FunctionGraph

Getting Started

Issue 01

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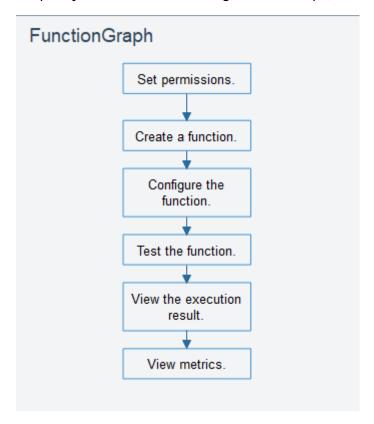
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1 Introduction

General Procedure

FunctionGraph allows you to run your code without provisioning or managing servers, while ensuring high availability and scalability. All you need to do is upload your code and set execution conditions, and FunctionGraph will take care of the rest. In addition, you pay only for what you use and you are not charged when your code is not running.

To quickly create a function using FunctionGraph, do as follows:



1. Set permissions: Ensure that you have the **FunctionGraph Administrator** permissions.

- 2. Create a function: Create a function from scratch or using the sample code or a container image.
- 3. Configure the function: Configure the code source or modify other parameters.
- 4. Test the function: Create a test event to debug the function.
- 5. View the execution result: On the function details page, view the execution result based on the configured test event.
- 6. View metrics: On the **Monitoring** tab page of the function details page, view function metrics.

2 Creating a Function from Scratch

Introduction

This section describes how to quickly create and test a HelloWorld function on the FunctionGraph console.

Step 1: Prepare the Environment

To perform the operations described in this section, ensure that you have the **FunctionGraph Administrator** permissions, that is, the full permissions for FunctionGraph. For more information, see section "Permissions Management".

Step 2: Create a Function

- Log in to the FunctionGraph console. In the navigation pane, choose Functions > Function List.
- 2. Click **Create Function** in the upper right corner and choose **Create from** scratch.
- On the displayed page, set Function Name to HelloWorld, retain the default values for other parameters, and click Create Function. For details, see Figure 2-1.

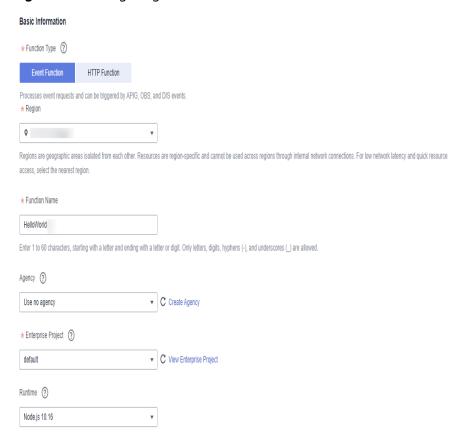


Figure 2-1 Configuring basic information

4. Configure the code source, copy the following code to the code window, and click **Deploy**.

The sample code enables you to obtain test events and print test event information.

```
exports.handler = function (event, context, callback) {
    const error = null;
    const output = 'Hello message: ${JSON.stringify(event)}';
    callback(error, output);
}
```

Step 3: Test the Function

- 1. On the function details page, click **Test**. In the displayed dialog box, create a
- Select blank-template, set Event Name to test, modify the test event as follows, and click Create.

```
{
    "hello": "function"
}
```

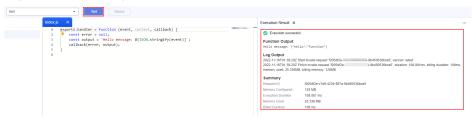
Figure 2-2 Configuring a test event

Step 4: View the Execution Result

Click **Test** and view the execution result on the right.

- Function Output: displays the return result of the function.
- Log Output: displays the execution logs of the function.
- **Summary**: displays key information of the logs.

Figure 2-3 Viewing the execution result



□ NOTE

A maximum of 2 KB logs can be displayed. For more log information, see section "Querying Function Logs".

Step 5: View Monitoring Metrics

On the function details page, click the **Monitoring** tab.

- On the **Monitoring** tab page, choose **Metrics**, and select a time range (such as 5 minutes, 15 minutes, or 1 hour) to query the function.
- The following metrics are displayed: invocations, errors, duration (maximum, average, and minimum durations), throttles, and instance statistics (reserved instances).

Step 6: Delete a Function

1. On the function details page, choose **Operation** > **Delete Function** in the upper right corner.

2. In the confirmation dialog box, enter **DELETE** and click **OK** to release resources in a timely manner.

3 Creating a Function Using a Template

Introduction

FunctionGraph provides templates to automatically complete code and running environment configurations when you create a function, helping you quickly build applications.

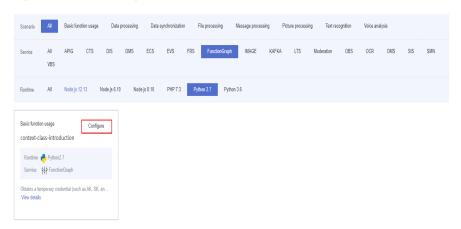
Step 1: Prepare the Environment

To perform the operations described in this section, ensure that you have the **FunctionGraph Administrator** permissions, that is, the full permissions for FunctionGraph. For more information, see section "Permissions Management".

Step 2: Create a Function

- Log in to the FunctionGraph console. In the navigation pane, choose Functions > Function List.
- 2. Click **Create Function** in the upper right corner and choose **Select template**.
- 3. Select the template shown in Figure 3-1 and click Configure.

Figure 3-1 Selecting a template

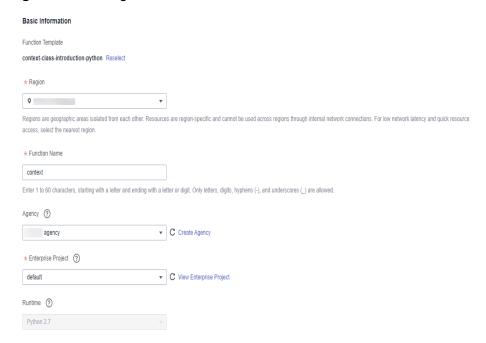


4. Set **Function Name** to **context**, select any agency from the **Agency** dropdown list, retain default values for other parameters, and click **Create Function**.

◯ NOTE

 If no agency is configured, the following message will be displayed when the function is triggered:
 Failed to access other services because no temporary AK, SK, or token has been obtained.
 Please set an agency.

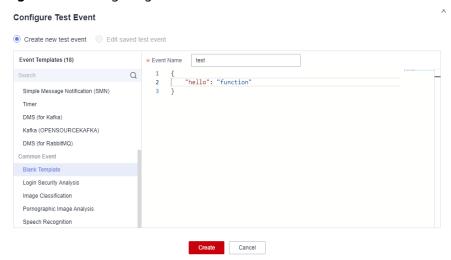
Figure 3-2 Setting basic information



Step 3: Test the Function

- On the function details page, click **Test**. In the displayed dialog box, create a test event.
- 2. Select **blank-template**, set **Event Name** to **test**, and click **Create**.

Figure 3-3 Configuring a test event



Step 4: View the Execution Result

Click **Test** and view the execution result on the right.

- Function Output: displays the return result of the function.
- **Log Output**: displays the execution logs of the function.
- **Summary**: displays key information of the logs.

■ NOTE

A maximum of 2 KB logs can be displayed. For more log information, see section "Querying Function Logs".

Step 5: View Monitoring Metrics

On the function details page, click the **Monitoring** tab.

- On the **Monitoring** tab page, choose **Metrics**, and select a time range (such as 5 minutes, 15 minutes, or 1 hour) to query the function.
- The following metrics are displayed: invocations, errors, duration (maximum, average, and minimum durations), throttles, and instance statistics (reserved instances).

Step 6: Delete a Function

- On the function details page, choose Operation > Delete Function in the upper right corner.
- 2. In the confirmation dialog box, enter **DELETE** and click **OK** to release resources in a timely manner.

4 Deploying a Function Using a Container Image

4.1 Developing an HTTP Function

Introduction

When developing an HTTP function using a custom image, implement an HTTP server in the image and listen on **port 8000** for requests. **(Do not change port 8000 in the examples provided in this section.)** HTTP functions support only APIG triggers.

Step 1: Prepare the Environment

To perform the operations described in this section, ensure that you have the **FunctionGraph Administrator** permissions, that is, the full permissions for FunctionGraph. For more information, see section "Permissions Management".

Step 2: Create an Image

Take the Linux x86 64-bit OS as an example. (No system configuration is required.)

- Create a folder. mkdir custom_container_http_example && cd custom_container_http_example
- 2. Implement an HTTP server. Node.js is used as an example. For details about other languages, see section "Creating an HTTP Function".

Create the **main.js** file to introduce the Express framework, receive POST requests, print the request body as standard output, and return "Hello FunctionGraph, method POST" to the client.

```
const express = require('express');
const PORT = 8000;
const app = express();
app.use(express.json());
```

```
app.post('/*', (req, res) => {
  console.log('receive', req.body);
  res.send('Hello FunctionGraph, method POST');
});
app.listen(PORT, () => {
  console.log(`Listening on http://localhost:${PORT}`);
});
```

3. Create the **package.json** file for npm so that it can identify the project and process project dependencies.

- name: project name
- version: project version
- main: application entry file
- dependencies: all available dependencies of the project in npm
- Create a Dockerfile.

```
FROM node:12.10.0
ENV HOME=/home/custom_container
ENV GROUP_ID=1003
ENV GROUP_NAME=custom_container
ENV USER_ID=1003
ENV USER NAME=custom container
RUN mkdir -m 550 ${HOME} && groupadd -g ${GROUP_ID} ${GROUP_NAME} && useradd -u $
{USER_ID} -g ${GROUP_ID} ${USER_NAME}
COPY --chown=${USER ID}:${GROUP ID} main.is ${HOME}
COPY --chown=${USER_ID}:${GROUP_ID} package.json ${HOME}
RUN cd ${HOME} && npm install
RUN chown -R ${USER_ID}:${GROUP_ID} ${HOME}
RUN find ${HOME} -type d | xargs chmod 500
RUN find ${HOME} -type f | xargs chmod 500
USER ${USER_NAME}
WORKDIR /
EXPOSE 8000
ENTRYPOINT ["node", "main.js"]
```

- FROM: Specify base image node:12.10.0. The base image is mandatory and its value can be changed.
- ENV: Set environment variables HOME (/home/custom_container),
 GROUP_NAME and USER_NAME (custom_container), USER_ID and
 GROUP_ID (1003). These environment variables are mandatory and their values can be changed.

- RUN: Use the format RUN < Command>. For example, RUN mkdir -m
 550 \${HOME}, which means to create the home directory for user \${USER_NAME}\$ during container building.
- USER: Switch to user \${USER_NAME}.
- WORKDIR: Switch the working directory to the / directory of user \$
 {USER_NAME}.
- COPY: Copy main.js and package.json to the home directory of user \$
 {USER NAME} in the container.
- EXPOSE: Expose port 8000 of the container. Do not change this parameter.
- ENTRYPOINT: Run the node main.js command to start the container. Do not change this parameter.

□ NOTE

- 1. You can use any base image.
- In the cloud environment, UID 1003 and GID 1003 are used to start the container by default. The two IDs can be modified by choosing Configuration > Basic Settings > Container Image Override on the function details page. They cannot be root or a reserved ID.
- 3. Do not change port 8000 in the example HTTP function.
- Build an image.

In the following example, the image name is **custom_container_http_example**, the tag is **latest**, and the period (.) indicates the directory where the Dockerfile is located. Run the image build command to pack all files in the directory and send the package to a container engine to build an image.

docker build -t custom_container_http_example:latest .

Step 3: Perform Local Verification

- 1. Start the Docker container. docker run -u 1003:1003 -p 8000:8000 custom_container_http_example:latest
- 2. Open a new Command Prompt, and send a message through port 8000. You can access all paths in the root directory in the template code. The following uses **helloworld** as an example.

curl -XPOST -H 'Content-Type: application/json' -d '{"message":"HelloWorld"}' localhost:8000/helloworld

The following information is returned based on the module code: Hello FunctionGraph, method POST

 Check whether the following information is displayed: receive {"message":"HelloWorld"}

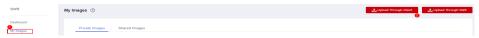
```
[root@ecs-74d7 ~]# docker run -u 1003:1003 -p 8000:8000 custom_container_http_example:latest Listening on http://localhost:8000 receive { message: 'HelloWorld' }
```

Alternatively, run the **docker logs** command to obtain container logs.

```
[root@ecs-74d7 custom_container_http_example]# docker logs 1354c3580638
Listening on http://localhost:8000
receive { message: 'HelloWorld' }
[root@ecs-74d7 custom_container_http_example]# ■
```

Step 4: Upload the Image

- 1. Log in to the SoftWare Repository for Container (SWR) console. In the navigation pane, choose **My Images**.
- 2. Click **Upload Through Client** or **Upload Through SWR** in the upper right corner
- 3. Upload the image as prompted.



4. View the image on the **My Images** page.

Step 5: Create a Function

- In the left navigation pane of the management console, choose Compute >
 FunctionGraph. On the FunctionGraph console, choose Functions > Function
 List from the navigation pane.
- 2. Click **Create Function** in the upper right corner and choose **Container Image**.
- Set the basic information.
 - Function Type: Select HTTP Function.
 - Function Name: Enter custom_container_http.
 - Container Image: Select the image uploaded to SWR.
 - **Agency**: Select an agency with the **SWR Admin** permission. If no agency is available, create one by referring to section "Creating an Agency".
- 4. After the configuration is complete, click **Create Function**.

Step 6: Test the Function

- 1. On the function details page, click **Test**. In the displayed dialog box, create a test event.
- Select apig-event-template, set Event Name to helloworld, modify the test event as follows, and click Create.

```
{
  "body": "{\"message\": \"helloworld\"}",
  "requestContext": {
      "requestId": "11cdcdcf33949dc6d722640a13091c77",
      "stage": "RELEASE"
  },
  "queryStringParameters": {
      "responseType": "html"
  },
  "httpMethod": "POST",
  "pathParameters": {},
  "headers": {
      "Content-Type": "application/json"
  },
  "path": "/helloworld",
  "isBase64Encoded": false
}
```

Step 7: View the Execution Result

Click **Test** and view the execution result on the right.

Figure 4-1 Execution result

```
Execution Result X
 Execution successful
 Function Output
     "body": "SGVsbG8gRnVuY3Rpb25HcmFwaCwgbWV0aG9kIFBPU1Q=",
     "headers": {
         "Content-Length": [
             "32"
          "Content-Type": [
             "text/html; charset=utf-8"
         "Date": [
             "Wed, 02 Nov 2022 11:06:38 GMT"
         "Etag": [
             "W/\"20-uygbC2IEf2PxTTMC0H1BL5d/vwI\""
         "X-Powered-By": [
             "Express"
     "statusCode": 200,
     "isBase64Encoded": true
 Log Output
 2022-11-02T11:06:38Z Start invoke request '7309717e-f597-4368-a7fe-89ac3d9b5df5', version: latest
 receive { message: 'helloworld' }
 2022-11-02T11:06:38Z Finish invoke request '7309717e-f597-4368-a7fe-89ac3d9b5df5', duration: 31.563ms, billing duration: 32ms, memory
 used: 10.566MB, billing memory: 128MB
 Summary
                       7309717e-f597-4368-a7fe-89ac3d9b5df5
Request ID
Memory Configured 128 MB
Execution Duration 34.247 ms
Memory Used
                       10.566 MB
                       35 ms
```

- Function Output: displays the return result of the function.
- **Log Output**: displays the execution logs of the function.
- **Summary**: displays key information of the logs.

□ NOTE

A maximum of 2 KB logs can be displayed. For more log information, see section "Querying Function Logs".

Step 8: View Monitoring Metrics

On the function details page, click the **Monitoring** tab.

- On the **Monitoring** tab page, choose **Metrics**, and select a time range (such as 5 minutes, 15 minutes, or 1 hour) to query the function.
- The following metrics are displayed: invocations, errors, duration (maximum, average, and minimum durations), throttles, and instance statistics (reserved instances).

Step 9: Delete the Function

- On the function details page, choose Operation > Delete Function in the upper right corner.
- 2. In the confirmation dialog box, enter **DELETE** and click **OK** to release resources in a timely manner.

4.2 Developing an Event Function

Introduction

When developing an event function using a custom image, implement an HTTP server in the image and listen on port 8000 for requests. By default, the request path /init is the function initialization entry. Implement it as required. The request path /invoke is the function execution entry where trigger events are processed. For details about request parameters, see section "Supported Event Sources".

Step 1: Prepare the Environment

To perform the operations described in this section, ensure that you have the **FunctionGraph Administrator** permissions, that is, the full permissions for FunctionGraph. For more information, see section "Permissions Management".

Step 2: Create an Image

Take the Linux x86 64-bit OS as an example. (No system configuration is required.)

- 1. Create a folder.
 mkdir custom_container_event_example && cd custom_container_event_example
- 2. Implement an HTTP server to process **init** and **invoke** requests and give a response. Node.js is used as an example.

Create the **main.js** file to introduce the Express framework and implement a function handler (method **POST** and path /invoke and an initializer (method **POST** and path /init).

```
const express = require('express');
const PORT = 8000;
const app = express();
app.use(express.json());
app.post('/init', (req, res) => {
    console.log('receive', req.body);
    res.send('Hello init\n');
});
app.post('/invoke', (req, res) => {
    console.log('receive', req.body);
    res.send('Hello invoke\n');
});
app.listen(PORT, () => {
    console.log(`Listening on http://localhost:${PORT}`);
});
```

3. Create the **package.json** file for npm so that it can identify the project and process project dependencies.

```
name": "custom-container-event-example",
"version": "1.0.0",
"description": "An example of a custom container event function",
"main": "main.js",
```

```
"scripts": {},
"keywords": [],
"author": "",
"license": "ISC",
"dependencies": {
    "express": "^4.17.1"
}
```

- name: project name
- version: project version
- main: application entry file
- **dependencies**: all available dependencies of the project in npm
- 4. Create a Dockerfile.

```
FROM node:12.10.0
ENV HOME=/home/custom container
ENV GROUP_ID=1003
ENV GROUP NAME=custom_container
ENV USER_ID=1003
ENV USER_NAME=custom_container
RUN mkdir -m 550 ${HOME} && groupadd -g ${GROUP_ID} ${GROUP_NAME} && useradd -u $
{USER_ID} -g ${GROUP_ID} ${USER_NAME}
COPY --chown=${USER_ID}:${GROUP_ID} main.js ${HOME}
COPY --chown=${USER_ID}:${GROUP_ID} package.json ${HOME}
RUN cd ${HOME} && npm install
RUN chown -R ${USER_ID}:${GROUP_ID} ${HOME}
RUN find ${HOME} -type d | xargs chmod 500
RUN find ${HOME} -type f | xargs chmod 500
USER ${USER_NAME}
WORKDIR /
EXPOSE 8000
ENTRYPOINT ["node", "main.js"]
```

- **FROM**: Specify base image **node:12.10.0**. The base image is mandatory and its value can be changed.
- ENV: Set environment variables HOME (/home/custom_container),
 GROUP_NAME and USER_NAME (custom_container), USER_ID and
 GROUP_ID (1003). These environment variables are mandatory and their values can be changed.
- RUN: Use the format RUN < Command>. For example, RUN mkdir -m
 550 \${HOME}, which means to create the home directory for user \${USER_NAME}\$ during container building.
- USER: Switch to user \${USER_NAME}.
- WORKDIR: Switch the working directory to the / directory of user \$
 {USER NAME}.
- COPY: Copy main.js and package.json to the home directory of user \$
 {USER_NAME} in the container.
- EXPOSE: Expose port 8000 of the container. Do not change this parameter.
- **ENTRYPOINT**: Run the **node /home/tester/main.js** command to start the container.

- 1. You can use any base image.
- In the cloud environment, UID 1003 and GID 1003 are used to start the container by default. The two IDs can be modified by choosing Configuration > Basic Settings > Container Image Override on the function details page. They cannot be root or a reserved ID.
- 5. Build an image.

In the following example, the image name is **custom_container_event_example**, the tag is **latest**, and the period (.) indicates the directory where the Dockerfile is located. Run the image build command to pack all files in the directory and send the package to a container engine to build an image.

docker build -t custom_container_event_example:latest .

Step 3: Perform Local Verification

- 1. Start the Docker container.
 docker run -u 1003:1003 -p 8000:8000 custom container event example:latest
- 2. Open a new Command Prompt, and send a message through port 8000 to access the **/init** directory specified in the template code. curl -XPOST -H 'Content-Type: application/json' localhost:8000/init

The following information is returned based on the module code:

Hello init

3. Open a new Command Prompt, and send a message through port 8000 to access the /invoke directory specified in the template code. curl -XPOST -H 'Content-Type: application/json' -d '{"message":"HelloWorld"}' localhost:8000/invoke

The following information is returned based on the module code:

Hello invoke

4. Check whether the following information is displayed:

```
Listening on http://localhost:8000 receive {} receive { message: 'HelloWorld' }
```

```
[root@ecs-74d7 ~]# docker run -u 1003:1003 -p 8000:8000 custom_container_event_example:latest
Listening on http://localhost:8000
receive {}
receive { message: 'HelloWorld' }
```

Alternatively, run the **docker logs** command to obtain container logs.

```
[root@ecs-74d7 custom_container_event_example]# docker logs 5560e1ec09d3
Listening on http://localhost:8000
receive {}
receive { message: 'HelloWorld' }
[root@ecs-74d7 custom_container_event_example]# ■
```

Step 4: Upload the Image

- 1. Log in to the SWR console. In the navigation pane, choose **My Images**.
- 2. Click **Upload Through Client** or **Upload Through SWR** in the upper right corner.
- Upload the image as prompted.



4. View the image on the **My Images** page.

Step 5: Create a Function

- 1. In the left navigation pane of the management console, choose **Compute** > **FunctionGraph**. On the FunctionGraph console, choose **Functions** > **Function List** from the navigation pane.
- 2. Click **Create Function** in the upper right corner and choose **Container Image**.
- 3. Set the basic information.
 - Function Type: Select Event Function.
 - Function Name: Enter custom_container_event.
 - Container Image: Enter the image uploaded to SWR. Example: swr. {Region ID}.myhuaweicloud.com/{Organization name}/{Image name}: {Image tag}
 - Agency: Select an agency with the SWR Admin permission. If no agency is available, create one by referring to section "Creating an Agency"
- 4. After the configuration is complete, click **Create Function**.
- 5. On the function details page, choose **Configuration** > **Advanced Settings**, and enable **Initialization**. The **init** API will be called to initialize the function.

Step 6: Test the Function

- 1. On the function details page, click **Test**. In the displayed dialog box, create a test event.
- 2. Select **blank-template**, set **Event Name** to **helloworld**, modify the test event as follows, and click **Create**.

```
{
    "message": "HelloWorld"
}
```

Step 7: View the Execution Result

Click **Test** and view the execution result on the right.

Figure 4-2 Execution result

```
Execution Result X
 Execution successful
 Function Output
      "body": "SGVsbG8gRnVuY3Rpb25HcmFwaCwgbWV0aG9kIFBPU10=",
      "headers": {
         "Content-Length": [
             "32"
         "Content-Type": [
             "text/html; charset=utf-8"
          "Date": [
             "Wed, 02 Nov 2022 11:06:38 GMT"
         "Etag": [
             "W/\"20-uygbC2IEf2PxTTMC0H1BL5d/vwI\""
         "X-Powered-By": [
             "Express"
         1
      "statusCode": 200.
     "isBase64Encoded": true
 Log Output
 2022-11-02T11:06:38Z Start invoke request '7309717e-f597-4368-a7fe-89ac3d9b5df5', version: latest
 receive { message: 'helloworld' }
 2022-11-02T11:06:38Z Finish invoke request '7309717e-f597-4368-a7fe-89ac3d9b5df5', duration: 31.563ms, billing duration: 32ms, memory
 used: 10.566MB, billing memory: 128MB
 Summary
                      7309717e-f597-4368-a7fe-89ac3d9b5df5
 Request ID
 Memory Configured
                      34.247 ms
 Execution Duration
 Memory Used
                      10.566 MB
 Billed Duration
                      35 ms
```

- Function Output: displays the return result of the function.
- Log Output: displays the execution logs of the function.
- **Summary**: displays key information of the logs.

A maximum of 2 KB logs can be displayed. For more log information, see section "Querying Function Logs".

Step 8: View Monitoring Metrics

On the function details page, click the Monitoring tab.

- On the **Monitoring** tab page, choose **Metrics**, and select a time range (such as 5 minutes, 15 minutes, or 1 hour) to query the function.
- The following metrics are displayed: invocations, errors, duration (maximum, average, and minimum durations), throttles, and instance statistics (reserved instances).

Step 9: Delete the Function

1. On the function details page, choose **Operation** > **Delete Function** in the upper right corner.

2. In the confirmation dialog box, enter **DELETE** and click **OK** to release resources in a timely manner.