file is located in the **src/main/resources** directory. Enter the obtained Kafka instance connection address, topic name, and SASL information in the following configuration. **kafka.rest.group** indicates the consumer group ID, which can be specified on the client.

```
# Kafka rest endpoint.
kafka.rest.endpoint=https://{MQS_Instance_IP_Addr}:9292
# Kafka topic name.
kafka.rest.topic=topic_name_demo
# Kafka consume group.
kafka.rest.group=group_id_demo
# Kafka sasl username.
kafka.rest.username=sasl_username_demo
# Kafka sasl password.
kafka.rest.password=sasl_user_passwd_demo
```

Step 6 Edit log4j.properties.

For example, modify the directory for storing logs.

```
log.directory=D://workspace/logs
```

Step 7 Run the sample project to view the message production and consumption examples.

The main method for producing and consuming messages is in the **RestMain.java** file. You can run the main method in Java Application mode.

----End

Code of the Sample Project

- Project entry

  The project entry is in the **RestMain.java** file.

```
public class RestMain
{
    private static final Logger LOGGER = LoggerFactory.getLogger(RestMain.class);

    public static void main(String[] args) throws InterruptedException
    {
        //Initialize the request object. The RestServiceImpl class file also contains the RESTful APIs and request signature.
        IRestService restService = new RestServiceImpl();
        Base64.Decoder decoder = Base64.getDecoder();
        //The following are message production, message consumption, and consumption confirmation.
        // Produce message
        ProduceReq messages = new ProduceReq();
        messages.addMessage("{[{'id': '00001', 'name': 'John'}, {'id': '00002', 'name': 'Mike'}]}").addMessage("Kafka rest client demo!");
        LOGGER.debug("produce message: {}", JsonUtils.convertObject2Str(messages));
        restService.produce(messages);

        // Consume message
        List<ConsumeResp> consumeResps = restService.consume();
        CommitReq commitReq = new CommitReq();
        consumeResps.forEach(resp ->
        {
            LOGGER.debug("handler: {}, content: {}", resp.getHandler(), new String(decoder.decode(resp.getMessage().getContent())));
            commitReq.addCommit(resp.getHandler());
        });

        // Commit message
        if (commitReq.getMessages().size() != 0)
        {
            CommitResp resp = restService.commit(commitReq);
            LOGGER.info("Commit resp: success: {}, failed: {}", resp.getSuccess(), resp.getFail());
        }
        else
        {
            LOGGER.warn("Commit is empty.");
        }
    }
}
```

- Message assembling and sending

  The following uses message production as an example to describe how to assemble and sign a message. After the signature method is invoked, two message headers are returned: **Authorization** and **X-Sdk-Date**. **Authorization** contains signature information of the requested content. Another parameter **Content-Type** in the message header must be added to the code. For details, see the createRequest() method in the example.

```
public List<ProduceResp> produce(ProduceReq messages)
    {
        List<ProduceResp> prodResp = null;
        try
        {
            Request request = createRequest();
            request.setUrl(produceURI);
            request.setMethod("POST");
            request.setBody(JsonUtils.convertObject2Str(messages));
            //After the request content is signed, two parameters are added to the request header: **Authorization** and **X-Sdk-Date**. **Authorization** contains signature information of the requested content.
            HttpRequestBase signedRequest = Client.sign(request);
            LOGGER.debug("Request uri: {}, headers: {}", signedRequest.getURI(),
```



```
signedRequest.getAllHeaders());
            LOGGER.debug("Request body: {}", request.getBody());

            HttpResponse response = HttpUtils.execute(signedRequest);
            if (response.getStatusLine().getStatusCode() == HttpStatus.SC_CREATED)
            {
                String jsonStr = EntityUtils.toString(response.getEntity(), "UTF-8");
                prodResp = JsonUtils.convertStr2ListObject(jsonStr, new
TypeReference<List<ProduceResp>>() { });
                LOGGER.info("Produce response: {}", jsonStr);
                return prodResp;
            }
            else
            {
                LOGGER.error("Produce message failed. statusCode: {}, error msg: {}",
                        response.getStatusLine().getStatusCode(),
                        EntityUtils.toString(response.getEntity(), "UTF-8"));
            }
        }
        catch (Exception e)
        {
            LOGGER.error("Produce message failed.");
        }
        return prodResp;
    }
```

2.4.2 Message Production API

Function

This API is used to send messages to a queue. Multiple messages can be sent at a time. The following requirements must be met:

- A maximum of 10 messages can be sent at a time.
- The aggregated size of messages sent at a time cannot exceed 2 MB.
- The endpoint is https://{rest_connect_address}:9292. You can query the value of rest_connect_address through a specified instance interface.

URI

POST /v1/topic/{topic_name}/messages

Table 2-4 Parameter description

Parameter	Type	Mandatory	Description
topic_name	String	Yes	Topic name.

Request

Request parameter

Parameter	Type	Mandatory	Description
messages	Array	Yes	Message list. The array size cannot exceed 10 and cannot be null.

Table 2-5 Parameter description of messages

Parameter	Type	Mandatory	Description
content	Object	Yes	Message content.
id	String	Yes	Message sequence number, which must be unique.

Example request

```
{
  "messages": [
    {
      "content": "hello roma-1",
      "id": "1"
    },
    {
      "content": "hello roma-2",
      "id": "2"
    },
    {
      "content": "hello roma-3",
      "id": "3"
    }
  ]
}
```

Response

Response parameter

Parameter	Type	Description
state	String	Result status. The value can be **success** or **fail**.
id	String	Message sequence number.

Example response

```
[
  {
    "state": "success",
    "id": "1"
  },
  {
```



```
    "state": "success",
    "id": "2"
  },
  {
    "state": "success",
    "id": "3"
  }
]
```

2.4.3 Message Consumption API

Function

This API is used to consume messages in a specified queue. Multiple messages can be consumed at the same time.

- When there are only a few messages in a queue, the number of messages actually consumed at a time may be less than the message quantity specified in the consumption request. However, all messages in the queue will be eventually obtained by the message consumer after multiple rounds of consumption. If the returned message is an empty array, no message is consumed.
- The endpoint is https://{rest_connect_address}:9292. You can query the value of rest_connect_address through a specified instance interface.

URI

GET /v1/topic/{topic_name}/group/{group_name}/messages?ack_wait={ack_wait}&time_wait={time_wait}&max_msgs={max_msgs}

Table 2-6 Parameter description

Parameter	Type	Mandatory	Description
topic_name	String	Yes	Topic name.
group_name	String	Yes	Consumer group name. The value is a string of 1 to 249 characters that contain letters, digits, hyphens (-), and underscores (_).

Parameter	Type	Mandatory	Description
ack_wait	Integer	No	Timeout duration that the API call can wait for message consumption acknowledgement. The client needs to submit the message consumption acknowledgement within the specified time. If the message consumption is not acknowledged within this period of time, the system displays a message, indicating that message consumption acknowledgement has timed out or the handler is invalid. In this case, the system determines that the message fails to be consumed by default. Value range: 1–300s Default value: **15s**
time_wait	Integer	No	Amount of time that the API call can wait for a message to arrive in the empty queue before returning an empty response. If a message is available during the wait period, the message consumption result is returned immediately. If no dead letter message is available until the wait period expires, an empty response will be returned after the wait period ends. Value range: 1–30s Default value: **3s**
max_msgs	Integer	No	Number of consumable messages that can be obtained per time. Value range: 1–10 Default value: **10**
max_bytes	Integer	No	Maximum message load that can be consumed each time. Value range: 1–2097152 Default value: **524288**

Request

Request parameters

None.

Example request

None.

Response

Response parameters

Parameter	Type	Description
handler	String	Message handler.
message	JSON object	Message content.

Table 2-7 Parameter description of message

Parameter	Type	Description
content	JSON	Message body content, which is encrypted using Base64.

Example response

```
[
  {
    "handler": "NCMxMDAjMTgjMA==",
    "message": {
      "content": "ImhlbGxvIGh1YXdlaWNsb3VkLTIi"
    }
  }
]
```

2.4.4 Message Retrieval Confirmation API

Function

This API is used to acknowledge consumption of specified messages.

- When a message is being consumed, it remains in the queue. It cannot be consumed again by the same consumer group within 30s since the start of the consumption. If consumption is not acknowledged within this period, MQS determines that this message fails to be consumed, and this message can be consumed again.
- The endpoint is https://{rest_connect_address}:9292. You can query the value of rest_connect_address through a specified instance interface.

URI

POST /v1/topic/{topic_name}/group/{group_name}/messages

Table 2-8 Parameter description

Parameter	Type	Mandatory	Description
topic_name	String	Yes	Topic name.
group_name	String	Yes	Consumer group name.

Request

Request parameter

Parameter	Type	Mandatory	Description
messages	Array	Yes	Message list. The array size cannot exceed 10 and cannot be null.

Table 2-9 Parameter description

Parameter	Type	Mandatory	Description
handler	String	Yes	Message handler.
status	String	Yes	Consumption status. The value can only be **success** or **fail**.

Example request

```
{
  "messages": [
    {
      "handler": "NCMxMDAjMTgjMA==",
      "status": "success"
    }
  ]
}
```

Response

Response parameter

Parameter	Type	Description
success	Integer	Number of consumptions that are successfully acknowledged.

Parameter	Type	Description
fail	Integer	Number of consumptions that fail to be acknowledged.

Example response

```
{
  "success": 1,
  "fail": 0
}
```


3 Developer Guide for Device Integration

3.1 Device Integration Development

Overview

This section describes how to transmit messages with devices through LINK. Two parts are involved: configuring device connection information for a demo, and sending and receiving messages.

Preparations

- Downloading SDKs

  ROMA LINK supports the standard Message Queue Telemetry Transport (MQTT) protocol. You can use the open-source Eclipse Paho MQTT Client to connect to ROMA LINK.

  Download link: **Eclipse Paho MQTT Client**
- Downloading a device integration demo

  Log in to the ROMA Connect console and choose **LINK** > **Device Management**. Click **Download Demo**.

  In this example, the demo uses a Java SDK. A demo contains two files. The **DeviceConnectDemo.java** file is used to connect to devices, and the **DeviceControlDemo.java** file is used to call APIs of control devices.
- Creating a product

  For details, see **Creating a Product**.
- Creating a device

  For details, see **Registering a Device**.

Configuring Device Connection Information of a Demo

1. Log in to the ROMA Connect console and click **View Console**.
2. In the navigation pane on the left, choose **LINK** > **Device Management**.
3. On the **Device Management** page displayed, click the name of a created device to access the device details page and obtain device connection information.

You can edit the following device information: device connection address, device client ID, username, password, topics with the PUB permission, and topics with the SUB permission.

4. Decompress the demo package and find the **DeviceConnectDemo.java** file under **romalink_demo** > **src** > **com** > **demo** > **romalink**.
5. Use the Java editing tool to open the file and edit the device connection information. After the running is successful, you can view the status of the online device on the **Device Management** page.

   NOTE

   The format of the device connection address is tcp://*ip:port*. Enter the device connection address in the correct format.

```
//Device connection address
final String host = "";
//Device client ID
final String clientId = "";
//Username for device authentication
final String userName = "";
//Password for device authentication
final String password = "";
//Topic with the PUB permission
final String pubTopic = "";
//Topic with the SUB permission
final String subTopic = "";
//Content of the message sent by the device
final String payload = "hello world.";
```

Sending and Receiving Messages

The **DeviceConnectDemo.java** file has preset messages of topics with the PUB permission. If you call an API for sending control messages to a device, the device can receive the message immediately.

```
client.subscribe(subTopic, (s, mqttMessage) -> {
            String recieveMsg = "Receive message from topic:" + s + "\n";
            System.out.println(recieveMsg + new String(mqttMessage.getPayload(),
StandardCharsets.UTF_8));
        });
```

1. Call APIs for sending control messages.
   a. Use the Java editor to open the **DeviceControlDemo.java** file and change the parameters of the API for sending control messages to the created device information.

      Enter the following information: appKey, appSecret, device client ID, topic with the SUB permission, access address of the API for sending control messages, access port, and message content.

```
public static void main(String[] args)
   {
      //appKey used for API authentication
      String appKey = "";
      //appSecret used for API authentication
      String appSecret = "";
      //ID of the device client that needs to send control messages
      String clientId = "";
      //Topic with the SUB permission of the device that needs to send control messages
      String subTopic = "";
      //Access address of the API for sending control messages
      String host = "";
      //Access port of the API for sending control messages
      String port = "";
      //Content of the message to be sent to the device
```



```
        String payload = "hello world.";

        String url = "https://" + host + ":" + port + "/v1/devices/" + clientId;
        controlDevice(url, appKey, appSecret, clientId, subTopic, payload);
    }
```

- The values of **appKey** and **appSecret** can be obtained by clicking the name of the integration application to which the device belongs on the **Integration Applications** page of the ROMA Connect console and viewing the key and secret from basic information about the integration application.
- The port number is 7443. The values of **clientId**, **subTopic**, **host**, and **port** can be obtained by clicking the device name on **Device Management** page of the ROMA Connect console.

b. Recompile and run the DeviceControlDemo class. If the device is connected and subscribes to a topic with the SUB permission, the device immediately receives a message and prints it on the IDE console. The request IP address of the API is the same as the IP address for connecting to the device, and the port number is 7443.

2. Send messages.

   You can set the content and frequency of messages to be sent by a device. For example, you can instruct a device to send a message to ROMA LINK every 10 seconds. After the code runs, ROMA LINK receives a message every 10 seconds.

```
try
      {
         final MqttClient client = new MqttClient(host, clientId);
         client.connect(mqttConnectOptions);
         System.out.println("Device connect success. client id is " + clientId + ", host is " + host);

         final MqttMessage message = new MqttMessage();
         message.setQos(1);
         message.setRetained(false);
         message.setPayload(payload.getBytes(StandardCharsets.UTF_8));

         Runnable pubTask = () -> {
            try
            {
               client.publish(pubTopic, message);
            }
            catch (MqttException e)
            {
               System.out.println(e.getMessage());
            }
         };

         client.subscribe(subTopic, (s, mqttMessage) -> {
            String recieveMsg = "Receive message from topic:" + s + "\n";
            System.out.println(recieveMsg + new String(mqttMessage.getPayload(),
StandardCharsets.UTF_8));
         });

         ScheduledExecutorService service = Executors
               .newSingleThreadScheduledExecutor();
         service.scheduleAtFixedRate(pubTask, 0, 10, TimeUnit.SECONDS);
      }
```


NOTE

- The Connect code simulates the function of connecting the MQTT.fx client to the device. After the connection is successful, the device displays "Connected."
- To prevent device disconnection caused by unstable networks or instance upgrade, add the device status detection and automatic reconnection mechanisms during device development.

3.2 MQTT Topic Specifications

3.2.1 Before You Start

NOTICE

Currently, CoAP supports only command delivery and data reporting of directly connected devices.

- When the IoT platform functions as the message subscriber, it has subscribed to related topics by default. The IoT platform can receive messages sent by devices to the corresponding topics.
- When a device functions as a message subscriber, the device needs to subscribe to related topics first so that the device can receive messages sent by the IoT platform to the corresponding topics. The device determines the topics to be subscribed to based on the specific business requirements.

Topic	Supported Protocol	Publisher	Subscriber	Function
/v1/devices/{gatewayId}/topo/add	MQTT	Edge device	IoT platform	The edge device adds a subdevice.
/v1/devices/{gatewayId}/topo/addResponse		IoT platform	Edge device	The IoT platform returns a response for adding a subdevice.
/v1/devices/{gatewayId}/topo/update		Edge device	IoT platform	The edge device updates the subdevice status.
/v1/devices/{gatewayId}/topo/updateResponse		IoT platform	Edge device	The IoT platform returns a response for updating the subdevice status.

Topic	Supported Protocol	Publisher	Subscriber	Function
/v1/devices/{gatewayId}/topo/delete		IoT platform	Edge device	The IoT platform deletes a subdevice.
/v1/devices/{gatewayId}/topo/query		Edge device	IoT platform	The edge device queries gateway information.
/v1/devices/{gatewayId}/topo/queryResponse		IoT platform	Edge device	The IoT platform returns a response for querying gateway information.
/v1/devices/{gatewayId}/command		IoT platform	Edge device	The IoT platform delivers a command to a device or an edge device.
/v1/devices/{gatewayId}/commandResponse		Edge device	IoT platform	The edge device returns a command response to the IoT platform.
/v1/devices/{gatewayId}/datas		Edge device	IoT platform	The edge device reports data.

NOTE

In the preceding table, {*gatewayId*} indicates the device ID. Specifications of previous sites are inherited by delete, while specifications are not provided for deleteResponse now.

3.2.2 Gateway Login

The IoT platform supports the CONNECT message API using the MQTT protocol in the southbound direction to obtain the authentication information clientId, Username, and Password.

Parameter Description

Parameter	Mandatory / Optional	Type	Description
clientId	Mandatory	String(256)	The value of this parameter consists of the device or node ID, authentication type, password signature type, and timestamp, which are separated by underscores (_). ● The authentication type is 1 byte long and can be set to one of the following values – **0**: The device ID, which is unique for each device, is used for access – **2**: The node ID, which is unique for each device, is used for access ● The signature type is 1 byte long and can be set to one of the following values: – **0**: The timestamp is not verified using the HMAC-SHA256 algorithm. – **1**: The timestamp is verified using the HMAC-SHA256 algorithm. ● The timestamp is the UTC time when the device was connected to the platform, in the format of YYYYMMDDHH. For example, if the UTC time is 2018/7/24 17:56:20, the timestamp is **2018072417**. For example, the client ID of the device ID is D39564861q3gDa_0_0_2018072417.
Username	Mandatory	String(256)	Username, which is unique for each device. ● When the device accesses the platform using deviceId, set this parameter to the value of **deviceId** used when the device is registered successfully. ● When the device accesses the platform using nodeId, set this parameter to the value of **nodeId** used when the device is registered successfully.
Password	Mandatory	String(256)	The value of this parameter is the value of the device secret encrypted by using the HMAC-SHA256 algorithm with the timestamp as the key. The value of this parameter is the secret returned by the platform during device registration or is the secret of the device.

3.2.3 Adding a Gateway Subdevice

Topic

Topic	/v1/devices/{gatewayId}/topo/add
Publisher	Edge device
Subscriber	IoT platform

Parameter Description

Field	Mandatory/ Optional	Type	Description
mid	Mandatory	Integer	Command ID.
deviceInfos	Mandatory	List<DeviceInfos>	Subdevice information list. The list contains 1 to 100 records.

DeviceInfos struct description

Field	Mandatory/ Optional	Type	Description
nodeId	Mandatory	String	Device identifier. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, and hyphens (-).
name	Optional	String	Device name. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and number signs (#).
description	Optional	String	Device description. The value length cannot exceed 200 characters.

Field	Mandatory/ Optional	Type	Description
manufacturerId	Mandatory	String	Manufacturer ID. The value must contain 2 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).
model	Mandatory	String	Product model. The value must contain 2 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).

Example

```
{
      "deviceInfos": [{
"manufacturerId": "Test_n",
"model": "A_n",
            "nodeId": "n-device"
      }],
      "mid": 7
}
```

3.2.4 Response for Adding a Gateway Subdevice

Topic

Topic	/v1/devices/{gatewayId}/topo/addResponse
Publisher	IoT platform
Subscriber	Edge device

Parameter Description

After a subdevice is added successfully, a response containing information about the new subdevice is returned. During secondary development, information about the new subdevice needs to be saved locally. The returned **deviceId** field is used for reporting subdevice data, updating the subdevice status, and deleting the subdevice.

Response parameter description

Field	Mandatory/ Optional	Type	Description
mid	Mandatory	Integer	Command ID.
statusCode	Mandatory	Integer	Result code for request processing. The options are as follows: ● **0**: success ● non-0: failure
statusDesc	Optional	String	Response status description.
data	Mandatory	List< AddDeviceRsp >	Information about the added subdevice.

AddDeviceRsp struct description

Field	Mandatory/ Optional	Type	Description
statusCode	Mandatory	Integer	Result code for request processing. The options are as follows: ● **0**: success ● non-0: failure
statusDesc	Optional	String	Response status description.
deviceInfo	Optional	DeviceInfo	Device information.

DeviceInfo struct description

Field	Mandatory/ Optional	Type	Description
nodeId	Mandatory	String	Device identifier. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, and hyphens (-).

Field	Mandatory/ Optional	Type	Description
deviceId	Mandatory	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
name	Mandatory	String	Device name. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and number signs (#).
description	Optional	String	Device description. The value length cannot exceed 200 characters.
manufacturerId	Mandatory	String	Manufacturer ID. The value must contain 2 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).
model	Mandatory	String	Product model. The value must contain 2 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).

Example

```
{
    "data": [{
        "deviceInfo": {
 "manufacturerId": "Test_n",
            "name": "n-device",
 "model": "A_n",
            "nodeId": "n-device",
            "deviceId": "D59eGSxy"
        },
        "statusCode": 0
    }],
    "mid": 7,
    "statusCode": 0
}
```


3.2.5 Updating the Gateway Subdevice Status

Topic

Topic	/v1/devices/{gatewayId}/topo/update
Publisher	Edge device
Subscriber	IoT platform

Parameter Description

Field	Mandatory/Optional	Type	Description
mid	Mandatory	Integer	Command ID.
deviceStatuses	Mandatory	List<DeviceStatus>	Device status list. The list contains 1 to 100 records.

deviceStatus struct description

Field	Mandatory/Optional	Type	Description
deviceId	Mandatory	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
status	Mandatory	String	Subdevice status. The options are as follows: • **OFFLINE** • **ONLINE**

Example

```
{
    "deviceStatuses": [{
        "deviceId": "D59eGSxy",
        "status": "ONLINE"
    }],
    "mid": 9
}
```


3.2.6 Response for Updating the Gateway Subdevice Status

Topic

Topic	/v1/devices/{gatewayId}/topo/updateResponse
Publisher	IoT platform
Subscriber	Edge device

Parameter Description

Field	Mandatory/ Optional	Type	Description
mid	Mandatory	Integer	Command ID.
statusCode	Mandatory	Integer	Result code for request processing. The options are as follows: ● **0**: success ● non-0: failure
statusDesc	Optional	String	Response status description.
data	Optional	List< UpdateStatusRsp >	Device status information after being updated.

UpdateStatusRsp struct description

Field	Mandatory/ Optional	Type	Description
statusCode	Mandatory	Integer	Result code for request processing. The options are as follows: ● **0**: success ● non-0: failure
statusDesc	Optional	String	Result description.

Field	Mandatory/ Optional	Type	Description
deviceId	Mandatory	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.

Example

```
{
    "data": [{
        "deviceId": "D59eGSxy",
        "statusCode": 0
    }],
    "mid": 9,
    "statusCode": 0
}
```

3.2.7 Deleting a Gateway Subdevice

Topic

Topic	/v1/devices/{gatewayId}/topo/delete
Publisher	IoT platform
Subscriber	Edge device

Parameter Description

Field	Mandatory/ Optional	Type	Description
id	Mandatory	Integer	ID of the command for deleting a subdevice.
deviceId	Mandatory	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
requestTime	Mandatory	Timestamp	Request timestamp.
request	Mandatory	JsonObject	Subdevice information.

JsonObject struct description

Field	Mandatory/ Optional	Type	Description
manufacturerName	Mandatory	String	Manufacturer name. The value must contain 2 to 64 characters.
manufacturerId	Mandatory	String	Manufacturer ID. The value must contain 2 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).
model	Mandatory	String	Product model. The value must contain 2 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).

Example

```
{
      "requestTime": 1576639584536,
      "request": {
 "manufacturerName": "ATest_n",
"manufacturerId": "Test_n",
 "model": "A_n"
      },
      "id": 8,
      "deviceId": "n-device"
}
```

3.2.8 Querying Gateway Information

Topic

Topic	/v1/devices/{gatewayId}/topo/query
Publisher	Edge device
Subscriber	IoT platform

Parameter Description

Field	Mandatory/ Optional	Type	Description
mid	Mandatory	Integer	Command ID.
deviceId	Optional	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
nodeId	Mandatory	String	Device identifier. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, and hyphens (-).
model	Optional	String	Product model. The value must contain 3 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).
manufactureId	Optional	Timestamp	Manufacturer ID. The value must contain 3 to 32 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).
nodeType	Optional	JsonObject	Subdevice information.

Example

```
{
   "mid": 2,
   "nodeId": "test123"
}
```

3.2.9 Response for Querying Gateway Information

Topic

Topic	/v1/devices/{ deviceId}/queryResponse
Publisher	IoT platform
Subscriber	Edge device

Parameter Description

Field	Mandatory/ Optional	Type	Description
mid	Mandatory	Integer	Command ID.
statusCode	Mandatory	Integer	Result code for request processing. The options are as follows: • **0**: success • non-0: failure
statusDesc	Optional	String	Response status description.
data	Optional	List< UpdateStatusRsp >	Device information.
count	Optional	String	Device quantity.
marker	Optional	String	Tag.

JsonObject struct description

Field	Mandatory/ Optional	Type	Description
deviceId	Mandatory	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
nodeId	Mandatory	String	Device identifier. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, and hyphens (-).
name	Mandatory	String	Device name. The value must contain 2 to 64 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and number signs (#).

Field	Mandatory/ Optional	Type	Description
description	Optional	String	Device description. The value length cannot exceed 200 characters.
manufactureId	Mandatory	String	Manufacturer ID. The value must contain 3 to 32 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).
model	Mandatory	String	Product model. The value must contain 3 to 50 characters and can consist of only uppercase and lowercase letters, digits, hyphens (-), and underscores (_).

Example

```
{
   "mid": 2,
   "statusCode": 0,
   "statusDesc": "",
      "marker": "",
      "count": "1",
   "data": [
      {
         "deviceId": "D59eGSxy",
         "nodeId": "test123",
         "name": "n-device",
         "description": "addsSubDevice",
"manufacturerId": "Test_n",
"model": "A_n"
      }
   ]
}
```

3.2.10 Delivering a Command to a Device

Topic

Topic	/v1/devices/{ deviceId}/command
Publisher	IoT platform
Subscriber	Edge device

Parameter Description

Field	Mandatory/ Optional	Type	Description
deviceId	Mandatory	String	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
msgType	Mandatory	String	This field has a fixed value of **cloudReq**, which indicates a request delivered by the IoT platform.
serviceId	Mandatory	String	Service ID.
cmd	Mandatory	String	Command name of a service.
paras	Mandatory	ObjectNode	Command parameter.
mid	Mandatory	Int	Command ID.

Example

```
{
        "msgType": "cloudReq",
        "mid": 54132,
        "cmd": "command1",
        "paras": {
                "temperature": 123
        },
        "serviceId": "service1",
        "deviceId": "D23pigXo"
}
```

3.2.11 Response for Delivering a Command to a Device

Topic

Topic	/v1/devices/{ deviceId}/commandResponse
Publisher	Edge device
Subscriber	IoT platform

Parameter Description

Field	Mandatory/ Optional	Type	Description
msgType	Mandatory	String	This field has a fixed value of **deviceRsp**, which indicates a response returned by a device.
mid	Mandatory	Int	Command ID.
errcode	Mandatory	Int	Result code for request processing. The options are as follows: ● **0**: success ● non-0: failure
body	Optional	ObjectNode	Command response.

Example

```
{
	"body": {
		"orginParameters": {
			"temperature": 123
		},
		"state": "ok"
	},
	"errcode": 0,
	"mid": 54132,
	"msgType": "deviceRsp"
}
```

3.2.12 Reporting Device Data

Topic

Topic	/v1/devices/{deviceId}/datas
Publisher	Edge device
Subscriber	IoT platform

Parameter Description

Field	Mandatory/ Optional	Type	Description
devices	Mandatory	DeviceS[]	Device data.

DeviceS struct description

Field	Mandatory/ Optional	Type	Description
deviceId	Mandatory	String(256)	Unique device ID generated by the IoT platform, which corresponds to the device client ID.
services	Mandatory	List<Services>	Service list.

Services struct description

Field	Mandatory/ Optional	Type	Description
serviceId	Mandatory	String(256)	Service ID.
data	Mandatory	ObjectNode	Service data.
eventTime	Mandatory	String(256)	Time. The format is ***yyyyMMdd*'T'*HHmmss*'Z'**, for example, **20151212T121212Z**.

Example

```
{
    "devices": [{
        "deviceId": "D68NZxB4",
        "services": [{
            "data": {
                "key": "value"
            },
            "eventTime": "20191023T173625Z",
            "serviceId": "serviceName"
        }]
    }]
}
```

