

FunctionGraph

User Guide

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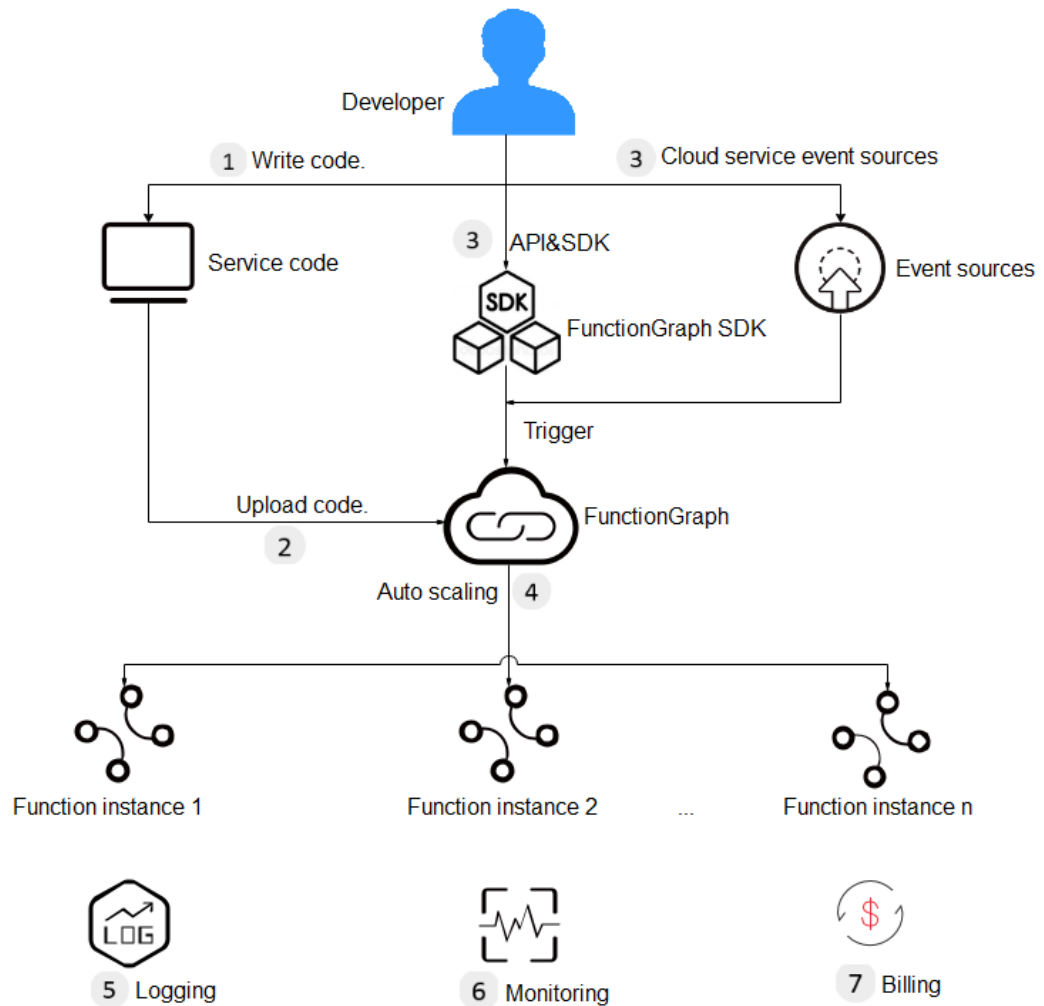
1 Service Overview

1.1 What Is FunctionGraph?

FunctionGraph hosts and computes event-driven functions in a serverless context while ensuring high availability, high scalability, and zero maintenance. All you need to do is write your code and set conditions.

[Figure 1-1](#) shows the process of using FunctionGraph.

Figure 1-1 Usage process



1. Write code.

Write code in Node.js, Python, Java, or Go.

2. Upload code.

Currently, you can edit code inline, upload a ZIP or JAR file, or obtain a ZIP file from OBS. For details, see [Table 1-2](#).

3. Trigger functions by API calls or cloud service events.

Call RESTful APIs or use cloud service event sources to trigger function execution and generate instances to implement service functions.

4. Auto scaling is implemented.

During function execution, FunctionGraph scales automatically based on the number of requests without the need for configurations. For details about the maximum number of function instances that can be run concurrently, see [Notes and Constraints](#).

5. View logs.

View run logs of functions as FunctionGraph is interconnected with Log Tank Service (LTS).

6. View monitoring information.

View graphical monitoring information as FunctionGraph is interconnected with Application Operations Management (AOM).

1.2 Product Features

Function Management

FunctionGraph provides console-based function management.

- The Node.js, Java, Python, Go, and custom runtimes are supported. [Table 1-1](#) provides the details.

 **NOTE**

You are advised to use the latest runtime version.

Table 1-1 Runtimes

Runtime	Supported Version
Node.js	6.10, 8.10, 10.16, 12.13, 14.18, 16.17
Python	2.7, 3.6, 3.9, 3.10
Java	8.0 and 11
Go	1.x
C#	.NET Core 2.1 and .NET Core 3.1
PHP	7.3
Custom	-

- Multiple code entry modes
FunctionGraph allows you to edit code inline, upload a ZIP file from Object Storage Service (OBS), or directly upload a ZIP or JAR file. [Table 1-2](#) lists the code entry modes supported for each runtime.

Table 1-2 Code entry modes

Runtime	Editing Code Inline	Uploading a ZIP File	Uploading a JAR File	Uploading a ZIP File from OBS
Node.js	Supported	Supported	Not supported	Supported
Python	Supported	Supported	Not supported	Supported

Runtime	Editing Code Inline	Uploading a ZIP File	Uploading a JAR File	Uploading a ZIP File from OBS
Java	Not supported	Supported	Supported	Supported
Go	Not supported	Supported	Not supported	Supported
C#	Not supported	Supported	Not supported	Supported
PHP	Supported	Supported	Not supported	Supported
Custom	Supported	Supported	Not supported	Supported

Trigger

[Table 1-3](#) lists the invocation modes for different trigger types.

Table 1-3 Function invocation modes

Trigger	Function Invocation Mode
APIG trigger	Synchronous invocation
OBS trigger	Asynchronous invocation
Timer trigger	Asynchronous invocation
Log Tank Service (LTS) trigger	Asynchronous invocation
Cloud Trace Service (CTS) trigger	Asynchronous invocation
Kafka trigger	Asynchronous invocation

Logs and Metrics

FunctionGraph graphically displays function monitoring metrics and collects function running logs, enabling you to view function statuses, and locate problems by querying logs.

To query logs, see [Managing Function Logs](#).

For details about monitoring metric, see [Function Monitoring](#).

For details about tenant-level function monitoring metrics, see [Introduction to Dashboard](#).

Function Initialization

The initializer interface is introduced to:

- Isolate function initialization and request processing to enable clearer program logic and better structured and higher-performance code.
- Ensure smooth function upgrade to prevent performance loss during the application layer's cold start initialization. Enable new function instances to automatically execute initialization logic before processing requests.
- Identify the overhead of application layer initialization, and accurately determine the time for resource scaling and the quantity of required resources. This feature makes request latency more stable when the application load increases and more function instances are required.

HTTP Functions

You can set **Function Type** to **HTTP Function** on the function creation page. HTTP functions are designed to optimize web services. You can send HTTP requests to URLs to trigger function execution. HTTP functions support APIG and API Connect (APIC) triggers only.

Custom Images

You can directly package and upload container images. The images are loaded and started by the platform and can be called in a similar way as HTTP functions. Unlike the previous code upload mode, you can use a custom code package, which is flexible and reduces migration costs.

1.3 Product Advantages

No Servers to Manage

FunctionGraph automatically runs your code and frees you from provisioning and managing servers, allowing you to focus on business innovation.

Auto Scaling

FunctionGraph automatically scales to suit fluctuations in resource demands and ensures that the service remains accessible even during peaks and spikes.

It automatically scales in/out resources based on the number of service requests, and distributes requests to function instances through automatic load balancing.

In addition, the system intelligently preheats instances for the traffic loads to reduce the impact of cold start on your services.

Event-based Triggering

FunctionGraph integrates with multiple cloud services using an event-based triggering mechanism to meet service requirements.

It is interconnected with the LTS and Cloud Eye services, allowing you to view function logs and metrics without the need for any configurations.

High Availability

If an instance becomes faulty, FunctionGraph starts another instance to process new requests and releases resources from the unhealthy instance.

Dynamic Resource Adjustment

Resource specifications can be dynamically adjusted to minimize resource usage and reduce costs.

1.4 Application Scenarios

FunctionGraph is suitable for various scenarios, such as real-time file processing, real-time data stream processing, web & mobile application backends, and AI application.

Scenario 1: Event-Driven Applications

Services are executed in event-driven mode and resources are provisioned based on demands. Developers do not need to be concerned about service peaks or troughs. Idle resources are not billed, reducing O&M costs. Event-driven applications include file processing, image processing, live streaming/transcoding, real-time data stream processing, and IoT rule/event processing.

- **Real-time file processing**

When files are uploaded from a client to OBS, functions can be triggered to create image thumbnails in real time, convert video formats, aggregate and filter data files, or implement other file operations.

Advantages:

- FunctionGraph automatically allocates resources to run more function instances as the number of received requests increases.
- Files are uploaded to OBS to trigger file processing functions.
- You will be billed only for resources used to process files as needed (you are not billed for idle resources during lows in demand).

- **Real-time data stream processing**

FunctionGraph works with DIS to process data streams in real time. FunctionGraph supports application activity tracking, sequential transaction processing, data stream analysis, data sorting, metric generation, log filtering, indexing, social media analysis, and IoT device data telemetry and metering.

Advantages:

- Data is collected by means of DIS streams to trigger data processing functions.
- FunctionGraph automatically allocates resources to run more function instances as the number of received requests increases.
- You will be billed only for resources used to process files as needed (you are not billed for idle resources during lows in demand).

Scenario 2: Web Applications

Interconnect FunctionGraph with other cloud services or your VMs to quickly build highly available and scalable web & mobile backends. Web applications include mini programs, web pages/apps, chatbots, and Backends for Frontends (BFF).

Advantages:

- FunctionGraph ensures high reliability of website data using OBS and CloudTable, and high-availability of website logic using API Gateway.
- FunctionGraph automatically allocates resources to run more function instances as the number of received requests increases.
- You will be billed only for resources used to process files as needed (you are not billed for idle resources during lows in demand).

Scenario 3: AI Applications

Intelligence evolution requires various services to be integrated for quick rollout. These services include third-party service integration, AI inference, and license plate recognition.

Advantages:

- FunctionGraph works with EI services for text recognition and content moderation to suit a wide range of scenarios – make adjustments whenever you need as demands change.
- You only need to apply for related services and write service code without having to provision or manage servers.
- You will be billed only for function execution and used EI services without having to pay for idle resources when service demands are low.

1.5 Function Types

1.5.1 Event Functions

Overview

FunctionGraph supports event functions. An event can trigger function execution. Generally, it is in JSON format. You can create an event to trigger your function through the cloud service platform or CodeArts IDE Online. All types of triggers supported by FunctionGraph can trigger event functions.

NOTE

1. On the function creation page, **Function Type** is set to **Event Function** by default.
2. During testing, a function can be triggered by simply entering the specified event in JSON format.
3. You can also use triggers to trigger event functions.

Advantages

- Easy single-node programming
You can edit event functions on FunctionGraph or CodeArts IDE Online or upload code packages there and deploy them with just a few clicks. There is no need for you to care about function concurrency or fault rectification.
- High-performance, high-speed runtimes
Event functions can be started, scaled, and called within milliseconds. Faults can be detected and rectified within seconds.
- Complete tool chain
FunctionGraph provides comprehensive logging, tracing, debugging, and monitoring, allowing developers to roll out functions in just three steps.

Restrictions

Event functions face event source restrictions. You need to comply with the function development rules of the function platform.

1.5.2 HTTP Functions

Overview

FunctionGraph supports event functions and HTTP functions. HTTP functions are designed to optimize web services. You can send HTTP requests to URLs to trigger function execution. HTTP functions support APIG and APIC triggers only.

NOTE

1. HTTP functions support the HTTP/1.1 protocol.
2. On the function creation page, **HTTP Function** is newly added.
3. The HTTP function must be set to bootstrap. You can directly write the startup command and **allow access over port 8000**.

Advantages

- Support for multiple frameworks
You can use common web frameworks, such as Node.js Express and Koa, to write web functions, and migrate your local web framework services to the cloud with least modifications.
- Fewer request processing steps
Functions can directly receive and process HTTP requests, eliminating the need for API Gateway to convert the JSON format. This accelerates request processing and improves web service performance.
- Premium writing experience
Writing HTTP functions is similar to writing native web services. You can also use native Node.js APIs to enjoy local development-like experience.

Restrictions

- HTTP functions support APIG (dedicated), APIG (shared), and APIC triggers only.

- Multiple API triggers can be bound to the same function, but all the APIs must belong to the same APIG service.
- For HTTP functions, the size of the HTTP response body cannot exceed 6 MB.
- HTTP functions cannot be executed for a long time, invoked asynchronously, or retried.

1.6 Notes and Constraints

Account Resource Constraints

Table 1-4 Account resource constraints

Resource	Limit	Adjustable
Maximum number of functions that can be created under an account	400	No. To adjust the quota, contact customer service.
Maximum number of versions allowed for a function	20	No. To adjust the quota, contact customer service.
Maximum number of aliases allowed for a function	10	No. To adjust the quota, contact customer service.
Size of a code deployment package (in ZIP or JAR format) that can be uploaded to the FunctionGraph console	40 MB	No. To adjust the quota, contact customer service.
Size of a code deployment package (in ZIP or JAR format) that can be edited inline during function API invocation	50 MB	No. To adjust the quota, contact customer service.

Resource	Limit	Adjustable
Size of an original code deployment package allowed during function API invocation	<ul style="list-style-type: none"> • ZIP: 1500 MB (after decompression) • OBS bucket: 300 MB (after compression) 	No. To adjust the quota, contact customer service.
Maximum size of deployment packages allowed for an account	10 GB	No. To adjust the quota, contact customer service.
Number of concurrent executions per account	100	Yes
Maximum number of reserved instances that an account can create	90 (Number of concurrent executions per account x 90%)	Yes
Size of all environment variables of a function	4096 characters	No. To adjust the quota, contact customer service.
Maximum size of code that can be displayed on the console	20 MB	No. To adjust the quota, contact customer service.

Function Running Resource Constraints

Table 1-5 Function running resource constraints

Resource	Default	Adjustable
Ephemeral disk space (/tmp space)	512 MB	No. To adjust the quota, contact customer service.
Number of file descriptors	1024	No. To adjust the quota, contact customer service.

Resource	Default	Adjustable
Total number of processes and threads	1024	No. To adjust the quota, contact customer service.
Maximum execution duration per request	259,200s	Yes
Valid payload size of invocation request body (synchronous invocation)	6 MB	No. To adjust the quota, contact customer service.
Valid payload size of invocation response body (synchronous invocation)	6 MB	No. To adjust the quota, contact customer service.
Valid payload size of invocation request body (asynchronous invocation)	256 KB	No. To adjust the quota, contact customer service.
Size of imported resources	≤ 50 MB ZIP file	No. To adjust the quota, contact customer service.
Image size per function	10 GB	No. To adjust the quota, contact customer service.
Size of exported resources	≤ 50 MB	No. To adjust the quota, contact customer service.
Instances per tenant	1000	Yes
Max. memory per function	10 GB	No. To adjust the quota, contact customer service.
Bandwidth	Unlimited	-
Single log size	Unlimited	-
Maximum execution duration of initializer	259,200s	Yes

 **NOTE**

- Valid payload size of invocation response body (synchronous invocation): The returned character string or the JSON character string of the serialized response body is less than or equal to 6 MB by default. The actual data size varies depending on the backend settings of FunctionGraph. The backend determines the size of the serialized data with a byte-level deviation. The actual valid payload size is 6 MB ± 100 bytes.
- You are not advised to invoke a function whose execution time exceeds 90s on the FunctionGraph console. To invoke such a function, use asynchronous invocation.

1.7 Permissions Management

If you need to assign different permissions to employees in your enterprise to access your FunctionGraph resources, IAM is a good choice for fine-grained permissions management. IAM provides identity authentication, permissions management, and access control, helping you secure access to your cloud resources.

With IAM, you can use your account to create IAM users for your employees, and assign permissions to the users to control their access to specific resource types. For example, some software developers in your enterprise need to use FunctionGraph resources but must not delete them or perform any high-risk operations. To achieve this result, you can create IAM users for the software developers and grant them only the permissions required for using FunctionGraph resources.

If your account does not need individual IAM users for permissions management, you may skip over this chapter.

FunctionGraph Permissions

By default, new IAM users do not have any permissions assigned. You need to add a user to one or more groups, and assign permissions policies to these groups. The user then inherits permissions from the groups it is a member of. This process is called authorization. After authorization, the user can perform specified operations on FunctionGraph based on the permissions.

FunctionGraph is a project-level service deployed and accessed in specific physical regions. To assign FunctionGraph permissions to a user group, specify the scope as region-specific projects and select projects in relevant regions for the permissions to take effect. If **All projects** is selected, the permissions will take effect for the user group in all region-specific projects. When accessing FunctionGraph, the users need to switch to a region where they have been authorized to use the FunctionGraph service.

You can grant users permissions by using roles and policies.

- **Roles:** A type of coarse-grained authorization mechanism that defines permissions related to user responsibilities. This mechanism provides only a limited number of service-level roles for authorization. When using roles to grant permissions, you may also need to assign other roles on which the permissions depend. However, roles are not an ideal choice for fine-grained authorization and secure access control.
- **Policies:** A type of fine-grained authorization mechanism that defines permissions required to perform operations on specific cloud resources under certain conditions. This mechanism allows for more flexible policy-based authorization, meeting requirements for secure access control.

Table 1-6 lists all the system policies supported by FunctionGraph.

Table 1-6 Permissions description

Role/Policy Name	Description	Category	Dependency
FunctionGraph FullAccess	This policy grants all permissions for FunctionGraph.	System-defined policy	N/A
FunctionGraph ReadOnlyAccess	This policy grants read-only permissions for FunctionGraph.	System-defined policy	N/A
FunctionGraph CommonOperations	This policy grants permissions to query functions and triggers, and invoke functions.	System-defined policy	N/A

 **NOTE**

If an IAM user granted the **FunctionGraph FullAccess** permission has no permission to create a certain type of trigger or use a certain function, the relevant service or function does not support fine-grained authentication. In this case, grant the admin permission for this service or function to the user. These services and functions include:

- CTS, APIG, and DIS: These do not support fine-grained authentication. Add the admin permission for them.
- SMN: This supports fine-grained authentication in some regions. If needed, add the admin permission for this service.
- IoTDA: This is a new trigger type and is not covered in **FullAccess**. When you create an IoTDA trigger, you will be prompted to create an agency and add the **iam:agencies:list** and **iam:agencies:createAgency** permissions.
- TMS, DNS, BSS, Cloud Eye, EG, and DMS: These are new functions and are not covered in **FullAccess**. Add the permissions for them as required.

For more information about the permissions required to use these triggers and relevant functions, see [Table 1-7](#).

Table 1-7 Permissions required to use triggers and relevant functions

Trigger/Function	Permission
APIG	apig:groups:get apig:groups:list apig:apis:create apig:apis:delete apig:apis:update apig:apis:publish apig:apis:list apig:apis:get apig:apis:offline apig:apps:list apig:envs:list
APIG (dedicated)	apig:instances:get apig:instances:create apig:instances:update apig:instances:list apig:sharedInstance:operate
CTS	cts:notification:create cts:notification:delete cts:notification:update cts:operation:list cts:tracker:list cts:trace:list
DDS	dds:instance:get dds:instance:list
DIS	dis:streams:list
IoTDA	iotda:routingrules:create iotda:routingrules:delete iotda:routingrules:queryList iotda:routingrules:query iotda:routingactions:create iotda:routingactions:delete iotda:routingactions:query iotda:routingactions:queryList iotda:subscriptions:queryList iotda:rules:modifyStatus iotda:apps:queryList

Trigger/Function	Permission
LTS	lts:groups:create lts:groups:get lts:groups:list lts:groups:put lts:logstreams:delete lts:logstreams:list lts:topics:get lts:subscriptions:create lts:subscriptions:delete lts:subscriptions:put lts:structConfig:create lts:structConfig:get
OBS	obs:bucket:GetBucketLocation obs:bucket:GetBucketNotification obs:bucket:PutBucketNotification obs:bucket:ListBucket
SMN	smn:topic:list smn:topic:update
TMS	tms:predefineTags:list tms:tagValues:list
DNS	dns:recordset:create, dns:recordset:list, dns:recordset:update, dns:zone:create, dns:zone:delete, dns:zone:get, dns:zone:list
BSS	bss:bill:view bss:renewal:view
CES	ces:alarms:get ces:alarms:list ces:alarms:create
DMS	dms:instance:get

Trigger/Function	Permission
EG	eg:subscriptions:get eg:subscriptions:list eg:sources:list eg:sources:get eg:agency:create eg:subscriptions:create eg:subscriptions:delete eg:subscriptions:operate

Table 1-8 lists the common operations supported by each system-defined policy of FunctionGraph. Please choose proper system-defined policies according to this table.

Table 1-8 Common operations supported by each system-defined policy

Operation	FunctionGraph ReadOnlyAccess	FunctionGraph CommonOperations	FunctionGraph FullAccess
Creating functions	×	×	√
Querying functions	√	√	√
Modifying functions	×	×	√
Deleting functions	×	×	√
Invoking functions	×	√	√
Querying function logs	√	√	√
Viewing function metrics	√	√	√

1.8 Concepts

Function

Functions are code defined to handle events.

Event Source

An event source is a public cloud service or custom application that publishes events.

Synchronous Invocation

Clients wait for explicit responses to their requests from a function. Responses are returned only after the function is invoked.

Asynchronous Invocation

Clients do not care about the function invocation results of their requests. After receiving a request, FunctionGraph puts it in a queue, returns a response, and processes other requests when there are idle resources.

Trigger

A trigger is an event that triggers function execution.

Single-Instance Multi-Concurrency

The number of requests that can be concurrently processed by an instance.

Custom Images

You can directly package and upload container images. The platform then loads and starts these images to create functions.

Custom Function Execution

You can customize scripts and files to execute functions.

Function Logs

Logs generated during function invocation.

Function Monitoring

Monitoring information generated during function execution.

Function Version

FunctionGraph allows you to publish one or more versions throughout the development, testing, and production processes to manage your function code. The code and environment variables of each version are saved as a snapshot. After the function code is published, modify settings when necessary.

Function Alias

You can create an alias for a specific function version. To roll back to a previous version, use the corresponding alias to represent the version instead of modifying the function code.

Each function alias can be bound to a major version and an additional version for traffic shifting.

Dependency Package

FunctionGraph enables you to manage dependencies in a unified manner. You can upload dependencies from a local path, or through OBS if they are too large, and specify names for them.

Bootstrap File

The **bootstrap** file is the startup file of an HTTP function. The HTTP function can only read **bootstrap** as the startup file name. If the file name is not **bootstrap**, the service cannot be started.

1.9 Relationships Between FunctionGraph and Other Services

[Table 1-9](#) describes the cloud services that have been interconnected with FunctionGraph.

Table 1-9 Interconnected services

Service	Function
SMN	FunctionGraph functions are constructed to process SMN notifications.
OBS	FunctionGraph functions are created to process OBS bucket events, such as object creation or deletion events. For example, when an image is uploaded to the specified bucket, OBS invokes the function to read the image and create a thumbnail.
Cloud Eye	FunctionGraph is interconnected with Cloud Eye to report monitoring metrics, allowing you to view function metrics and alarm messages through Cloud Eye.
VPC	Functions can be configured to access resources in Virtual Private Clouds (VPCs) or to access the Internet through source network address translation (SNAT) by binding elastic IP addresses.

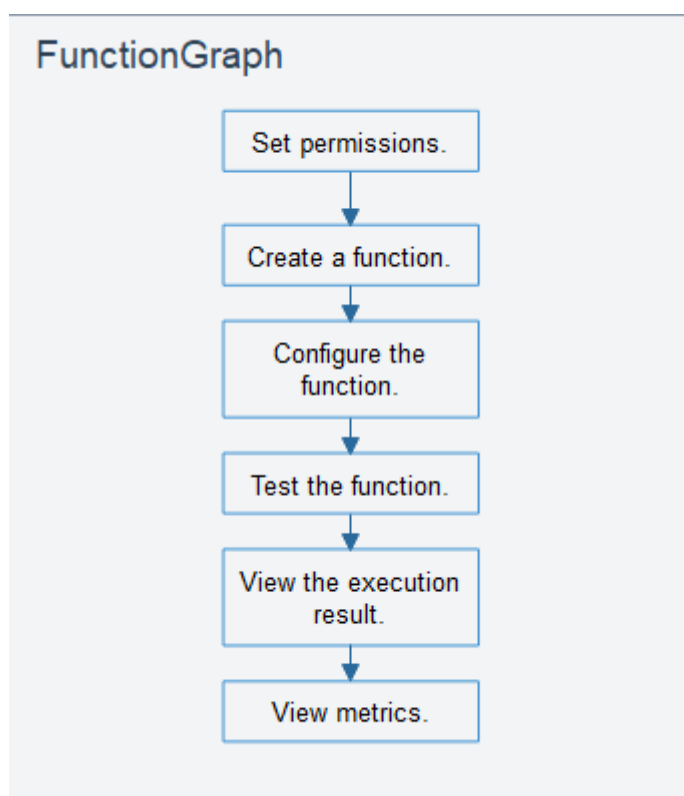
2 Getting Started

2.1 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.

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



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

2.2 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 FullAccess** permissions, that is, all permissions for FunctionGraph. For more information, see [Permissions Management](#).

Step 2: Create a Function

1. 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**.
3. 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

Basic Information

* Function Type [?](#)

Event Function HTTP Function

Processes event requests and can be triggered by APIG, OBS, and DIS events.

* Region

Regions are geographic areas isolated from each other. Resources are region-specific and cannot be used across regions through internal network connections. For low network latency and quick resource access, select the nearest region.

* Function Name

Enter 1 to 60 characters, starting with a letter and ending with a letter or digit. Only letters, digits, hyphens (-), and underscores (_) are allowed.

Agency [?](#)

[Create Agency](#)

* Enterprise Project [?](#)

[View Enterprise Project](#)

Runtime [?](#)

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.

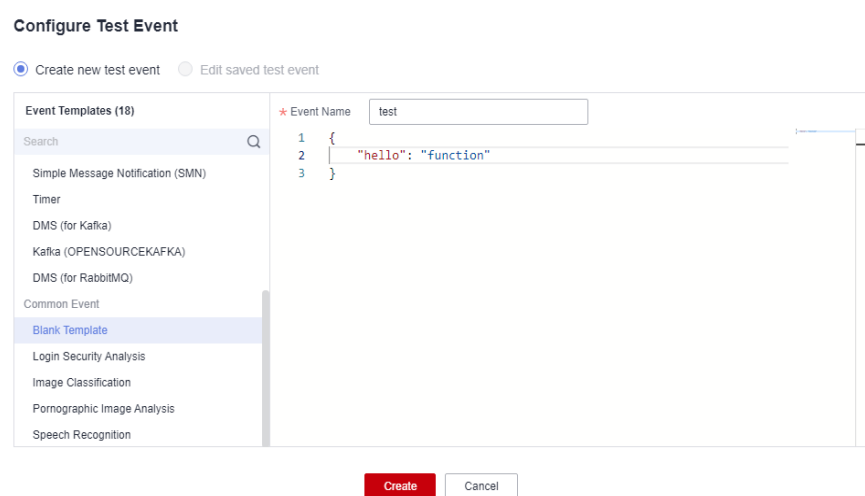
```
exports.handler = function (event, context, callback) {  
  const error = null;  
  const output = `Hello message: ${JSON.stringify(event)}`;  
  callback(error, output);  
}
```

Step 3: Test the Function

1. On the function details page, click **Test**. In the displayed dialog box, create a test event.
2. 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

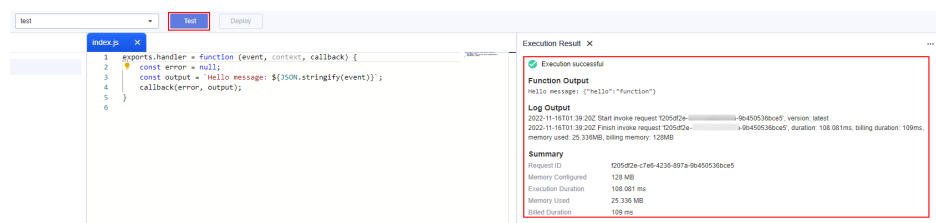


Step 4: View the Execution Result

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 [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.

2.3 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.

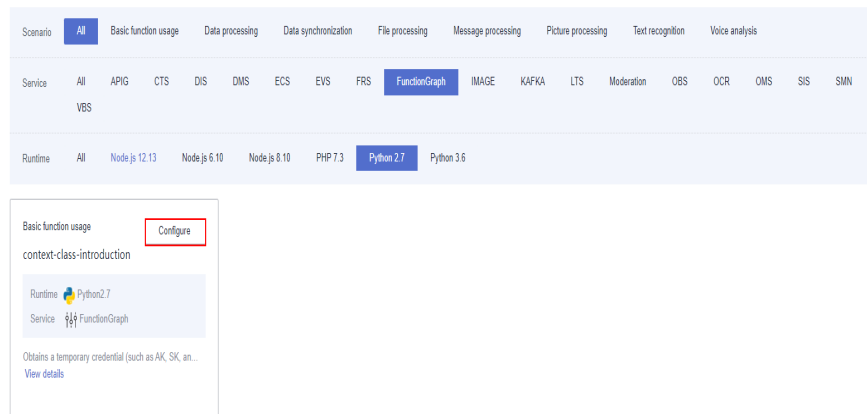
Step 1: Prepare the Environment

To perform the operations described in this section, ensure that you have the **FunctionGraph FullAccess** permissions, that is, all permissions for FunctionGraph. For more information, see [Permissions Management](#).

Step 2: Create a Function

1. 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 2-4](#) and click **Configure**.

Figure 2-4 Selecting a template



4. Set **Function Name** to **context**, select any agency from the **Agency** drop-down 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 2-5 Setting basic information

Basic Information

Function Template
context-class-introduction-python [Reselect](#)

* Region

Regions are geographic areas isolated from each other. Resources are region-specific and cannot be used across regions through internal network connections. For low network latency and quick resource access, select the nearest region.

* Function Name

Enter 1 to 60 characters, starting with a letter and ending with a letter or digit. Only letters, digits, hyphens (-), and underscores (_) are allowed.

Agency [?](#)
 [Create Agency](#)

* Enterprise Project [?](#)
 [View Enterprise Project](#)

Runtime [?](#)

Step 3: 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 **test**, and click **Create**.

Figure 2-6 Configuring a test event

Configure Test Event

Create new test event Edit saved test event

Event Templates (18)

Search

- Simple Message Notification (SMN)
- Timer
- DMS (for Kafka)
- Kafka (OPENSOURCEKAFKA)
- DMS (for RabbitMQ)
- Common Event
- Blank Template**
- Login Security Analysis
- Image Classification
- Pornographic Image Analysis
- Speech Recognition

* Event Name

```

1 {
2   "hello": "function"
3 }
```

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 [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.

2.4 Deploying a Function Using a Container Image

2.4.1 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 FullAccess** permissions, that is, all permissions for FunctionGraph. For more information, see [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_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 [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": "custom-container-http-example",
  "version": "1.0.0",
  "description": "An example of a custom container http 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 main.js** command to start the container. Do not change this parameter.

NOTE

1. You can use any base image.
 2. 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.**
5. 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

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

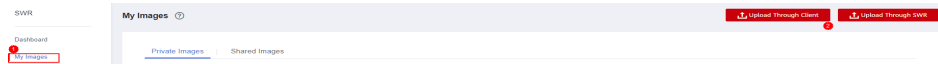
```
[root@ecs-74d7 ~]# docker run -u 1003:1003 -p 8000:8000 custom_container_http_example:latest
Listening on http://localhost:8000
receive { message: 'HelloWorld' }
```

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

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 **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 [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.
2. Select **apig-event-template**, set **Event Name** to **helloworld**, modify the test event as follows, and click **Create**.


```
{
  "body": "{\"message\": \"helloworld\"}",
  "requestContext": {
    "requestId": "11cdcdf33949dc6d722640a13091c77",
    "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 2-7 Execution result

Execution Result ✕

 Execution successful

Function Output

```
{
  "body": "SGVsbG8gRnVuY3Rpb25HcmFwaCwgblV0aG9kIFBPU1Q=",
  "headers": {
    "Content-Length": [
      "32"
    ],
    "Content-Type": [
      "text/html; charset=utf-8"
    ],
    "Date": [
      "Wed, 02 Nov 2022 11:06:38 GMT"
    ],
    "Etag": [
      "W/\\"20-uygbC2IEf2PxTTM0H1BL5d/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

Request ID	7309717e-f597-4368-a7fe-89ac3d9b5df5
Memory Configured	128 MB
Execution Duration	34.247 ms
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.

 **NOTE**

A maximum of 2 KB logs can be displayed. For more log information, see [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.

3 Before You Start

3.1 Use of FunctionGraph

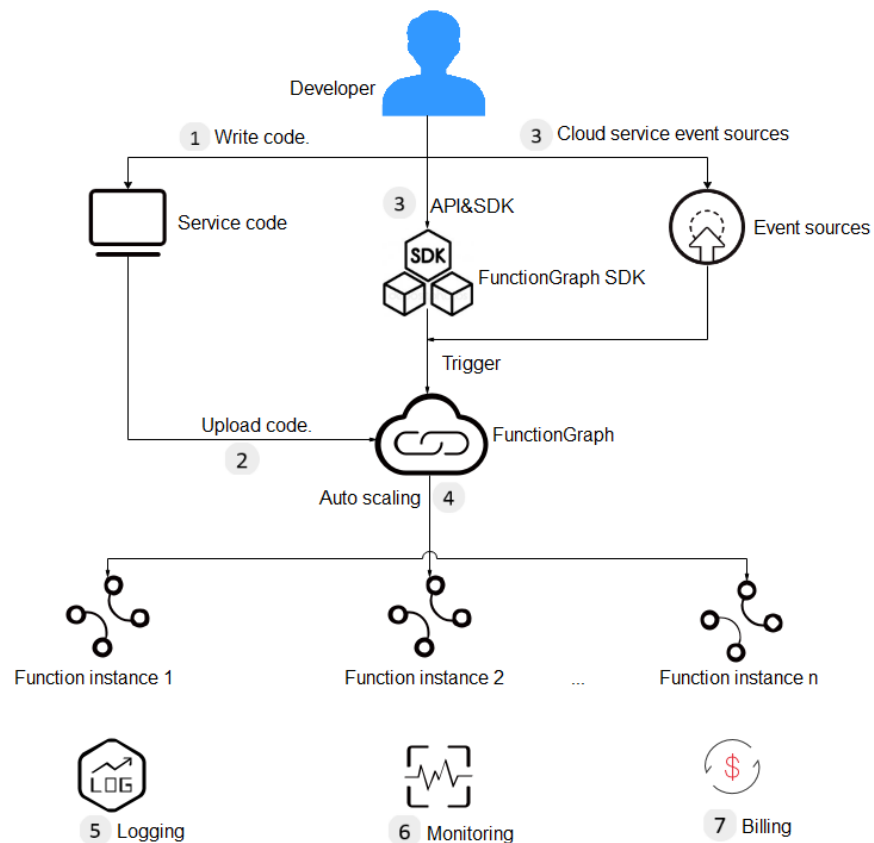
FunctionGraph allows you to run your code without provisioning or managing servers, while ensuring high availability and scalability. All you need to do is upload your code and set execution conditions, and FunctionGraph will take care of the rest.

Process

Figure 3-1 shows the process of using functions.

1. Write code, package and upload it to FunctionGraph, and add event sources such as Simple Message Notification (SMN), Object Storage Service (OBS), and API Gateway (APIG) event sources to build applications.
2. Functions are triggered by RESTful API calls or event sources to achieve expected service purposes. During this process, FunctionGraph automatically schedules resources.
3. View logs and metrics. Note that you will be billed based on code execution duration.

Figure 3-1 Flowchart



The following shows the details:

1. Write code.
Write code in Node.js, Python, Java, or Go.
2. Upload code.
Edit code inline, upload a local ZIP or JAR file, or upload a ZIP file from OBS. For details, see [Creating a Deployment Package](#).
3. Trigger functions by API calls or cloud service events.
Functions are triggered by API calls or cloud service events. For details, see [Creating Triggers](#).
4. Implement auto scaling.
FunctionGraph implements auto scaling based on the number of requests. For details, see [Notes and Constraints](#).
5. View logs.
View run logs of function. FunctionGraph is interconnected with Log Tank Service (LTS). For details, see [Logs](#).
6. View monitoring information.
View graphical monitoring information. FunctionGraph is interconnected with Cloud Eye. For details, see [Metrics](#).

Introduction to Dashboard

Log in to the FunctionGraph console and choose **Dashboard** in the navigation pane on the left.

- View your created functions/function quota, used storage/storage quota, and monthly invocations and resource usage.

Figure 3-2 Monthly statistics



- View tenant-level metrics, including invocations, errors, duration, and throttles.

Table 3-1 describes the function metrics.

Table 3-1 Function metrics

Metric	Unit	Description
Invocations	Count	Total number of invocation requests, including invocation errors and throttled invocations. In case of asynchronous invocation, the count starts only when a function is executed in response to a request.
Duration	ms	<p>Maximum duration: the maximum duration all functions are executed at a time within a period.</p> <p>Minimum duration: the minimum duration all functions are executed at a time within a period.</p> <p>Average duration: the average duration all functions are executed at a time within a period.</p>
Errors	Count	Number of times that your functions failed with error code 200 being returned. Errors caused by function syntax or execution are also included.
Throttles	Count	Number of times that FunctionGraph throttles your functions due to the resource limit.

3.2 Permissions Management

3.2.1 Creating a User and Granting Permissions

This section describes how to use Identity and Access Management (IAM) to implement fine-grained permissions control for your FunctionGraph resources. With IAM, you can:

- Create IAM users for employees based on the organizational structure of your enterprise. Each IAM user has their own security credentials for accessing FunctionGraph resources.
- Grant only the permissions required for users to perform a task.
- Entrust other accounts or cloud services to perform professional and efficient O&M on your FunctionGraph resources.

If your account does not need individual IAM users, then you may skip over this chapter.

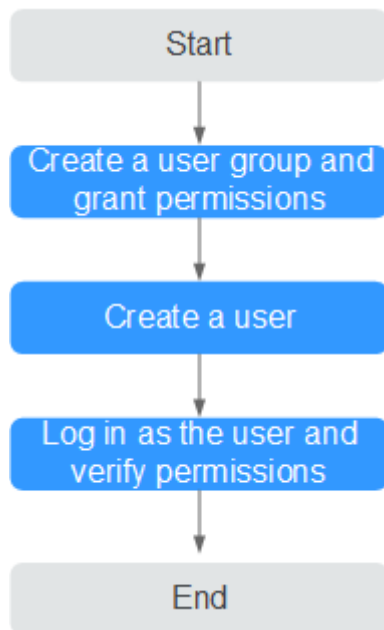
This section describes the procedure for granting permissions. For details, see [Figure 3-3](#).

Prerequisites

Before assigning permissions to user groups, you should learn about the system permissions listed in "Permissions Management" in the *FunctionGraph Service Overview*. For the system policies of other services, see section "Permissions".

Process

Figure 3-3 Process for granting FunctionGraph permissions



1. .
Create a user group on the IAM console, and assign the **FunctionGraph Invoker** role to the group.
2. .
Create a user on the IAM console and add the user to the group created in **1.**
3. and Verifying Permissions
Log in to the management console as the created user and check whether this user only has read permissions for FunctionGraph:

- Choose **Service List > FunctionGraph** to access the FunctionGraph console. In the navigation pane, choose **Functions > Function List**. Then click **Create Function**. If a message appears indicating insufficient permissions to perform the operation, the **FunctionGraph Invoker** role has already taken effect.
- Choose any other service in the **Service List**. If a message appears indicating insufficient permissions to access the service, the **FunctionGraph Invoker** role has already taken effect.

3.2.2 Creating a Custom Policy

Custom policies can be created as a supplement to the system policies of FunctionGraph.

You can create custom policies in either of the following ways:

- Visual editor: Select cloud services, actions, resources, and request conditions. This does not require knowledge of policy syntax.
- JSON: Edit JSON policies from scratch or based on an existing policy.

For details, see [Creating a Custom Policy](#). This section introduces examples of common FunctionGraph custom policies.

Example Custom Policies

- Example 1: Authorizing a user to query function code and configuration

```
{
  "Version": "1.1",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "functiongraph:function:list",
        "functiongraph:function:getConfig",
        "functiongraph:function:getCode"
      ]
    }
  ]
}
```

- Example 2: Denying function deletion

A policy with only "Deny" permissions must be used in conjunction with other policies to take effect. If both "Allow" and "Deny" permissions are assigned to a user, the "Deny" permissions take precedence over the "Allow" permissions.

If you need to assign permissions of the **FunctionGraph FullAccess** policy to a user but prevent the user from deleting functions, create a custom policy for denying function deletion, and attach both policies to the group to which the user belongs. In this way, the user can perform all operations on FunctionGraph except deleting functions. The following is an example of a deny policy:

```
{
  "Version": "1.1",
  "Statement": [
    {
      "Effect": "Deny",
      "Action": [
        "functiongraph:function:delete"
      ]
    }
  ]
}
```

- Example 3: Configuring permissions for specific resources

You can grant an IAM user permissions for specific resources. For example, to grant a user permissions for the **functionname** function in the **Default** application, set **functionname** to a specified resource path, that is, **FUNCTIONGRAPH:*:*:function:Default/functionname**.

 **NOTE**

Specify function resources:

Format: **FUNCTIONGRAPH:*:*:function:** *application or function name*

For function resources, IAM automatically generates the resource path prefix **FUNCTIONGRAPH:*:*:function:**. You can specify a resource path by adding the application or function name next to the path prefix. Wildcards (*) are supported. For example, **FUNCTIONGRAPH:*:*:function:Default/*** indicates any function in the **Default** application.

```
{
  "Version": "1.1",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "functiongraph:function:list"
      ]
    },
    {
      "Effect": "Allow",
      "Action": [
        "functiongraph:function:listAlias",
        "functiongraph:function:listVersion",
        "functiongraph:function:getConfig",
        "functiongraph:function:getCode",
        "functiongraph:function:updateCode",
        "functiongraph:function:invoke",
        "functiongraph:function:updateConfig",
        "functiongraph:function:createVersion",
        "functiongraph:function:updateAlias",
        "functiongraph:function:createAlias"
      ],
      "Resource": [
        "FUNCTIONGRAPH:*:*:function:Default/*"
      ]
    }
  ]
}
```

3.3 Supported Programming Languages

3.3.1 Node.js

✓: Supported. ✗: Not supported.

Runtime	Supported
Node.js 6.10	✓
Node.js 8.10	✓
Node.js 10.16	✓

Runtime	Supported
Node.js 12.13	√
Node.js 14.18	√
Node.js 16.17	√
Node.js 18.15	√

3.3.2 Python

√: Supported. ×: Not supported.

Runtime	Supported
Python 2.7	√
Python 3.6	√
Python 3.9	√
Python 3.10	√

3.3.3 Java

√: Supported. ×: Not supported.

Runtime	Supported
Java 8	√
Java 11	√

3.3.4 Go

√: Supported. ×: Not supported.

Runtime	Supported
Go 1.x	√

3.3.5 Custom Runtime

Scenarios

A runtime runs the code of a function, reads the handler name from an environment variable, and reads invocation events from the runtime APIs of

FunctionGraph. The runtime passes event data to the function handler and returns the response from the handler to FunctionGraph.

FunctionGraph supports custom runtimes. You can use an executable file named **bootstrap** to include a runtime in your function deployment package. The runtime runs the function's handler method when the function is invoked.

Your runtime runs in the FunctionGraph execution environment. It can be a shell script or a binary executable file that is compiled in Linux.

 **NOTE**

After programming, simply package your code into a ZIP file (Java, Node.js, Python, and Go) or JAR file (Java), and upload the file to FunctionGraph for execution. When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.

If you edit code in Go, zip the compiled file, and ensure that the name of the dynamic library file is consistent with the plug-in name of the handler. For example, if the name of the dynamic library file is **testplugin.so**, set the handler name to **testplugin.Handler**.

Compiling Description

If you compile files on Windows and execute them on Linux, you need to configure the following parameters:

```
CGO_ENABLED=0 GOOS=linux GOARCH=amd64 go build main.go
```

Runtime File bootstrap

If there is a file named **bootstrap** in your function deployment package, FunctionGraph executes that file. If the **bootstrap** file is not found or not executable, your function will return an error when invoked.

The runtime code is responsible for completing initialization tasks. It processes invocation events in a loop until it is terminated.

The initialization tasks run once for each instance of the function to prepare the environment for handling invocations.

Runtime APIs

FunctionGraph provides HTTP runtime APIs to receive function invocation events and returns response data in the execution environment.

- **Obtaining Invocation Event**

Method – Get

Path – `http://$RUNTIME_API_ADDR/v1/runtime/invocation/request`

This API is used to retrieve an invocation event. The response body contains the event data. The following table describes additional data about the invocation contained in the response header.

Table 3-2 Response header information

Parameter	Description
X-Cff-Request-Id	Request ID.

Parameter	Description
X-CFF-Access-Key	AK of the account. An agency must be configured for the function if this variable is used.
X-CFF-Auth-Token	Token of the account. An agency must be configured for the function if this variable is used.
X-CFF-Invoke-Type	Invocation type of the function.
X-CFF-Secret-Key	SK of the account. An agency must be configured for the function if this variable is used.
X-CFF-Security-Token	Security token of the account. An agency must be configured for the function if this variable is used.

- **Invocation Response**

Method – POST

Path – `http://$RUNTIME_API_ADDR/v1/runtime/invocation/response/$REQUEST_ID`

This API is used to send a successful invocation response to FunctionGraph. After the runtime invokes the function handler, it publishes the response from the function to the invocation response path.

- **Invocation Error**

Method – POST

Path – `http://$RUNTIME_API_ADDR/v1/runtime/invocation/error/$REQUEST_ID`

\$REQUEST_ID is the value of variable **X-Cff-Request-Id** in the header of an event retrieval response. For more information, see [Table 3-2](#).

\$RUNTIME_API_ADDR is a system environment variable. For more information, see [Table 3-3](#).

This API is used to send an error invocation response to FunctionGraph. After the runtime invokes the function handler, it publishes the response from the function to the invocation response path.

Runtime Environment Variables

You can use both custom and runtime environment variables in function code. The following table lists the runtime environment variables that are used in the FunctionGraph execution environment.

Table 3-3 Environment variables

Key	Description
RUNTIME_PROJECT_ID	Project ID

Key	Description
RUNTIME_FUNC_NAME	Function name
RUNTIME_FUNC_VERSION	Function version
RUNTIME_PACKAGE	App to which the function belongs
RUNTIME_HANDLER	Function handler
RUNTIME_TIMEOUT	Function timeout duration
RUNTIME_USERDATA	Value passed through an environment variable
RUNTIME_CPU	Number of allocated CPU cores
RUNTIME_MEMORY	Allocated memory
RUNTIME_CODE_ROOT	Directory that stores the function code
RUNTIME_API_ADDR	Host IP address and port of a custom runtime API

The value of a custom environment variable can be retrieved in the same way as the value of a FunctionGraph environment variable.

Example

This example contains one file called **bootstrap**. The file is implemented in Bash.

The runtime loads the function script from the deployment package by using two variables.

The **bootstrap** file is as follows:

```
#!/bin/sh
set -o pipefail
#Processing requests loop
while true
do
HEADERS="$(mktemp)"
# Get an event
EVENT_DATA=$(curl -sS -LD "$HEADERS" -X GET "http://$RUNTIME_API_ADDR/v1/runtime/invocation/
request")
# Get request id from response header
REQUEST_ID=$(grep -Fi x-cff-request-id "$HEADERS" | tr -d '[:space:]' | cut -d: -f2)
if [ -z "$REQUEST_ID" ]; then
continue
fi
# Process request data
RESPONSE="Echoing request: hello world!"
# Put response
curl -X POST "http://$RUNTIME_API_ADDR/v1/runtime/invocation/response/$REQUEST_ID" -d
"$RESPONSE"
done
```

After loading the script, the runtime processes invocation events in a loop until it is terminated. It uses the API to retrieve invocation events from FunctionGraph,

passes the events to the handler, and then sends responses back to FunctionGraph.

To obtain the request ID, the runtime saves the API response header in a temporary file, and then reads the request ID from the **x-cff-request-id** header field. The runtime processes the retrieved event data and sends a response back to FunctionGraph.

The following is an example of source code in Go. It can be executed only after compilation.

```
package main

import (
    "bytes"
    "encoding/json"
    "fmt"
    "io"
    "io/ioutil"
    "log"
    "net"
    "net/http"
    "os"
    "strings"
    "time"
)

var (
    getRequestUrl      = os.ExpandEnv("http://${RUNTIME_API_ADDR}/v1/runtime/invocation/request")
    putResponseUrl     = os.ExpandEnv("http://${RUNTIME_API_ADDR}/v1/runtime/invocation/response/{REQUEST_ID}")
    putErrorResponseUrl = os.ExpandEnv("http://${RUNTIME_API_ADDR}/v1/runtime/invocation/error/{REQUEST_ID}")
    requestIdInvalidError = fmt.Errorf("request id invalid")
    noRequestAvailableError = fmt.Errorf("no request available")
    putResponseFailedError = fmt.Errorf("put response failed")
    functionPackage       = os.Getenv("RUNTIME_PACKAGE")
    functionName         = os.Getenv("RUNTIME_FUNC_NAME")
    functionVersion      = os.Getenv("RUNTIME_FUNC_VERSION")

    client = http.Client{
        Transport: &http.Transport{
            DialContext: (&net.Dialer{
                Timeout: 3 * time.Second,
            }).DialContext,
        },
    }
)

func main() {
    // main loop for processing requests.
    for {
        requestId, header, payload, err := getRequest()
        if err != nil {
            time.Sleep(50 * time.Millisecond)
            continue
        }

        result, err := processRequestEvent(requestId, header, payload)
        err = putResponse(requestId, result, err)
        if err != nil {
```

```
        log.Printf("put response failed, err: %s.", err.Error())
    }
}

// event processing function
func processRequestEvent(requestId string, header http.Header, evtBytes []byte) ([]byte, error) {
    log.Printf("processing request '%s'.", requestId)
    result := fmt.Sprintf("function: %s:%s:%s, request id: %s, headers: %+v, payload: %s",
functionPackage, functionName,
        functionVersion, requestId, header, string(evtBytes))

    var event FunctionEvent
    err := json.Unmarshal(evtBytes, &event)
    if err != nil {
        return (&ErrorMessage{ErrorType: "invalid event", ErrorMessage: "invalid json formatted
event"}).toJsonBytes(), err
    }

    return (&APIGFormatResult{StatusCode: 200, Body: result}).toJsonBytes(), nil
}

func getRequest() (string, http.Header, []byte, error) {
    resp, err := client.Get(getRequestUrl)
    if err != nil {
        log.Printf("get request error, err: %s.", err.Error())
        return "", nil, nil, err
    }
    defer resp.Body.Close()

    // get request id from response header
    requestId := resp.Header.Get("X-CFF-Request-Id")
    if requestId == "" {
        log.Printf("request id not found.")
        return "", nil, nil, requestIdInvalidError
    }

    payload, err := ioutil.ReadAll(resp.Body)
    if err != nil {
        log.Printf("read request body error, err: %s.", err.Error())
        return "", nil, nil, err
    }

    if resp.StatusCode != 200 {
        log.Printf("get request failed, status: %d, message: %s.", resp.StatusCode, string(payload))
        return "", nil, nil, noRequestAvailableError
    }

    log.Printf("get request ok.")
    return requestId, resp.Header, payload, nil
}

func putResponse(requestId string, payload []byte, err error) error {
    var body io.Reader
    if payload != nil && len(payload) > 0 {
        body = bytes.NewBuffer(payload)
    }

    url := ""
    if err == nil {
        url = strings.Replace(putResponseUrl, "{REQUEST_ID}", requestId, -1)
    } else {
```



```
    url = strings.Replace(putErrorResponseUrl, "{REQUEST_ID}", requestId, -1)
  }

  resp, err := client.Post(strings.Replace(url, "{REQUEST_ID}", requestId, -1), "", body)
  if err != nil {
    log.Printf("put response error, err: %s.", err.Error())
    return err
  }
  defer resp.Body.Close()

  responsePayload, err := ioutil.ReadAll(resp.Body)
  if err != nil {
    log.Printf("read request body error, err: %s.", err.Error())
    return err
  }

  if resp.StatusCode != 200 {
    log.Printf("put response failed, status: %d, message: %s.", resp.StatusCode,
string(responsePayload))
    return putResponseFailedError
  }

  return nil
}

type FunctionEvent struct {
  Type string `json:"type"`
  Name string `json:"name"`
}

type APIGFormatResult struct {
  StatusCode      int           `json:"statusCode"`
  IsBase64Encoded bool          `json:"isBase64Encoded"`
  Headers         map[string]string `json:"headers,omitempty"`
  Body            string        `json:"body,omitempty"`
}

func (result *APIGFormatResult) toJsonBytes() []byte {
  data, err := json.MarshalIndent(result, "", " ")
  if err != nil {
    return nil
  }

  return data
}

type ErrorMessage struct {
  ErrorType string `json:"errorType"`
  ErrorMessage string `json:"errorMessage"`
}

func (errMsg *ErrorMessage) toJsonBytes() []byte {
  data, err := json.MarshalIndent(errMsg, "", " ")
  if err != nil {
    return nil
  }

  return data
}
```

Table 3-4 describes the environment variables used in the preceding code.

Table 3-4 Environment variables

Environment Variable	Description
RUNTIME_FUNC_NAME	Function name
RUNTIME_FUNC_VERSION	Function version
RUNTIME_PACKAGE	App to which the function belongs

4 Building Functions

4.1 Creating a Deployment Package

To create a function, you must create a deployment package which includes your code and all dependencies. You can create a deployment package locally or edit code on the FunctionGraph console. If you edit code inline, FunctionGraph automatically creates and uploads a deployment package for your function. FunctionGraph allows you to edit function code in the same way as managing a project. You can create and edit files and folders. After you upload a ZIP code package, you can view and edit the code on the console.

 **NOTE**

- After programming, simply package your code into a ZIP file (Java, Node.js, Python, and Go) or JAR file (Java), and upload the file to FunctionGraph for execution.
- When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.
- If you edit code in Go, zip the compiled file, and ensure that the name of the dynamic library file is consistent with the plug-in name of the handler. For example, if the name of the dynamic library file is **testplugin.so**, set the handler name to **testplugin.Handler**.
- Java is a compiled language, which does not support editing code inline. If your function does not use any third-party dependencies, you can upload a function JAR file. If your function uses third-party dependencies, compress the dependencies and the function JAR file into a ZIP file, and then upload the ZIP file.

Table 4-1 lists the code entry modes supported by FunctionGraph for each runtime.

Table 4-1 Code entry modes

Runtime	Editing Code Inline	Uploading a ZIP File	Uploading a JAR File	Uploading a ZIP File from OBS
Node.js	Supported	Supported	Not supported	Supported

Runtime	Editing Code Inline	Uploading a ZIP File	Uploading a JAR File	Uploading a ZIP File from OBS
Python	Supported	Supported	Not supported	Supported
Java	Not supported	Supported	Supported	Supported
Go	Not supported	Supported	Not supported	Supported
Custom runtime	Supported	Supported	Not supported	Supported

NOTICE

If the code to be uploaded contains sensitive information (such as account passwords), encrypt the sensitive information to prevent leakage.

Table 4-2 Code entry modes

Code Entry Mode	Description
Edit code inline	FunctionGraph allows you to edit function code in the same way as managing a project. You can create and edit files and folders. After you upload a ZIP code package, you can edit the code on the Code tab of the function details page. <ul style="list-style-type: none">• File: Create files and folders, save changes, and close all files.• Edit: Undo/redo typing; cut, copy, and paste code; find and replace content.• Settings: Set the font size, auto formatting, and theme color.
Upload ZIP file	<ol style="list-style-type: none">1. On the Code tab of the function details page, choose Upload > Local ZIP.2. Click Select File and upload a local code package to FunctionGraph. The size of the ZIP file cannot exceed 40 MB. For a larger file, upload it through OBS.
Upload file from OBS	<ol style="list-style-type: none">1. On the Code tab of the function details page, choose Upload > OBS ZIP.2. Click Select File and upload a local code package to FunctionGraph.

Node.js

Editing Code Inline

FunctionGraph provides an SDK for editing code in Node.js. If your custom code uses only the SDK library, you can edit code using the inline editor on the FunctionGraph console. After you edit code inline and upload it to FunctionGraph, the console compresses your code and the related configurations into a deployment package that FunctionGraph can run.

Uploading a Deployment Package

If your code uses other resources, such as a graphic library for image processing, first create a deployment package, and then upload the package to the FunctionGraph console. You can upload a Node.js deployment package in two ways.

NOTICE

- When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.
- The size of the decompressed source code cannot exceed 1.5 GB. If the code is too large, contact the customer service.

-
- **Directly uploading a local deployment package**
After creating a ZIP deployment package, upload it to the FunctionGraph console. If the package size exceeds 40 MB, upload the package from OBS.
For details about function resource restrictions, see [Notes and Constraints](#).
 - **Uploading a deployment package using an OBS bucket**
After creating a ZIP deployment package, upload it to an OBS bucket in the same region as your FunctionGraph, and then paste the link URL of the OBS bucket into the function. The maximum size of the ZIP file that can be uploaded to OBS is 300 MB.
For details about function resource restrictions, see [Notes and Constraints](#).

Python

Editing Code Inline

FunctionGraph provides an SDK for editing code in Python. If your custom code uses only the SDK library, you can edit code using the inline editor on the FunctionGraph console. After you edit code inline and upload it to FunctionGraph, the console compresses your code and the related configurations into a deployment package that FunctionGraph can run.

Uploading a Deployment Package

If your code uses other resources, such as a graphic library for image processing, first create a deployment package, and then upload the package to the FunctionGraph console. You can upload a Python deployment package in two ways.

NOTICE

- When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.
- The size of the decompressed source code cannot exceed 1.5 GB. If the code is too large, contact the customer service.
- When you write code in Python, do not name your package with the same suffix as a standard Python library, such as **json**, **lib**, and **os**. Otherwise, an error indicating a module loading failure will be reported.

- **Directly uploading a local deployment package**
After creating a ZIP deployment package, upload it to the FunctionGraph console. If the package size exceeds 40 MB, upload the package from OBS. For details about function resource restrictions, see [Notes and Constraints](#).
- **Uploading a deployment package using an OBS bucket**
After creating a ZIP deployment package, upload it to an OBS bucket in the same region as your FunctionGraph, and then paste the link URL of the OBS bucket into the function. The maximum size of the ZIP file that can be uploaded to OBS is 300 MB.
For details about function resource restrictions, see [Notes and Constraints](#).

Java

Java is a compiled language, which does not support editing code inline. You can only upload a local deployment package, which can be a ZIP or JAR file.

Uploading a JAR File

- If your function does not use any dependencies, directly upload a JAR file.
- If your function uses dependencies, upload them to an OBS bucket, set them during function creation, and upload the JAR file.

Uploading a ZIP File

If your function uses third-party dependencies, compress the dependencies and the function JAR file into a ZIP file, and then upload the ZIP file.

You can upload a Java deployment package in two ways.

NOTICE

- When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.
 - The size of the decompressed source code cannot exceed 1.5 GB. If the code is too large, contact the customer service.
- **Directly uploading a local deployment package**
After creating a ZIP deployment package, upload it to the FunctionGraph console. If the package size exceeds 40 MB, upload the package from OBS. For details about function resource restrictions, see [Notes and Constraints](#).

- Uploading a deployment package using an OBS bucket
After creating a ZIP deployment package, upload it to an OBS bucket in the same region as your FunctionGraph, and then paste the link URL of the OBS bucket into the function. The maximum size of the ZIP file that can be uploaded to OBS is 300 MB.
For details about function resource restrictions, see [Notes and Constraints](#).

Go

Uploading a Deployment Package

You can only upload a Go deployment package in ZIP format. There are two ways to upload it.

NOTICE

- When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.
- The size of the decompressed source code cannot exceed 1.5 GB. If the code is too large, contact the customer service.

-
- Directly uploading a local deployment package
After creating a ZIP deployment package, upload it to the FunctionGraph console. If the package size exceeds 40 MB, upload the package from OBS.
For details about function resource restrictions, see [Notes and Constraints](#).
 - Uploading a deployment package using an OBS bucket
After creating a ZIP deployment package, upload it to an OBS bucket in the same region as your FunctionGraph, and then paste the link URL of the OBS bucket into the function. The maximum size of the ZIP file that can be uploaded to OBS is 300 MB.
For details about function resource restrictions, see [Notes and Constraints](#).

Custom Runtime

Editing Code Inline

After you edit code inline and upload it to FunctionGraph, the console compresses your code and the related configurations into a deployment package that FunctionGraph can run.

Uploading a Deployment Package

If your code uses other resources, such as a graphic library for image processing, first create a deployment package, and then upload the package to the FunctionGraph console. You can upload a deployment package for a custom runtime in two ways.

NOTICE

- When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can run normally after being decompressed.
 - The size of the decompressed source code cannot exceed 1.5 GB. If the code is too large, contact the customer service.
-
- Directly uploading a local deployment package
After creating a ZIP deployment package, upload it to the FunctionGraph console. If the package size exceeds 40 MB, upload the package from OBS.
For details about function resource restrictions, see [Notes and Constraints](#).
 - Uploading a deployment package using an OBS bucket
After creating a ZIP deployment package, upload it to an OBS bucket in the same region as your FunctionGraph, and then paste the link URL of the OBS bucket into the function. The maximum size of the ZIP file that can be uploaded to OBS is 300 MB.
For details about function resource restrictions, see [Notes and Constraints](#).

4.2 Creating a Function from Scratch

4.2.1 Creating an Event Function

Overview

A function is customized code for processing events. You can create a function from scratch and configure the function based on site requirements.

FunctionGraph manages the compute resources required for function execution. After editing code for your function, configure compute resources on the FunctionGraph console.

You can create a function from scratch or by using [a template](#) or [container image](#).

 NOTE

When creating a function from scratch, configure the basic and code information based on [Table 4-3](#). The parameters marked with an asterisk (*) are mandatory.

Each FunctionGraph function runs in its own environment and has its own resources and file system.

Prerequisites

1. You must be familiar with the programming languages supported by FunctionGraph. For details, see [Supported Programming Languages](#).
2. You have created a deployment package. For details, see [Creating a Deployment Package](#).
3. (Optional) You have created an agency. For details, see [Configuring Agency Permissions](#).

Procedure

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. On the **Function List** page, click **Create Function** in the upper right corner.
3. Click **Create from scratch** and configure the function information by referring to [Table 4-3](#). The parameters marked with an asterisk (*) are mandatory.

Table 4-3 Basic information

Parameter	Description
* Function Type	<ul style="list-style-type: none">• Event functions: triggered by triggers.• HTTP functions: triggered once HTTP requests are sent to specific URLs. <p>NOTE</p> <ul style="list-style-type: none">• HTTP functions do not distinguish between programming languages. The handler must be set in the bootstrap file. You can directly write the startup command, and allow access over port 8000.• HTTP functions support APIG and APIC triggers only.• For details about how to use HTTP functions, see Creating an HTTP Function.
*Region	Select a region where you will deploy your code.
*Function Name	Name of the function, which must meet the following requirements: <ul style="list-style-type: none">• Consists of 1 to 60 characters, and can contain letters, digits, hyphens (-), and underscores (_).• Starts with a letter and ends with a letter or digit.
Agency	An agency is required if FunctionGraph accesses other cloud services. For details on how to create an agency, see Configuring Agency Permissions . No agency is required if FunctionGraph does not access any cloud services.
*Enterprise Project	Select a created enterprise project and add the function to it. By default, default is selected.
Runtime	Select a runtime to compile the function. <p>NOTICE</p> CloudIDE supports Node.js and Python only.

4. Click **Create Function**. On the displayed **Code** tab page, continue to configure the code.

Configuring Code

1. You can deploy the code based on the runtime you select. For details, see [Creating a Deployment Package](#). After the deployment is complete, click **Deploy**.

As shown in the following example, to deploy code in Node.js 10.16, you can edit code inline, upload a local ZIP file, or upload a ZIP file from OBS.

Figure 4-1 Deploying code



2. You can modify the code and click **Deploy** to deploy the code again.

Viewing Code Information

1. View code attributes.
Code attributes show the code size and the time the code was modified.

Figure 4-2 Viewing code attributes



2. View basic information.
Configuring Basic Settings shows the default memory and execution timeout in each runtime. You can click **Edit** to switch to the **Basic Settings** page and modify **Handler**, **Memory (MB)**, and **Execution Timeout (s)** as required. For details, see **Figure 4-3**.

Figure 4-3 Editing basic information



NOTICE

Once a function is created, the runtime cannot be changed.

Table 4-4 Default basic information of each runtime

Runtime	Default Basic Information
Java	Memory (MB): 512 Handler: com.demo.TriggerTests.apigTest Execution Timeout (s): 15
Node.js	Memory (MB): 128 Handler: index.handler Execution Timeout (s): 3

Runtime	Default Basic Information
Custom	Memory (MB): 128 Handler: bootstrap Execution Timeout (s): 3
Python	Memory (MB): 128 Handler: index.handler Execution Timeout (s): 3
Go 1.x	Memory (MB): 128 Handler: handler Execution Timeout (s): 3

4.2.2 Creating an HTTP Function

Overview

HTTP functions are designed to optimize web services. You can send HTTP requests to URLs to trigger function execution. HTTP functions support APIG triggers only.

NOTE

- HTTP functions do not distinguish between programming languages. The handler must be set in the **bootstrap** file. You can directly write the startup command, and allow access over port 8000. The bound IP address is **127.0.0.1**.
- The **bootstrap** file is the startup file of the HTTP function. The HTTP function can only read **bootstrap** as the startup file name. If the file name is not **bootstrap**, the service cannot be started. For more information, see the [bootstrap file example](#).
- HTTP functions support multiple programming languages.
- Functions must return a valid HTTP response.
- This section uses Node.js as an example. To use another runtime, simply change the runtime path. The code package path does not need to be changed. For the paths of other runtimes, see [Table 4-5](#).
- When a function initiates an HTTP request, the request IP address is dynamic for private network access and fixed for public network access. For more information, contact technical support.

Prerequisites

1. Prepare a Node.js script. A code example is as follows:

```
const http = require('http'); // Import Node.js core module

var server = http.createServer(function (req, res) { //create web server
  res.writeHead(200, { 'Content-Type': 'text/html' });
  res.write('<html><body><h2>This is http function.</h2></body></html>');
  res.end();
});

server.listen(8000, '127.0.0.1'); //6 - listen for any incoming requests

console.log('Node.js web server at port 8000 is running..')
```

- You have prepared a **bootstrap** file as the startup file of the HTTP function.

Example

The content of the **bootstrap** file is as follows:

```
/opt/function/runtime/nodejs12.13/rtsp/nodejs/bin/node $RUNTIME_CODE_ROOT/index.js
```

- Compress the preceding two files into a ZIP package.

Figure 4-4 Compressing files into a ZIP package



NOTE

For HTTP functions in Python, add the **-u** parameter in the **bootstrap** file to ensure that logs can be flushed to the disk. Example:

```
/opt/function/runtime/python3.6/rtsp/python/bin/python3 -u $RUNTIME_CODE_ROOT/index.py
```

To use another runtime, change the runtime path by referring to [Table 4-5](#). The code package path does not need to be changed.

Table 4-5 Paths for different runtimes

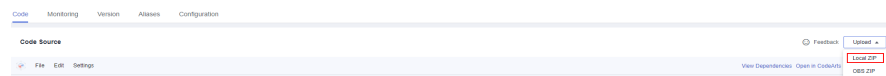
Runtime	Path
Java 8	/opt/function/runtime/java8/rtsp/jre/bin/java
Java 11	/opt/function/runtime/java11/rtsp/jre/bin/java
Node.js 6	/opt/function/runtime/nodejs6.10/rtsp/nodejs/bin/node
Node.js 8	/opt/function/runtime/nodejs8.10/rtsp/nodejs/bin/node
Node.js 10	/opt/function/runtime/nodejs10.16/rtsp/nodejs/bin/node
Node.js 12	/opt/function/runtime/nodejs12.13/rtsp/nodejs/bin/node
Node.js 14	/opt/function/runtime/nodejs14.18/rtsp/nodejs/bin/node
Node.js 16	/opt/function/runtime/nodejs16.17/rtsp/nodejs/bin/node
Node.js 18	/opt/function/runtime/nodejs18.15/rtsp/nodejs/bin/node

Runtime	Path
Python 2.7	/opt/function/runtime/python2.7/rtsp/python/bin/python
Python 3.6	/opt/function/runtime/python3.6/rtsp/python/bin/python3
Python 3.9	/opt/function/runtime/python3.9/rtsp/python/bin/python3

Procedure

1. Create a function.
 - a. Create an HTTP function. For details, see [Creating an Event Function](#). Pay special attention to the following parameters:
 - **Function Type:** HTTP function
 - **Region:** Select a region where you will deploy your code.
 - b. Choose **Upload > Local ZIP**, upload the ZIP package, and click **Deploy**.

Figure 4-5 Uploading a ZIP file



2. Create a trigger.

NOTE

HTTP functions support APIG triggers only.

- a. On the function details page, choose **Configuration > Triggers** and click **Create Trigger**.
- b. Set the trigger information. This step uses an APIG (dedicated) trigger as an example. For more information, see [Using an APIG \(Dedicated\) Trigger](#).

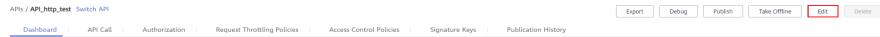
NOTE

In this example, **Security Authentication** is set to **None**. You need to select an authentication mode based on site requirements.

- **App:** AppKey and AppSecret authentication. This mode is of high security and is recommended.
 - **IAM:** IAM authentication. This mode grants access permissions to IAM users only and is of medium security.
 - **None:** No authentication. This mode grants access permissions to all users.
- c. When the configuration is complete, click **OK**. After the trigger is created, **API_test_http** will be generated on the APIG console.
3. Publish the API.
 - a. On the **Triggers** tab page, click an API name to go to the API overview page.

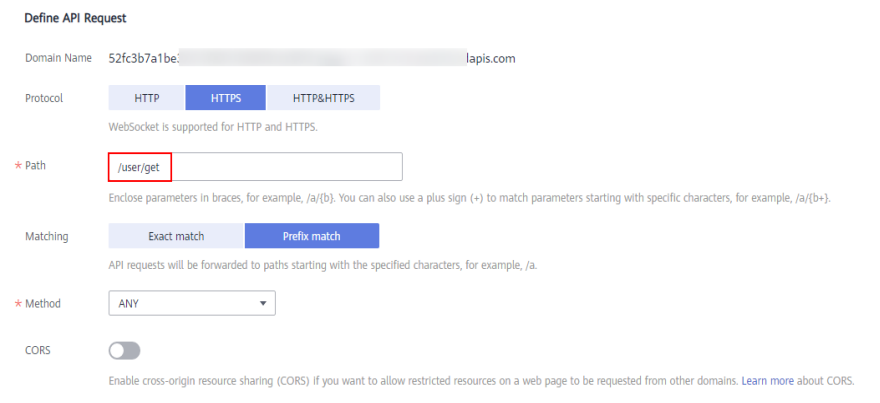
- b. Click **Edit** in the upper right corner. The **Basic Information** page is displayed.

Figure 4-6 Editing an API



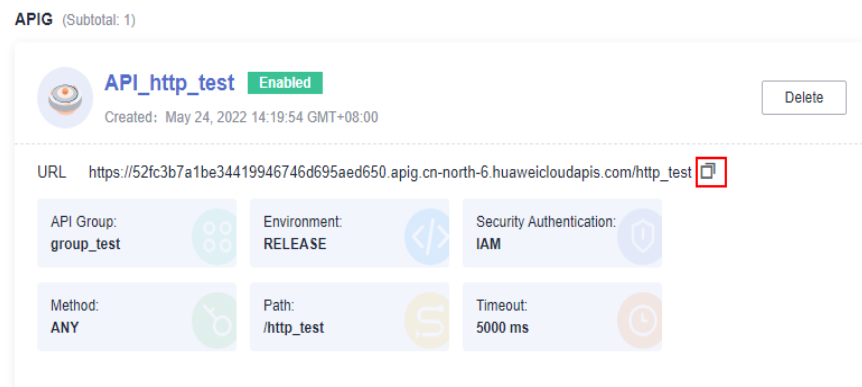
- c. Click **Next**. On the **Define API Request** page that is displayed, change **Path** to **/user/get** and click **Finish**.

Figure 4-7 Defining an API request



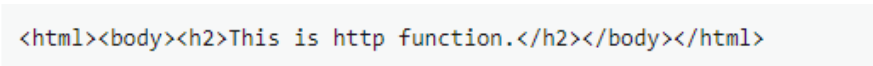
- d. Click **Publish API**. On the displayed page, click **Publish**.
4. Trigger a function.
- a. Go to the FunctionGraph console, choose **Functions > Function List** in the navigation pane, and click the created HTTP function to go to its details page.
 - b. Choose **Configuration > Triggers**, copy the URL, and access it using a browser.

Figure 4-8 Copying the URL



- c. View the request result.

Figure 4-9 Viewing the request result



Common Function Request Headers

The following table lists the default request header fields of an HTTP function.

Table 4-6 Default request header fields

Field	Description
X-CFF-Request-Id	ID of the current request
X-CFF-Memory	Allocated memory
X-CFF-Timeout	Function timeout duration
X-CFF-Func-Version	Function version
X-CFF-Func-Name	Function name
X-CFF-Project-Id	Project ID
X-CFF-Package	App to which the function belongs
X-CFF-Region	Current region

4.3 Creating a Function Using a Template

Overview

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

Creating a Function

1. Log in to the FunctionGraph console. In the navigation pane, choose **Templates**.
2. On the page that is displayed, select the **FunctionGraph** service, select the **context-class-introduction** template for Python 2.7, and click **Configure**.

NOTE

The **context-class-introduction** template for Python 2.7 is used as an example. You can also select other templates.

3. After you select a function template, the built-in code and configurations of the template are automatically loaded. The **Create Function** page is displayed.
4. Set **Function Name** to **context**, select a created agency, 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:

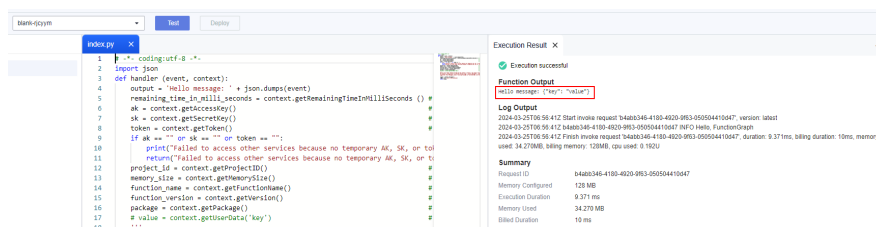
Failed to access other services because no temporary AK, SK, or token has been obtained. Please set an agency.

5. Set the parameters based for your service requirements.

Triggering a Function

1. On the **Code** tab page of the **context** function, click **Test** in the upper right corner.
2. In the **Configure Test Event** dialog box, select **Blank Template** and click **Create**.
3. Click **Test**. After the test is complete, view the test result.

Figure 4-10 Successful execution result



4.4 Deploying a Function Using a Container Image

Introduction

Package your container images complying with the Open Container Initiative (OCI) standard, and upload them to FunctionGraph. The images will be loaded and run by FunctionGraph. Unlike the code upload mode, you can use a custom code package, which is flexible and reduces migration costs. You can create HTTP functions by using a custom image.

For details about how to develop and deploy an HTTP function using a container image, see [Developing an HTTP Function](#).

The following features are supported:

- **Downloading images**

Images are stored in Software Repository for Container (SWR) and can only be downloaded by users with the **SWR Admin** permission. FunctionGraph will call the SWR API to generate and set temporary login commands before creating instances.

- **Setting environment variables**

Encryption settings and environment variables are supported. For details, see [Configuring Environment Variables](#).

- **Attaching external data disks**

External data disks can be attached. For details, see [Configuring Disk Mounting](#).

- **Reserved instances**

For details, see the description about reserved instances.

 **NOTE**

User containers will be started using UID 1003 and GID 1003, which are the same as other types of functions.

Prerequisites

You have created an agency with the **SWR Admin** permission by referring to [Configuring Agency Permissions](#). Images are stored in SWR, and only users with this permission can invoke and pull images.

Procedure

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. On the **Function List** page, click **Create Function** in the upper right corner.
3. Select **Container Image**. For details, see [Table 4-7](#).

Figure 4-11 Creating a function using a container image

Basic Information

* Function Type [?](#)

Event Function HTTP Function

Processes event requests and can be triggered by APIG, OBS, and DIS events.

* Region

Regions are geographic areas isolated from each other. Resources are region-specific and cannot be used across regions through internal network connections. For low network latency and quick resource access, select the nearest region.

* Function Name

Enter 1 to 60 characters, starting with a letter and ending with a letter or digit. Only letters, digits, hyphens (-), and underscores (_) are allowed.

* Container Image [?](#)

[View Image](#)

Address of the container image used to create the function.

Container Image Override ▲

Permissions [?](#)

No agency
 Use agency

* Agency

[Create Agency](#)

To create a function using an image, select an agency with the SWR Admin permission.

Table 4-7 Parameter description

Parameter	Description
*Function Type	<p>Select a function type.</p> <p>HTTP function: triggered once HTTP requests are sent to specific URLs.</p> <p>NOTE</p> <ul style="list-style-type: none"> The custom container image must contain an HTTP server with listening port 8000. HTTP functions support APIG and APIC triggers only. When calling a function using APIG, isBase64Encoded is valued true by default, indicating that the request body transferred to FunctionGraph is encoded using Base64 and must be decoded for processing. The function must return characters strings by using the following structure. <pre> { "isBase64Encoded": true false, "statusCode": httpStatusCode, "headers": {"headerName":"headerValue",...}, "body": "..." } </pre>
*Region	Select a region where you will deploy your code.
*Function Name	<p>Name of the function, which must meet the following requirements:</p> <ul style="list-style-type: none"> Consists of 1 to 60 characters, and can contain letters, digits, hyphens (-), and underscores (_). Starts with a letter and ends with a letter or digit.
*Enterprise Project	Select a created enterprise project and add the function to it. By default, default is selected.
Container Image	Enter an image URL, that is, the location of the container image. You can click View Image to view private and shared images.

Parameter	Description
Container Image Override	<ul style="list-style-type: none"> • CMD: container startup command. Example: <code>/bin/sh</code>. If no command is specified, the entrypoint or CMD in the image configuration will be used. Enter one or more commands separated with commas (,). • Args: container startup parameter. Example: <code>-args,value1</code>. If no argument is specified, CMD in the image configuration will be used. Enter one or more arguments separated with commas (,). • Working Dir: working directory of the container. The folder path can only be <code>/</code> and cannot be created or modified. The path will be <code>/</code> by default if not specified. • User ID: user ID for running the image. If no user ID is specified, the default value 1003 will be used. • Group ID: user group ID. If no user group ID is specified, the default value 1003 will be used.
Agency	Select an agency with the SWR Admin permission. To create an agency, see Creating an Agency .

 NOTE

- **Command, Args, and Working dir** can contain up to 5120 characters.
- When a function is executed at the first time, the image is pulled from SWR, and the container is started during cold start of the function, which takes a certain period of time. If there is no image on a node during subsequent cold starts, an image will be pulled from SWR.
- Public and private images are supported. For details, see [Setting Image Attributes](#).
- The port of a custom container image must be 8000.
- The image package cannot exceed 10 GB. For a larger package, reduce the capacity. For example, mount the data of a question library to a container where the data was previously loaded through an external file system.
- FunctionGraph uses LTS to collect all logs that the container outputs to the console. These logs can be redirected to and printed on the console through standard output or an open-source log framework. The logs should include the system time, component name, code line, and key data, to facilitate fault locating.
- When an out of memory (OOM) error occurs, view the memory usage in the function execution result.
- Functions must return a valid HTTP response.

Sample Code

The following uses **Node.js Express** as an example. During function initialization, FunctionGraph uses the POST method to access the `/init` path (optional). Each time when a function is called, FunctionGraph uses the POST method to access the `/invoke` path. The function obtains **context** from **req.headers**, obtains **event** from **req.body**, and returns an HTTP response struct.

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

app.post('/init', (req, res) => {
  res.send('Hello init\n');
});

app.post('/invoke', (req, res) => {
  res.send('Hello invoke\n');
});

app.listen(PORT, () => {
  console.log(`Listening on http://localhost:${PORT}`);
});
```

5 Configuring Functions

5.1 Configuring Initialization

Overview

The initializer of a function is executed after an instance is started. The instance starts to process requests only after the initializer is executed. The initializer is executed only once during the lifecycle of a function instance.

Scenario

The service logic shared by multiple requests can be implemented in the initializer to reduce the latency. For example, the logic of loading a deep learning model with large specifications or building a connection pool for databases.

Prerequisites

You have created a function.

Initializing a Function

- Step 1** Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the function to be configured to go to the function details page.
- Step 3** Click the **Configuration** tab and choose **Advanced Settings**.

Figure 5-1 Enabling initialization

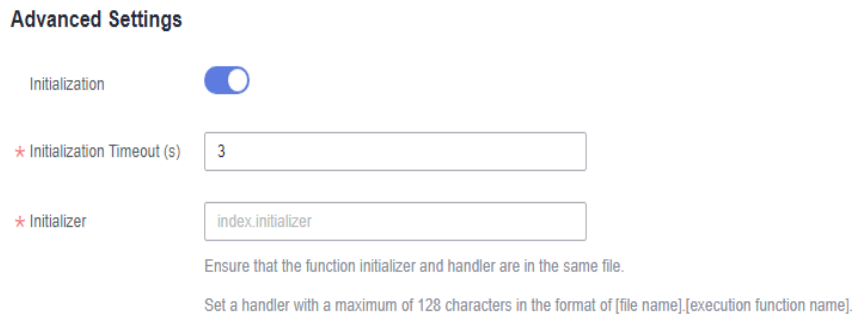


Table 5-1 Parameter configuration

Parameter	Description
Initialization	Enable initialization if needed.
Initialization Timeout (s)	Maximum duration the function can be initialized. Set this parameter if you enable function initialization. The value ranges from 1s to 300s.
Initializer	<p>You can enable function initialization on the Configuration tab page. The initializer must be named in the same way as the handler. For example, for a Node.js or Python function, set an initializer name in the format of <i>[file name].[initialization function name]</i>.</p> <p>NOTE</p> <ul style="list-style-type: none"> This parameter is not required if function initialization is disabled. Ensure that the function initializer and handler are in the same file.

NOTE

- Set the initializer in the same way as the handler. For example, for a Node.js or Python function, set an initializer name in the format of *[file name].[initialization function name]*.
- For details about the function code configuration, see [Creating a Deployment Package](#).

----End

5.2 Configuring Basic Settings

Introduction

After a function is created, **Memory (MB)**, **Handler**, and **Execution Timeout (s)** are automatically set based on your runtime. If needed, modify them based on this section.

Prerequisites

You have created a function.

Procedure

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. Choose **Configuration > Basic Settings** and configure parameters based on [Table 5-2](#). Parameters marked with an asterisk (*) are mandatory.

Table 5-2 Basic settings

Parameter	Description
App	After a function is created, it is automatically categorized into the default app and cannot be switched to other apps. NOTICE An app acts like a folder. In the future, functions will be managed by label for better experience.
*Handler	<ul style="list-style-type: none"> • For a Node.js, Python, or PHP function, the handler must be named in the format of <i>[file name].[function name]</i>, which must contain a period (.). Example: myfunction.handler • For a Java function, the handler must be named in the format of <i>[package name].[class name].[execution function name]</i>. Example: com.xxxxx.exp.Myfunction.myHandler • For a Go function, the handler name must be the same as the executable file name in the uploaded code package. Example: If the executable file is handler, set this parameter to handler.
*Enterprise Project	Select a created enterprise project and add the function to it. By default, default is selected.
*Execution Timeout (s)	Maximum duration the function can be executed. You can set this parameter on the Configuration tab page. If the execution takes longer than 90s, use asynchronous invocation. The value ranges from 3s to 259,200s.
Memory (MB)	Memory of a function instance. Options: 128, 256, 512, 768, 1024, 1280, 1536, 1792, 2048, 2560, 3072, 3584, 4096, 8192, 10,240.
Description	Description of the function, which cannot exceed 512 characters.

4. Click **Save**.

5.3 Configuring Agency Permissions

Overview

FunctionGraph works with other cloud services in most scenarios. Create a cloud service agency so that FunctionGraph can perform resource O&M in other cloud services on your behalf.

Scenario

Before using FunctionGraph in the following scenarios, **create an agency**. Adjust the permissions granted to the agency to meet your service requirements. For example, grant the Admin permission in the development phase, and **change it to the fine-grained minimum permission in the product environment**. This ensures the required permissions while eliminating risks. Select the required action by referring to [Table 5-3](#).

Table 5-3 Common actions

Scenario	Admin Permission	Fine-Grained Minimum Permission	Description
Using a custom image	SWR Admin	Unavailable	SWR Admin: administrator who has all permissions for the SoftWare Repository for Container (SWR) service. For details about how to create a custom image, see Deploying a Function Using a Container Image .
Mounting an SFS Turbo file system	SFS Administrator	sfsturbo:shares:getShare (Query details about a file system)	SFS Administrator: administrator who has all permissions for the Scalable File Service (SFS) service. sfsturbo:shares:getShare: permission for querying a file system in SFS. For details about how to mount an SFS Turbo file system, see Mounting an SFS Turbo File System .

Scenario	Admin Permission	Fine-Grained Minimum Permission	Description
Mounting an ECS shared directory	Tenant Guest and VPC Administrator	ecs:cloudServers:get (Query details about an ECS)	<p>Tenant Guest: user with read-only permissions for all cloud services (except IAM)</p> <p>VPC Administrator: network administrator</p> <p>ecs:cloudServers:get: permission for querying an ECS.</p> <p>For details about how to mount an ECS shared directory, see Mounting an ECS Shared Directory.</p>
Configuring cross-domain VPC access	VPC Administrator	vpc:ports:delete (Delete a port) vpc:ports:get (Query a port) vpc:ports:create (Create a port) vpc:vpcs:get (Query a VPC) vpc:subnets:get (Query a subnet)	<p>Users with the VPC Administrator permissions can perform any operations on all cloud resources of the VPC. To configure cross-VPC access, specify an agency with VPC management permissions.</p> <p>Fine-grained minimum permission for VPC: permission for deleting, querying, or creating a port, or querying a VPC or subnet.</p> <p>For details about how to configure cross-domain VPC access, see Configuring the Network.</p>
Creating an OBS bucket and trigger	OBS Administrator	obs:bucket:GetBucketLocation (Query a bucket location) obs:bucket:ListAllMyBuckets (Query buckets) obs:bucket:GetBucketNotification (Obtain the event notification configuration of a bucket) obs:bucket:PutBucketNotification (Configure event notifications for a bucket)	<p>OBS Administrator: OBS administrator.</p> <p>Fine-grained minimum permission for OBS: permission for querying a bucket location, buckets, or the event notification configuration of a bucket, or configuring event notifications for a bucket.</p> <p>For details about how to create an OBS trigger, see Using an OBS Trigger.</p>

Creating an Agency

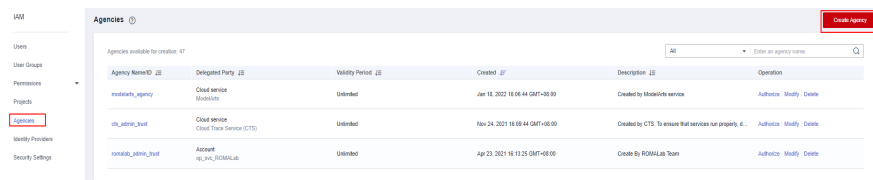
 **NOTE**

In the following example, the **Tenant Administrator** permission is assigned to FunctionGraph and this setting takes effect only in the authorized regions.

Create an agency by referring to [Creating an Agency](#) and set parameters as follows:

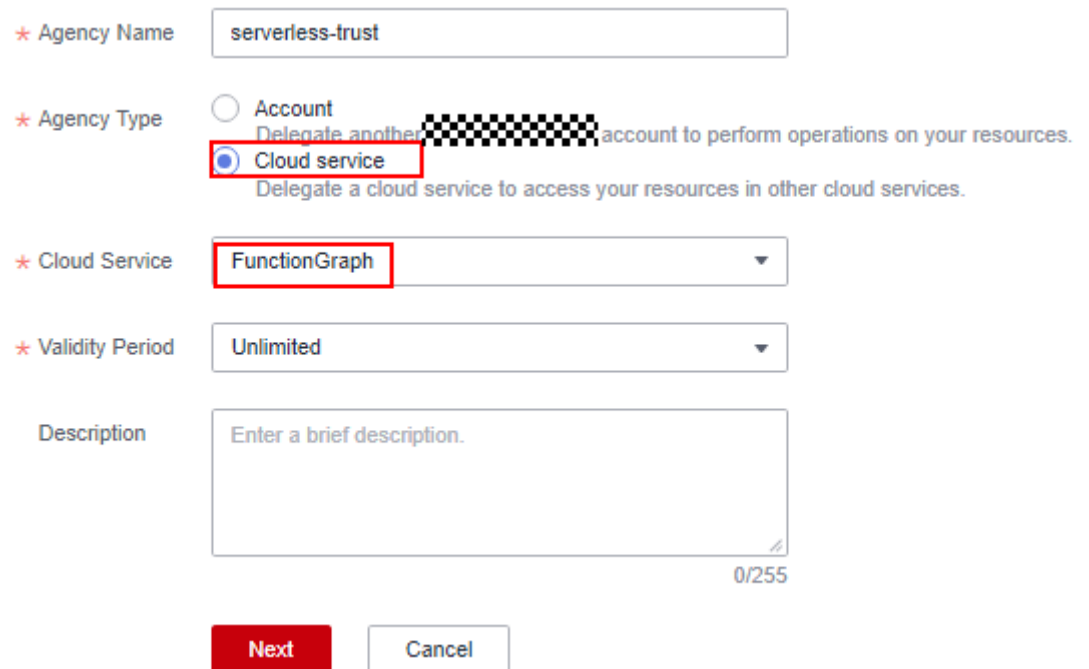
1. Log in to the IAM console.
2. On the IAM console, choose **Agencies** from the navigation pane, and click **Create Agency** in the upper right corner.

Figure 5-2 Creating an agency



3. Configure the agency.

Figure 5-3 Setting basic information



The screenshot shows the 'Create Agency' configuration form with the following fields:

- Agency Name:** serverless-trust
- Agency Type:** Cloud service (selected)
- Cloud Service:** FunctionGraph
- Validity Period:** Unlimited
- Description:** Enter a brief description. (0/255 characters)

Buttons: Next, Cancel

- For **Agency Name**, enter **serverless-trust**.
- For **Agency Type**, select **Cloud service**.
- For **Cloud Service**, select **FunctionGraph**.

- For **Validity Period**, select **Unlimited**.
 - **Description**: Enter the description.
4. Click **Next**. On the displayed page, search for the permissions to be added in the search box on the right and select the permissions. The **Tenant Administrator** permission is used as an example.

Figure 5-4 Selecting policies



Table 5-4 Example of agency permissions

Policy Name	Scenario
Tenant Administrator	Administrator for all cloud services except IAM. This user can perform any operations on all cloud resources of the enterprise.

5. Click **Next** and select the scope.

Configuring an Agency

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 the function to be configured to go to the function details page.
3. Choose **Configuration > Permissions**, click **Create Agency**, and set an agency based on site requirements by referring to [2-5](#).

Table 5-5 Agency configuration parameters

Parameter	Description
Configuration Agency	Select a function that you have created.
Execution Agency	Mandatory if you select Specify an exclusive agency for function execution .

 NOTE

- To ensure optimal performance, select **Specify an exclusive agency for function execution** and set different agencies for function configuration and execution. You can also use no agency or specify the same agency for both purposes. [Figure 5-5](#) shows the agency options.

Figure 5-5 Setting agencies

Permissions ⓘ

Agencies delegate FunctionGraph to access other cloud services. For example, an agency is required when FunctionGraph accesses services such as OBS, DMS, and DIS.

Configuration Agency Create Agency Specify an exclusive agency for function execution

A configuration agency enables you to create a trigger to access the relevant service, such as DMS and DIS

Execution Agency ⓘ

- **Configuration Agency:** For example, to create Data Ingestion Service (DIS) triggers, first specify an agency with DIS permissions. If such an agency is not specified or the specified agency does not exist, no DIS triggers can be created.
- **Execution Agency:** This type of agency enables you to obtain a token and AK/SK from the context in the function handler for accessing other cloud services.

4. Click **Save**.

Modifying an Agency

Modifying an agency: You can modify the permissions, validity period, and description of an agency on the IAM console.

⚠ CAUTION

- After an agency is modified, it takes about 10 minutes for the modification (for example, `context.getToken`) to take effect.
 - The agency information obtained using the `context` method is valid for 24 hours. Refresh it before it expires.
-

5.4 Configuring the Network

Public Access

By default, functions can access services on public networks. If the target public network service requires whitelist verification using a fixed IP address, [enable VPC access](#), configure a NAT gateway for the VPC, and bind an Elastic IP (EIP) to the gateway. For details, see [Configuring a Fixed Public IP Address](#)

Configuring VPC Access

Functions can access resources in a VPC bound to it. If a function needs both VPC and public access, configure a NAT gateway for the VPC and bind an EIP to the gateway. For details, see [Configuring a Fixed Public IP Address](#).

Required Permissions

Configure an agency by referring to [Configuring Agency Permissions](#).

- Permissions for VPC access: an agency with the **VPC Administrator** permission or with the least permissions listed in [Table 5-6](#)

Table 5-6 Least permissions required

Permission	Action
Deleting a port	vpc:ports:delete
Querying a port	vpc:ports:get
Creating a port	vpc:ports:create
Querying a VPC	vpc:vpcs:get
Querying a subnet	vpc:subnets:get

- Permissions for private domain name resolution: an agency with the **DNS ReadOnlyAccess** permission

Procedure

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. Choose **Configuration > Network**, enable **VPC Access**, and specify a VPC and subnet.

NOTE

1. For details on how to create a VPC and a subnet, see [Creating a VPC](#).
2. Specify an agency with VPC administrator permissions for the function. For details, see [Configuring Agency Permissions](#).
3. You can bind all functions in a project to up to four different subnets in any VPCs. (Each project has a unique 32-digit project ID, which is allocated when your account is created. The project IDs of your account and IAM user are the same.)
4. Enter one or more private domain names of the VPC so that the function can use them to access resources in this VPC.

NOTE

1. For details about how to create a private domain name, see [Creating a Private Zone](#).
2. Functions can resolve only domain names of the A record set type. For details about how to add a record set, see [Record Set Types and Configuration Rules](#).
5. Click **Save**.

Configuring a Fixed Public IP Address

If a function needs to access public network resources in a VPC or requires a fixed public IP address, configure a NAT gateway for the VPC and bind an EIP to the gateway.

Prerequisites

1. You have created a VPC and a subnet according to [Creating a VPC](#).
2. You have obtained an EIP according to [Assigning an EIP](#).

Procedure

1. In the left navigation pane of the management console, choose **Network > NAT Gateway** to go to the NAT Gateway console. Then click **Create NAT Gateway**.
2. On the displayed page, enter gateway information, select a VPC (for example, **vpc-01**) and subnet, and confirm and submit the settings. For details, see [Creating a Public NAT Gateway](#).
3. Click the NAT gateway name. On the details page that is displayed, click **Add SNAT Rule**, set the rule, and click **OK**.

5.5 Configuring Disk Mounting

Introduction

FunctionGraph allows you to mount file systems to your functions. Multiple functions can share the same file system. This greatly expands the function execution and storage space compared with the temporary disk space allocated to a function.

Scenarios

NOTICE

Before mounting file systems, enable access over the following ports:

1. 111, 445, 2049, 2051, 2052, and 20048
2. Another three ports for Ubuntu. To obtain the port numbers, run the following command:

```
rpcinfo -p|grep mountd|grep tcp
```

For details, see [What Resources Does SFS Occupy?](#)

FunctionGraph supports the following types of file systems:

- SFS Turbo
SFS Turbo supports the following storage classes: Standard (500 GB–32 TB), Standard-Enhanced (10 TB–320 TB), Performance (500 GB–32 TB), and Performance-Enhanced (10 TB–320 TB). SFS Turbo is expandable to 320 TB, and provides fully hosted shared file storage. It features high availability and durability, and supports massive quantities of small files and applications

requiring low latency and high input/output operations per second (IOPS). SFS Turbo is suitable for high-performance websites, log storage, compression and decompression, DevOps, enterprise offices, and containerized applications. For details, see [SFS Service Overview](#).

- ECS

A directory on an ECS is specified as a shared file system (see [Mounting an ECS Shared Directory](#)) by using the network file system (NFS) service. The directory can then be mounted to a function in the same VPC as the ECS so that the function can read and write data in the directory. ECS file systems make it possible for dynamic expansion of compute resources. This type of file system is suitable for low service demand scenarios.

Benefits from using these file systems:

- The function execution space can be greatly expanded comparing with `/tmp`.
- A file system can be shared by multiple functions.
- ECS compute resources can be dynamically expanded and existing ECS storage capability can be used to achieve stronger computing performance.

 **NOTE**

You can write temporary files in the `/tmp` directory. The total size of these files cannot exceed 10,240 MB.

Creating an Agency

Before adding file systems to a function, specify an agency with permissions for accessing the file system services for the function.

There is a limit on the maximum number of agencies you can create, and cloud service agencies cannot be modified. Therefore, you are advised to create an agency with high-level permissions, for example, **Tenant Administrator**, to allow a function to access all resources in the selected region. For more information, see [Configuring Agency Permissions](#).

Mounting an SFS Turbo File System

Setting an Agency

Before mounting an SFS Turbo file system to a function, specify an agency that has been granted **SFS Administrator** and **VPC Administrator** permissions for the function. If no agencies are available, create one in IAM.

Configuring VPC Access

An SFS Turbo file system is accessible only in the VPC where it has been created. Before mounting such a file system to a function, enable VPC access for the function.

1. On the SFS console, obtain the information about the VPC and subnet where a file system is to be mounted to your function. For details, see [File System Management](#).
2. Enable VPC access by referring to [Configuring the Network](#) and enter the VPC and subnet obtained in [1](#).

Mounting an SFS Turbo File System

SFS Turbo file systems can be mounted in the same way as SFS file systems. Select a file system and set the access path.

Mounting an ECS Shared Directory

Specifying an Agency

Before mounting an ECS shared directory to a function, specify an agency that has been granted **Tenant Guest** and **VPC Administrator** permissions for the function. If no agencies are available, create one in IAM. For details, see [Creating an Agency](#).

Configuring VPC Access

Before adding an ECS shared directory, specify the VPC where the ECS is deployed. View the VPC information on the details page of the ECS. Click the VPC name to go to the VPC details page, and view the subnet.

Set the acquired VPC and subnet for the function.

Mounting an ECS Directory

Enter a shared directory and function access path.

Figure 5-6 Setting the path

* Shared Directory	172.16.0.40:	/sharetest
* Access Path ?	/ecmdir	

Follow-up Operations

A function can read and write data in an access path in the same way as in the mounted file system.

Function logs can be persisted by configuring the log path as a subdirectory in the access path.

Creating an NFS Shared Directory on ECS

1. Linux

- CentOS, SUSE, EulerOS, Fedora, or openSUSE

i. Configure a YUM repository.

1. Create a file named **euleros.repo** in the **/etc/yum.repos.d** directory. Ensure that the file name must end with **.repo**.

2. Run the following command to enter **euleros.repo** and edit the configuration:

```
vi /etc/yum.repos.d/euleros.repo
```

The EulerOS 2.0 SP3 YUM configuration is as follows:

```
[base]
name=EulerOS-2.0SP3 base
baseurl=http://repo.cloud.com/euler/2.3/os/x86_64/
enabled=1
```

```
gpgcheck=1
gpgkey=http://repo.cloud.com/euler/2.3/os/RPM-GPG-KEY-EulerOS
```

The EulerOS 2.0 SP5 YUM configuration is as follows:

```
[base]
name=EulerOS-2.0SP5 base
baseurl=http://repo.cloud.com/euler/2.5/os/x86_64/
enabled=1
gpgcheck=1
gpgkey=http://repo.cloud.com/euler/2.5/os/RPM-GPG-KEY-EulerOS
```

NOTE

Parameter description:

name: repository name

baseurl: URL of the repository

- HTTP-based network address: **http://path/to/repo**
- Local repository address: **file:///path/to/local/repo**

gpgcheck: indicates whether to enable the GNU privacy guard (GPG) to check the validity and security of RPM package resources. **0:** The GPG check is disabled. **1:** The GPG check is enabled. If this option is not specified, the GPG check is enabled by default.

3. Save the configurations.

4. Run the following command to clear the cache:

```
yum clean all
```

ii. Run the following command to install nfs-utils:

```
yum install nfs-utils
```

iii. Create a shared directory.

When you open **/etc/exports** and need to create shared directory **/sharedata**, add the following configuration:

```
/sharedata 192.168.0.0/24(rw,sync,no_root_squash)
```

NOTE

The preceding configuration is used to share the **/sharedata** directory with other servers in the **192.168.0.0/24** subnet.

After the preceding command is run, run the **exportfs -v** command to view the shared directory and check whether the setting is successful.

iv. Run the following commands to start the NFS service:

```
systemctl start rpcbind
service nfs start
```

v. Create another shared directory.

For example, to create the **/home/myself/download** directory, add the following configuration to **/etc/exports**:

```
/home/myself/download 192.168.0.0/24(rw,sync,no_root_squash)
```

Restart the NFS service.

```
service nfs restart
```

Alternatively, run the following command without restarting the NFS service:

```
exportfs -rv
```

vi. (Optional) Enable automatic startup of the rpcbind service.

Run the following command:

```
systemctl enable rpcbind
```

– Ubuntu

- i. Run the following commands to install nfs-kernel-server:

```
sudo apt-get update  
sudo apt install nfs-kernel-server
```

- ii. Create a shared directory.

```
vim /etc/exports
```

When you open `/etc/exports` and need to create shared directory `/sharedata`, add the following configuration:

```
/sharedata 192.168.0.0/24(rw,sync,no_root_squash)
```

NOTE

The preceding configuration is used to share the `/sharedata` directory with other servers in the `192.168.0.0/24` subnet.

- iii. Start the NFS service.

```
service nfs-kernel-server restart
```

NOTE

After the preceding command is run, run the `exportfs -v` command to view the shared directory and check whether the setting is successful.

- iv. Create another shared directory.

For example, to create the `/home/myself/download` directory, add the following configuration to `/etc/exports`:

```
/home/myself/download 192.168.0.0/24(rw,sync,no_root_squash)
```

Restart the NFS service.

```
service nfs restart
```

Alternatively, run the following command without restarting the NFS service:

```
exportfs -rv
```

2. Windows

1. Install the NFS server.

Paid software: haneWIN. Download the software at the [haneWIN official website](#).

Free software: FreeNFS and WinNFSd. Download the software at the [SourceForge website](#).

2. Enable the NFS function.

– In the case of WinNFSd, see [WinNFSd configuration](#).

- i. Download and decompress WinNFSd, and create the `nfs` folder in the decompressed directory.
- ii. Set the sharing and read/write permissions on the `nfs` file.
 - 1) Right-click the `nfs` file and choose **Properties**.
 - 2) Click the **Sharing** tab, and then click **Share....**
 - 3) Add **Everyone** and click **Share**.

Figure 5-7 Adding Everyone



- 4) Click the **Security** tab, select **Everyone** in the **Group or user names** list, and click **Edit**.
 - 5) In the displayed **Security** dialog box, select **Everyone** from the **Group or user name** list, select **Read** and **Write** from the **Allow** check boxes in the **Permissions for Everyone** list, and click **OK**.
- iii. Disable all firewalls, including the **Domain network**, **Private network**, and **Public network**. Enable them after the entire configuration is complete.
 - iv. Log in to the virtual server of the router and enable ports **111**, **2049**, and **1058** of the external network. (Note: An external IP address is required.)
 - v. Run the following command. For details, see <https://github.com/winnfsd/winnfsd>.

```
WinNFSd.exe -addr {Your own local IP address 192.168.xxx.xxx} F:\nfs /nfs
```
- In the case of haneWIN, perform the following steps:
- i. Run the downloaded **.exe** file as the Windows system administrator.
 - ii. After the installation is complete, open the **NFS Server** file and choose **Edit > Preferences**.
 - iii. Retain the default settings on the **NFS, Server**, and **PortMapper** tab pages. Click the **Exports** tab, click **Edit exports file** to configure the shared directory, and click **Save**.

NOTE

The shared directory format can be referenced as **D:\share -public -name:nfs**, which means to set the permission on the **share** folder to **public** and define an alias **nfs**.

- iv. Click **OK**.
- v. Disable all firewalls, including the **Domain network**, **Private network**, and **Public network**. Enable them after the entire configuration is complete.

NOTE

Run the following command in Linux to mount the directory and check whether the file sharing is successful:

```
mount -t nfs -o nolock 192.168.xxx.xxx:/nfs /mnt
```

- **192.168.xxx.xxx** is the IP address of the Windows operating system.
- **nfs** is the alias created when the shared directory is configured.
- **/mnt** is the local directory where the remote directory is mounted.

5.6 Configuring Environment Variables

Overview

Environment variables allow you to pass dynamic parameters to a function without modifying code.

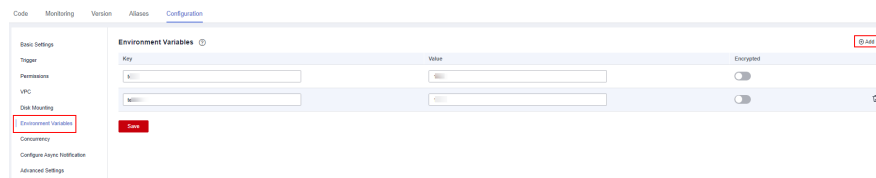
Scenario

- Environment distinguishing: Configure different environment variables for the same function logic. For example, use environment variables to configure testing and development databases.
- Configuration encryption: Configure encrypted environment variables to dynamically obtain authentication information (account, password, AK/SK) required to access other services.
- Dynamic configuration: Configure environment variables for parameters that need to be dynamically adjusted, including query period and timeout, in function logic.

Procedure

You can configure encryption settings and environment variables to dynamically pass settings to your function code and libraries without changing your code.

Figure 5-8 Adding environment variables



For example, for Node.js, encryption settings and environment variable values can be obtained from `getUserData(string key)` in **Context**.

WARNING

- Environment variables and encryption settings are user-defined key-value pairs that store function settings. Keys can contain letters, digits, and underscores (`_`), and must start with a letter.
 - The total length of the key and value cannot exceed 4096 characters.
 - When you define environment variables, FunctionGraph displays all your input information in plain text. For security purposes, do not include sensitive information.
 - After encryption is enabled, key-value pairs are encrypted on the console and will remain encrypted during transmission.
-

Preset Parameters

The following lists preset parameters. Do not configure environment variables with the same names as any of these parameters.

Table 5-7 Preset parameters and description

Environment Variable	Description	Obtaining Method and Default Value
RUNTIME_PROJECT_ID	Project ID	Obtain the value from a Context interface or a system environment variable.
RUNTIME_FUNC_NAME	Function name	Obtain the value from a Context interface or a system environment variable.
RUNTIME_FUNC_VERSION	Function version	Obtain the value from a Context interface or a system environment variable.
RUNTIME_HANDLER	Handler	Obtain the value from a system environment variable.
RUNTIME_TIMEOUT	Execution timeout allowed for a function.	Obtain the value from a system environment variable.
RUNTIME_USERDATA	Value passed through an environment variable	Obtain the value from a Context interface or a system environment variable.
RUNTIME_CPU	CPU usage of a function. The value is in proportion to MemorySize .	Obtain the value from a Context interface or a system environment variable.
RUNTIME_MEMORY	Memory size configured for a function	Obtain the value from a Context interface or a system environment variable. Unit: MB
RUNTIME_MAX_RESP_BODY_SIZE	Maximum size of a response body	Obtain the value from a system environment variable. Default value: 6,291,456 bytes
RUNTIME_INITIALIZER_HANDLER	Initializer	Obtain the value from a system environment variable.

Environment Variable	Description	Obtaining Method and Default Value
RUNTIME_INITIALIZER_TIMEOUT	Initialization timeout of a function	Obtain the value from a system environment variable.
RUNTIME_ROOT	Runtime package path	Obtain the value from a system environment variable. Default value: /home/snuser/runtime
RUNTIME_CODE_ROOT	Path for storing code in a container	Obtain the value from a system environment variable. Default value: /opt/function/code
RUNTIME_LOG_DIR	Path for storing system logs in a container	Obtain the value from a system environment variable. Default value: /home/snuser/log

Example

You can use environment variables to configure which directory to install files in, where to store outputs, and how to store connection and logging settings. These settings are decoupled from the application logic, so you do not need to update your function code when you change the settings.

In the following code snippet, **obs_output_bucket** is the bucket used for storing processed images.

```
def handler(event, context):
    srcBucket, srcObjName = getObsObjInfo4OBSTrigger(event)
    obs_address = context.getUserData('obs_address')
    outputBucket = context.getUserData('obs_output_bucket')
    if obs_address is None:
        obs_address = '{obs_address_ip}'
    if outputBucket is None:
        outputBucket = 'casebucket-out'

    ak = context.getAccessKey()
    sk = context.getSecretKey()

    # download file uploaded by user from obs
    GetObject(obs_address, srcBucket, srcObjName, ak, sk)

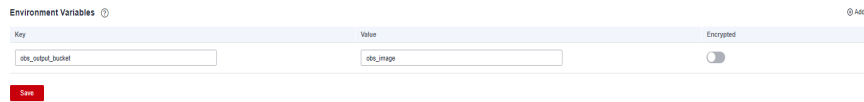
    outFile = watermark_image(srcObjName)

    # Upload converted files to a new OBS bucket.
    PostObject(obs_address, outputBucket, outFile, ak, sk)
```

```
return 'OK'
```

Using environment variable **obs_output_bucket**, you can flexibly set the OBS bucket used for storing output images.

Figure 5-9 Environment variables



5.7 Configuring Asynchronous Execution Notification

Overview

Functions can be invoked synchronously or asynchronously. In asynchronous mode, FunctionGraph sends a response immediately after persisting a request. The request result cannot be known in real time. To retry when an asynchronous request fails or obtain asynchronous processing results, configure asynchronous settings.

Scenario

- **Retry:** By default, FunctionGraph does not retry if a function fails due to a code error. If your function needs retry, for example, if third-party services often fail to be invoked, configure retry to improve the success rate.
- **Result notifications:** FunctionGraph automatically notifies downstream services of the asynchronous execution result of a function for further processing. For example, storing execution failure information in OBS for cause analysis, or pushing execution success information to DIS or triggering the function again.

Procedure

- Step 1** Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the function to be configured to go to the function details page.
- Step 3** Choose **Configuration > Configure Async Notification**. On the displayed page, click **Edit** next to **Asynchronous Notification Policy**.

Figure 5-10 Configuring an asynchronous notification policy

Note

1. Set an agency that allows FunctionGraph to access your target service.
2. To avoid cyclic invocation, do not set two functions as asynchronous execution targets of each other.

Asynchronous Notification Policy 

- Step 4** Set parameters by referring to [Table 5-8](#). For example, specify **FunctionGraph** for **Target Service**.

Figure 5-11 Setting parameters

Asynchronous Notification Policy

Max. Retries Value Range: 0-3
Maximum number of retries when asynchronous invocation fails.

Max. Validity Period (s) Value Range: 1-86,400
Maximum lifetime of a message in seconds.

Success Notification Send a notification to the following target service if the current function is executed successfully.

Target Service

Function Name [Create Function](#)

Version/Alias

Failure Notification Send a notification to the following target service if the current function fails to be executed.

Target Service

Function Name [Create Function](#)

Version/Alias

Table 5-8 Parameter description

Parameter	Description
Asynchronous Execution Notification Policy	<ul style="list-style-type: none"> Max. Retries: maximum number of retries when asynchronous invocation fails. Value range: 0–3. Default value: 1. Max. Validity Period (s): maximum lifetime of a message in seconds. Value range: 1–86,400.
Success Notification	<p>Target Service: to which a notification will be sent if a function is executed successfully.</p> <ol style="list-style-type: none"> FunctionGraph OBS
Failure Notification	<p>Target Service: to which a notification will be sent if a function fails to be executed.</p> <ol style="list-style-type: none"> FunctionGraph OBS

Step 5 Click **OK**.

 NOTE

1. Set an agency that allows FunctionGraph to access the target service.
2. To avoid cyclic invocation, do not set two functions as asynchronous execution targets of each other.

----End

Configuration Description

For details about how to set the target for asynchronous invocation, see [Table 5-9](#). The following shows an example:

```
{
  "timestamp": "2020-08-20T12:00:00.000Z+08:00",
  "request_context": {
    "request_id": "1167bf8c-87b0-43ab-8f5f-26b16c64f252",
    "function_urn": "urn:fss:xx-xxx-x:xxxxxxx:function:xxx:xxx:latest",
    "condition": "",
    "approximate_invoke_count": 0
  },
  "request_payload": "",
  "response_context": {
    "status_code": 200,
    "function_error": ""
  },
  "response_payload": "hello world!"
}
```

Table 5-9 Parameter description

Parameter	Description
timestamp	Time when the invocation starts.
request_context	Request context.
request_context.request_id	ID of an asynchronous invocation request.
request_context.function_urn	URN of the function that is to be executed asynchronously.
request_context.condition	Invocation error type.
request_context.approximate_invoke_count	Number of asynchronous invocation times. If the value is greater than 1, function execution has been retried.
request_payload	Original request payload.
response_context	Response context.
response_context.statusCode	Code returned after function invocation. If the code is not 200, a system error occurred.
response_context.function_error	Invocation error information.

Parameter	Description
response_payload	Payload returned after function execution.

5.8 Configuring Single-Instance Multi-Concurrency

NOTE

This feature is supported only by FunctionGraph v2.

Overview

By default, each function instance processes only one request at a specific time. For example, to process three concurrent requests, FunctionGraph triggers three function instances. To address this issue, FunctionGraph has launched the single-instance multi-concurrency feature, allowing multiple requests to be processed concurrently on one instance.

Scenario

This feature is suitable for functions which spend a long time to initialize or wait for a response from downstream services. The feature has the following advantages:

- Fewer cold starts and lower latency: Usually, FunctionGraph starts three instances to process three requests, involving three cold starts. If you configure the concurrency of three requests per instance, only one instance is required, involving only one cold start.
- Shorter processing duration and lower cost: Normally, the total duration of multiple requests is the sum of each request's processing time.

Comparison

If a function takes 5s to execute each time and you set the number of requests that can be concurrently processed by an instance to 1, three requests need to be processed in three instances, respectively. Therefore, the total execution duration is 15s.

When you set **Max. Requests per Instance** to 5, if three requests are sent, they will be concurrently processed by one instance. The total execution time is 5s.

NOTE

If the maximum number of requests per instance is greater than 1, new instances will be automatically added when this number is reached. The maximum number of instances will not exceed **Max. Instances per Function** you set.

Table 5-10 Comparison

Comparison Item	Single-Instance Single-Concurrency	Single-Instance Multi-Concurrency
Log printing	-	To print logs, Node.js Runtime uses the console.info() function, Python Runtime uses the print() function, and Java Runtime uses the System.out.println() function. In this mode, current request IDs are included in the log content. However, when multiple requests are concurrently processed by an instance, the request IDs are incorrect if you continue to use the preceding functions to print logs. In this case, use context.getLogger() to obtain a log output object, for example, Python Runtime. log = context.getLogger() log.info("test")
Shared variables	Not involved.	Modifying shared variables will cause errors. Mutual exclusion protection is required when you modify non-thread-safe variables during function writing.
Monitoring metrics	Perform monitoring based on the actual situation.	Under the same load, the number of function instances decreases significantly.
Flow control error	Not involved.	When there are too many requests, the error code in the body is FSS.0429 , the status in the response header is 429 , and the error message is Your request has been controlled by overload sdk, please retry later.

Configuring Single-Instance Multi-Concurrency

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. Choose **Configuration > Concurrency**.
Set parameters by referring to [Table 5-11](#) and click **Save**.

Figure 5-12 Concurrency configuration

Basic Settings

Max. Requests per Instance

An instance can concurrently process multiple requests. Set the concurrency value to specify how many requests a single function instance can process at a time.

Max. Instances per Function

The maximum number of instances that can be run for a function. Max value: 1000. -1 indicates unlimited instances and 0 indicates function disabled.

Table 5-11 Description

Parameter	Description
Max. Requests per Instance	Number of concurrent requests supported by a single instance. Value range: 1–1000.
Max. Instances per Function	<p>Maximum number of instances in which a function can run. Default: 400. Maximum: 1000. -1: The function can run in any number of instances. 0: The function is disabled.</p> <p>NOTE Requests that exceed the processing capability of instances will be discarded.</p> <p>Errors caused by excessive requests will not be displayed in function logs. You can obtain error details by referring to Configuring Asynchronous Execution Notification.</p>

Configuration Constraints

- For Python functions, threads on an instance are bound to one core due to the Python Global Interpreter Lock (GIL) lock. As a result, concurrent requests can only be processed using the single core, not multiple cores. The function processing performance cannot be improved even if larger resource specifications are configured.
- For Node.js functions, the single-process single-thread processing of the V8 engine results in processing of concurrent requests only using a single core, not multiple cores. The function processing performance cannot be improved even if larger resource specifications are configured.

5.9 Managing Versions

Overview

FunctionGraph allows you to publish one or more versions throughout the development, test, and production processes to manage your function code. The code and environment variables of each version are saved as a snapshot. After the function code is published, you can modify settings as required.

After a function is created, the default version is latest. Each function has the latest version. After the function code is published, you can modify the version configuration as required.

NOTE

A version is a snapshot of a function and corresponds to a tag in code. Each version contains the configuration and code of the function. By default, no trigger is bound to a new version. After a version is published, the configuration (such as environment variables) and code of the version cannot be updated, to ensure stability and traceability.

Publishing a Version

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. On the **Version** tab page, click **Publish new version**.

Figure 5-13 Parameters for publishing a new version

Version

Version to be published. If no version is specified, FunctionGraph will automatically generate one using the date and time, for example, v20180116-202722.
Enter a maximum of 42 characters, starting and ending with a letter or digit. Only letters, digits, hyphens (-), underscores (_), and periods (.) are allowed.

Description

0/512

- **Version:** Enter a version number. If no version number is specified, the system automatically generates a version number based on the current date, for example, **v20220510-190658**.
 - **Description:** Enter a description for the version. This parameter is optional.
4. Click **OK**. The system automatically publishes a version. Then you will be redirected to the new version.

NOTE


- You can publish up to 20 versions for a function.
- For a function whose latest version has been configured with reserved instances, the function configuration can be modified. By default, non-latest versions do not have reserved instances.
- No disk is attached to a new version created based on latest. Environment variables cannot be set if no trigger has been bound to the version.

Deleting a Version

1. Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.

3. On the **Version** tab page of the latest version, select the version to delete.

Figure 5-14 Deleting a version



Version	Aliases	Description	Last Modified	Operation
1	-	-	1 minute ago	Delete

 **NOTE**

- The latest version of a function cannot be deleted.
 - If a function version associated with aliases is deleted, the aliases will also be deleted.
4. Click **OK** to delete the version.

 **WARNING**

Deleting a version will permanently delete the associated code, configuration, alias, and event source mapping, but will not delete logs. Deleted versions cannot be recovered. Exercise caution when performing this operation.

5.10 Managing Aliases

Overview

An alias points to a specific function version. Create an alias and expose it to clients, for example, bind a trigger to the alias instead of the corresponding version. Then your modification to the version for update or rollback will be imperceptible to the clients. An alias can point to up to two versions with different weights for dark launch.

Creating an Alias

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. On the **Aliases** tab page, click **Create Alias**.

Figure 5-15 Creating an alias

* Alias
 The version associated with the alias. A function can have a maximum of 10 aliases. To create more aliases, delete aliases that are no longer used and try again.
 Enter 1 to 63 characters, starting with a letter and ending with a letter or digit. Only letters, digits, hyphens (-), and underscores (_) are allowed.

* Version

Traffic Shifting

* Additional Version

Shift By Percentage Rule
 You can forward a specified percentage of requests or requests with specified headers to the additional version.

* Weight %
 Percentage of requests to be forwarded to the additional version. For example, if you set the percentage to 5%, FunctionGraph will forward 5% of requests to the additional version and the remaining to the main version.

Description
 0/512

- **Alias:** Enter an alias.
 - **Version:** Select a version to be associated with the alias.
 - **Traffic Shifting:** Choose whether to enable traffic shifting. If this function is enabled, you can distribute a specific percentage of traffic to the additional version.
 - **Additional Version:** Select an additional version to be associated. The latest version cannot be used as an additional version.
 - **Weight:** Enter an integer from 0 to 100.
 - **Description:** Enter a description for the alias.
4. Click **OK**.

 **NOTE**

You can create up to 10 aliases for a function.

Modifying an Alias

1. Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. On the **Aliases** tab page of the latest version, select the alias to modify.

Figure 5-16 Modifying an alias

Name	Version	Description	Modified	Operation
11	latest	-	Just now	Edit Delete

4. Modify the alias information, and click **OK**.

Deleting an Alias

1. Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. On the **Aliases** tab page of the latest version, select the alias to delete.

Figure 5-17 Deleting an alias



Name	Version	Description	Modified	Operation
test	latest		4 minutes ago	OK Delete

4. Click **OK** to delete the version.

5.11 Configuring Dynamic Memory

Overview

By default, a function is bound with only one resource specification. After enabling dynamic memory, you can configure a specification for request processing. If no specification is configured, the default one is used.

Scenario

Take video transcoding as an example. The size of a video file ranges from MB to GB. Different encoding formats and resolutions require different computing resources. To ensure performance, you usually need to configure a large resource specification, which however will result in a waste during low-resolution video (such as short video) processing. To solve this problem, implement the transcoding service with two functions: metadata obtaining and transcoding. Configure a specification for the transcoding function according to the metadata information to minimize the resources and cost.

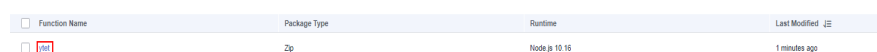
Prerequisites

You have created a function according to [Creating a Function from Scratch](#).

Procedure

- Step 1** Log in to the FunctionGraph console, choose **Functions > Function List** in the navigation pane, and click the name of the created function.

Figure 5-18 Selecting a created function

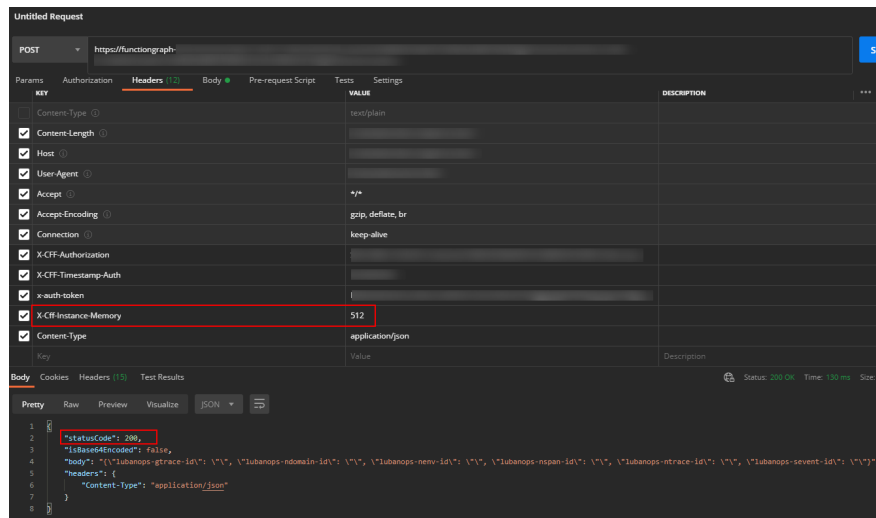


Function Name	Package Type	Runtime	Last Modified
test	Zip	Node.js 10.16	1 minutes ago

- Step 2** On the function details page, choose **Configuration > Advanced Settings** and enable **Dynamic Memory**.
- Step 3** Call the synchronous or asynchronous function execution API, add **X-Cff-Instance-Memory** to the request header, and set the value to **128, 256, 512, 768, 1024, 1280, 1536, 1792, 2048, 2560, 3072, 3584, 4096, 8192, or 10240**.

The following describes how to call an API using Postman. Add **X-Cff-Instance-Memory** to **Headers** and set the value to **512**. If the API is called successfully, error code 200 will be returned.

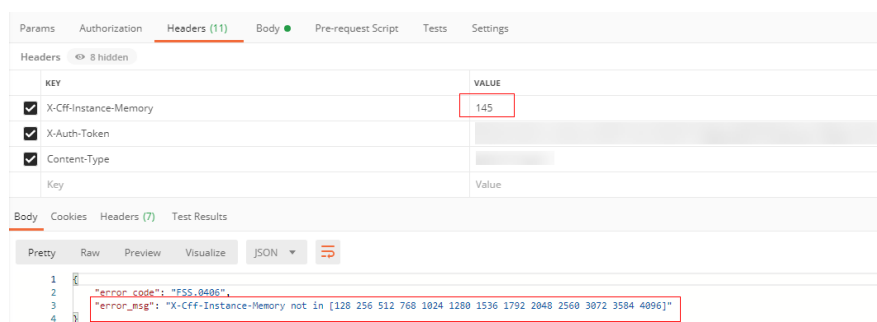
Figure 5-19 Adding a request header and calling the function



NOTE

- If **Dynamic Memory** is not enabled, the memory size set when the function is created will be used by default.
- If **Dynamic Memory** is enabled but the memory value has not been set, the memory size set when the function is created will be used by default. If the API is called successfully, error code 200 will be returned.
- If **Dynamic Memory** is enabled but the memory value is not **128, 256, 512, 768, 1024, 1280, 1536, 1792, 2048, 2560, 3072, 3584, 4096, 8192, or 10240**, error code FSS.0406 will be returned when the API is called. You only need to reset the memory value.

Figure 5-20 Invocation failure



----End

6 Online Debugging

Precautions

Event data is passed to the handler of your function as an input. After configuration, event data is persisted for later use. Each function can have a maximum of 10 test events.

Creating a Test Event

- Step 1** Log in to the FunctionGraph console, and choose **Functions > Function List** in the navigation pane.
- Step 2** Click the name of the desired function.
- Step 3** On the function details page, select a version, and click **Test**.
- Step 4** In the **Configure Test Event** dialog box, configure the test event information according to [Table 6-1](#). The parameter marked with an asterisk (*) is mandatory.

Table 6-1 Test event information

Parameter	Description
Configure Test Event	You can choose to create a test event or edit an existing one. Use the default option Create new test event .
Event Template	If you select blank-template , you can create a test event from scratch. If you select a template, the corresponding test event in the template is automatically loaded. For details about event templates, see Table 6-2 .
*Event Name	The event name can contain 1 to 25 characters and must start with a letter and end with a letter or digit. Only letters, digits, underscores (_), and hyphens (-) are allowed. For example, even-123test .
Event data	Enter a test event.

Table 6-2 Event template description

Template Name	Description
API Gateway (APIG)	Simulates an APIG event to trigger your function.
API Gateway (Dedicated Gateway)	Simulates a dedicated APIG event to trigger your function.
Cloud Trace Service (CTS)	Simulates a CTS event to trigger your function.
Document Database Service (DDS)	Simulates a DDS event to trigger your function.
GaussDB(for Mongo)	Simulates a GaussDB(for Mongo) event to trigger your function.
Data Ingestion Service (DIS)	Simulates a DIS event to trigger your function.
Log Tank Service (LTS)	Simulates an LTS event to trigger your function.
Object Storage Service (OBS)	Simulates an OBS event to trigger your function.
Simple Message Notification (SMN)	Simulates an SMN event to trigger your function.
Timer	Simulates a timer event to trigger your function.
DMS (for Kafka)	Simulates a Kafka event to trigger your function.
Kafka (OPENSOURCEKAFKA)	Simulates an open-source Kafka event to trigger your function.
DMS (for RabbitMQ)	Simulates a RabbitMQ event to trigger your function.
Blank Template	The event is {"key": "value"} , which can be changed based on requirements.
Login Security Analysis	Serves as an input for the loginSecurity-realtime-analysis-python function template.
Image Classification	Serves as an input for the image-tag function template.
Pornographic Image Analysis	Serves as an input for the porn-image-analysis function template.

Template Name	Description
Speech Recognition	Serves as an input for the voice-analysis function template.

Step 5 Click **Create**.

----End

Testing a Function

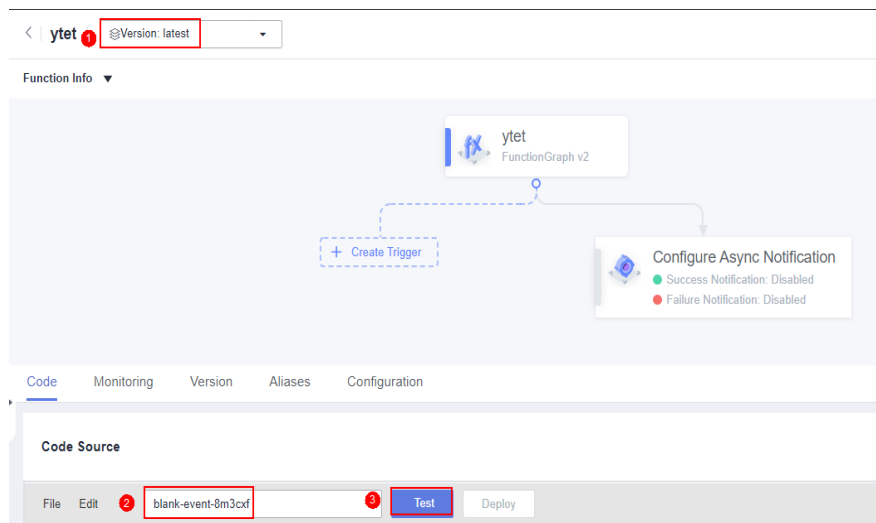
After creating a function, you can test it online to check whether it can run properly as expected.

Step 1 Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 Click the name of the desired function.

Step 3 On the displayed function details page, select a version and test event, and click **Test**.

Figure 6-1 Selecting a test event



Step 4 Click **Test**. The function test result is displayed.

NOTE

The **Log Output** area displays a maximum of 2 KB logs. To view more logs, see [Managing Function Logs](#).

----End

Modifying a Test Event

Step 1 Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

- Step 2** Click the name of the desired function.
- Step 3** On the displayed function details page, select a version and click **Configure Test Event**. The **Configure Test Event** dialog box is displayed.
- Step 4** In the **Configure Test Event** dialog box, modify the test event information according to [Table 6-3](#).

Table 6-3 Test event information

Parameter	Description
Create new test event	Create a test event.
Edit saved test event	Modify an existing test event.
Event data	Modify the test event code.

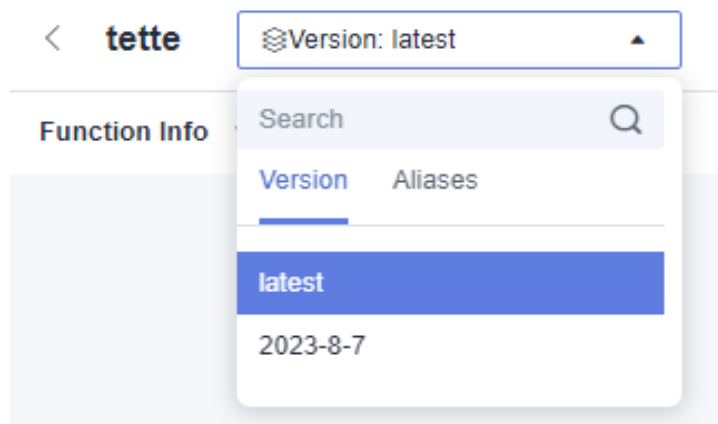
- Step 5** Click **Save**.

----End

Deleting a Test Event

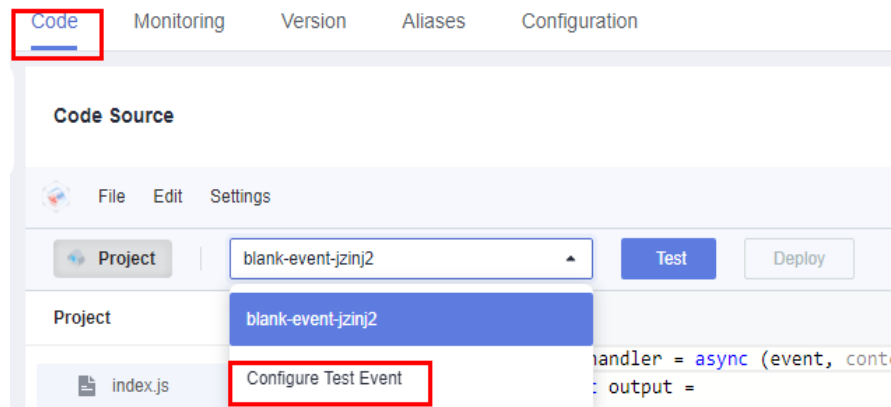
- Step 1** Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the name of the desired function.
- Step 3** On the function details page that is displayed, select a version, as shown in [Figure 6-2](#).

Figure 6-2 Selecting a FunctionGraph version



- Step 4** On the **Code** tab page, click **Configure Test Event**. The editing page is displayed, as shown in [Figure 6-3](#).

Figure 6-3 Selecting Configure Test Event



Step 5 On the **Configure Test Event** page, select **Edit saved test event**. In the **Saved Test Events** list on the left, select the event to be deleted and click **Delete**.

Figure 6-4 Deleting a test event

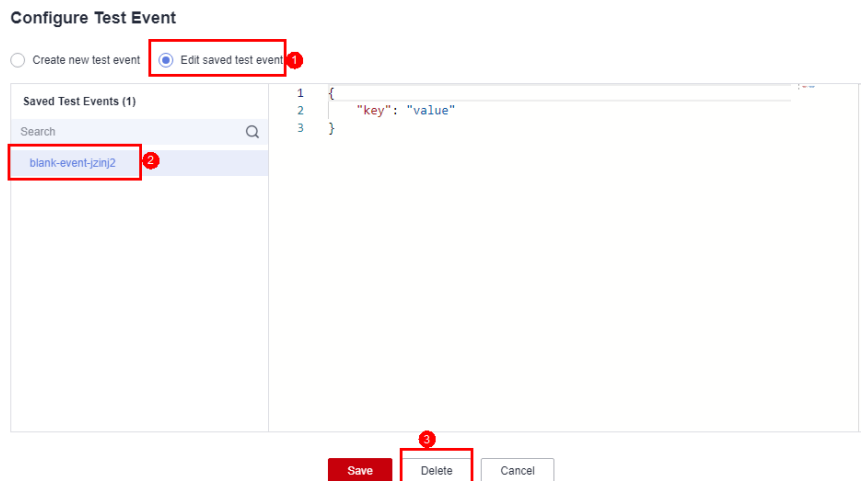


Table 6-4 Configuring test event information

Parameter	Description
Create new test event	Select a test event template.
Edit saved test event	Select the test event you want to delete.

----End

7 Creating Triggers

7.1 Managing Triggers

Enabling or Disabling a Trigger

You can enable or disable triggers as required. **Note that OBS and APIG triggers cannot be disabled and can only be deleted.**

- Step 1** Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the name of the desired function.
- Step 3** Choose **Configuration > Triggers**. On the displayed page, locate the row that contains the target trigger, and click **Disable** or **Enable**.

----End

Deleting a Trigger

You can delete triggers that will no longer be used.

- Step 1** Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the name of the desired function.
- Step 3** Choose **Configuration > Triggers**. On the displayed page, locate the row that contains the target trigger and click **Delete**.

----End

7.2 Using a Timer Trigger

This section describes how to create a timer trigger to invoke your function based on a fixed rate or cron expression.

Prerequisites

You have created a function. For details, see [Creating a Function from Scratch](#).

Creating a Timer Trigger

- Step 1** Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the function to be configured to go to the function details page.
- Step 3** Choose **Configuration > Triggers** and click **Create Trigger**.

Figure 7-1 Creating a trigger



- Step 4** Set the following parameters:
 - **Trigger Type:** Select **Timer**.
 - **Timer Name:** Enter a timer name, for example, **Timer**.
 - **Rule:** Set a fixed rate or a cron expression.
 - **Fixed rate:** The function is triggered at a fixed rate of minutes, hours, or days. You can set a fixed rate from 1 to 60 minutes, 1 to 24 hours, or 1 to 30 days.
 - **Cron expression:** The function is triggered based on a complex rule. For example, you can set a function to be executed at 08:30:00 from Monday to Friday. For more information, see [Cron Expressions for a Function Timer Trigger](#).
 - **Enable Trigger:** Choose whether to enable the timer trigger.
 - **Additional Information:** The additional information you configure will be put into the **user_event** field of the timer event source.
- Step 5** Click **OK**.

----End

Viewing the Execution Result

After the timer trigger is created, the function is executed every 1 minute. To view the function running logs, perform the following steps:

- Step 1** Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click a function to go to the function details page.
- Step 3** Choose **Monitoring > Logs** to query function running logs.

----End

7.3 Using an APIG (Dedicated) Trigger

This section describes how to create an APIG trigger and call an API to trigger a function.

Prerequisites

You have created an API group, for example, **APIGroup_test**. For details, see [Creating an API Group](#).

Creating an APIG Trigger

Step 1 Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 On the **Function List** page, click **Create Function** in the upper right corner.

Step 3 Set the following parameters:

- **Function Name:** Enter a function name, for example, **apig**.
- **Agency:** Select **Use no agency**.
- **Enterprise Project:** Select **default**.
- **Runtime:** Select **Python 2.7**.

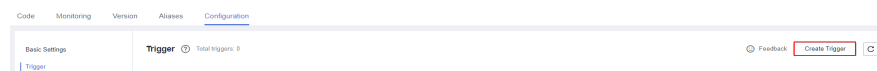
Step 4 Click **Create**.

Step 5 On the **Code** tab page, copy the following code to the code window and click **Deploy**.

```
# -*- coding:utf-8 -*-
import json
def handler(event, context):
    body = "<html><title>Functiongraph Demo</title><body><p>Hello, FunctionGraph!</p></body></html>"
    print(body)
    return {
        "statusCode":200,
        "body":body,
        "headers": {
            "Content-Type": "text/html",
        },
        "isBase64Encoded": False
    }
```

Step 6 Choose **Configuration > Triggers** and click **Create Trigger**.

Figure 7-2 Creating a trigger



Step 7 Configure the trigger information.

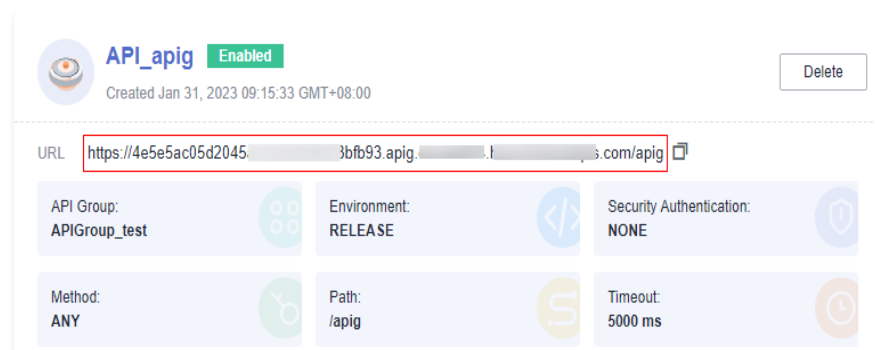
Table 7-1 Trigger information

Parameter	Description
Trigger Type	Select API Gateway (Dedicated Gateway) .

Parameter	Description
API Instance	Select an instance. If no instance is available, click Create Instance .
API Name	Enter an API name, for example, API_apig .
API Group	An API group is a collection of APIs. You can manage APIs by API group. Select APIGroup_test .
Environment	An API can be called in different environments, such as production, test, and development environments. APIG supports environment management, which allows you to define different request paths for an API in different environments. To ensure that the API can be called, select RELEASE .
Security Authentication	There are three authentication modes: <ul style="list-style-type: none"> • App: AppKey and AppSecret authentication. This mode is of high security and is recommended. • IAM: IAM authentication. This mode grants access permissions to IAM users only and is of medium security. • None: No authentication. This mode grants access permissions to all users. Select None .
Protocol	There are two types of protocols: <ul style="list-style-type: none"> • HTTP • HTTPS Select HTTPS .
Timeout (ms)	Enter 5000 .

Step 8 Click **OK**.

Figure 7-3 Creating a trigger



NOTE

1. **URL** indicates the calling address of the APIG trigger.
2. After the APIG trigger is created, an API named **API_apig** is generated on the APIG console. You can click the API name in the trigger list to go to the APIG console.

----End

Invoking the Function

Step 1 Enter the URL of the APIG trigger in the address bar of a browser, and press **Enter**.

Step 2 View the execution result, as shown in [Figure 7-4](#).

Figure 7-4 Returned result

**NOTE**

1. The input for APIG invocation comes from an event template provided by the function. For details, see [Table 6-2](#).
2. The function response for APIG invocation is encapsulated and must contain **body(String)**, **statusCode(int)**, **headers(Map)**, and **isBase64Encoded(boolean)**.

----End

Viewing the Execution Result

Step 1 Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 Click a function to go to the function details page.

Step 3 Choose **Monitoring > Logs** to query function running logs.

----End

7.4 Using an OBS Trigger

This section describes how to create an OBS trigger and upload an image package to a specified OBS bucket to trigger a function.

Prerequisites

Before creating a trigger, ensure that you have prepared the following:

- You have created a function. For details, see [Creating a Function from Scratch](#).
- You have created an OBS bucket, for example, **obs_cff**.

Creating an OBS Trigger

- Step 1** Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the function to be configured to go to the function details page.
- Step 3** Choose **Configuration > Triggers** and click **Create Trigger**.

Figure 7-5 Creating a trigger



- Step 4** Set the following parameters:
 - **Trigger Type:** Select **Object Storage Service (OBS)**.
 - **Bucket Name:** Specify the OBS bucket to be used as an event source, for example, **obs-cff**.
 - **Events:** Select events that will trigger the function. In this example, select **Put, Post, and Delete**. When files in the **obs_cff** bucket are updated, uploaded, or deleted, the function is triggered.
 - **Event Notification Name:** Specify the name of the event notification to be sent by SMN when an event occurs.
 - **Prefix:** Enter a keyword for limiting notifications to those about objects whose names start with the matching characters. This limit can be used to filter the names of OBS objects.
 - **Suffix:** Enter a keyword for limiting notifications to those about objects whose names end with the matching characters. This limit can be used to filter the names of OBS objects.

- Step 5** Click **OK**.

----End

Triggering a Function

On the OBS console, upload an image ZIP package to the **obs-cff** bucket.

NOTE

After the ZIP package is uploaded to the **obs-cff** bucket, the **HelloWorld** function is triggered.

Viewing the Execution Result

- Step 1** Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click a function to go to the function details page.
- Step 3** Choose **Monitoring > Logs** to query function running logs.

----End

7.5 Using a Kafka Trigger

This section describes how to create a Kafka trigger and configure a Kafka event to trigger a function.

After a Kafka trigger is used, FunctionGraph periodically polls for new messages in a specific topic in a Kafka instance and passes the messages as input parameters to invoke functions.

Prerequisites

Before creating a trigger, ensure that you have prepared the following:

- You have created a function. For details, see [Creating a Function from Scratch](#).
- You have enabled VPC access for the function. For details, see [Configuring the Network](#).
- You have created a Kafka instance. For details, see "Creating an Instance" in the *Distributed Message Service for Kafka User Guide*.
- You have created a topic under a Kafka instance. For details, see section "Creating a Topic" in the *Distributed Message Service for Kafka User Guide*.

Creating a Kafka Trigger

Step 1 Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 Click the function to be configured to go to the function details page.

Step 3 Choose **Configuration > Triggers** and click **Create Trigger**.

Figure 7-6 Creating a trigger



Step 4 Set the following parameters:

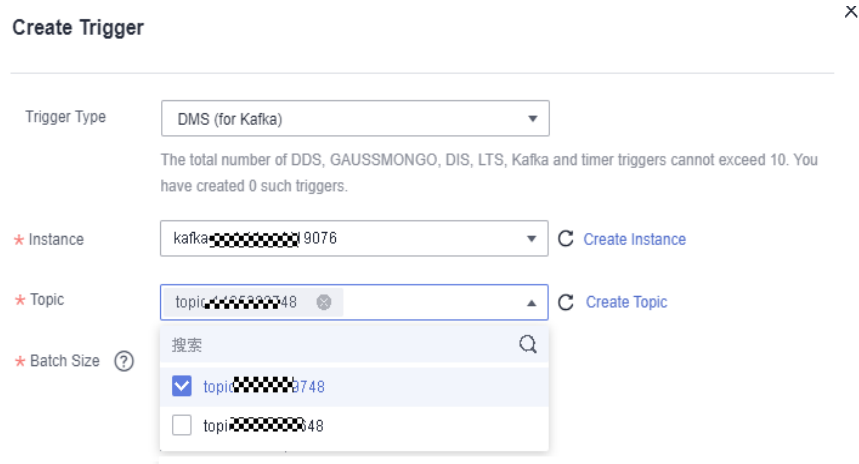
- **Trigger Type:** Select **DMS (for Kafka)**.
- **Instance:** Select a Kafka premium instance.
- **Topic:** Select a topic of the Kafka premium instance.
- **Batch Size:** Set the number of messages to be retrieved from a topic each time.
- **Username:** Enter the username of the instance if SSL has been enabled for it.
- **Password:** Enter the password of the instance if SSL has been enabled for it.

Step 5 Click **OK**.

NOTE

- After VPC access is enabled, you need to configure corresponding subnet permissions for the Kafka security group. For details about how to configure VPC access, see [Configuring the Network](#).
- You can create a Kafka trigger with multiple topics. You do not need to create one such trigger for each topic in the same instance.

Figure 7-7 Selecting multiple topics



----End

Configuring a Kafka Event to Trigger the Function

- Step 1** Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the function to be configured to go to the function details page.
- Step 3** On the function details page, select a version.
- Step 4** On the **Code** tab page, click **Test**. The **Configure Test Event** dialog box is displayed.
- Step 5** Set the parameters described in [Table 7-2](#) and click **Save**.

Table 7-2 Test event information

Parameter	Description
Configure Test Event	You can choose to create a test event or edit an existing one. Use the default option Create new test event .
Event Template	Select DMS (for Kafka) to use the built-in Kafka event template.
Event Name	The event name can contain 1 to 25 characters and must start with a letter and end with a letter or digit. Only letters, digits, underscores (_), and hyphens (-) are allowed. For example, kafka-123test .

Parameter	Description
Event data	The system automatically loads the built-in Kafka event template, which is used in this example without modifications.

Step 6 Click **Test**. The function test result is displayed.

----End

7.6 Using an LTS Trigger

This section describes how to create an LTS trigger for a function, and invoke the function when log events occur.

Prerequisites

- You have created a function. For details, see [Creating a Function from Scratch](#).
- You have created an agency with the **LTS FullAccess** permission. For details about how to create an agency, see [Configuring Agency Permissions](#).
- You have created a log group, for example, **LogGroup1**. For details, see [Creating a Log Group](#).
- You have created a log stream, for example, **LogTopic1**. For details, see [Creating a Log Stream](#).

Creating an LTS Trigger

Step 1 Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 Click the function to be configured to go to the function details page.

Step 3 Choose **Configuration > Triggers** and click **Create Trigger**.

Figure 7-8 Creating a trigger



Step 4 Set the following parameters:

- **Trigger Type:** Select **Log Tank Service (LTS)**.
- **Log Group:** Select a log group, for example, **LogGroup1**.
- **Log Stream:** Select a log stream, for example, **LogStream1**.

Step 5 Click **OK**.

----End

Configuring an LTS Event to Trigger the Function

NOTE

When the size of an LTS event message exceeds 75 KB, it will be split into multiple messages by 75 KB to trigger the function.

- Step 1** Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the function to be configured to go to the function details page.
- Step 3** On the function details page, select a version.
- Step 4** On the **Code** tab page, click **Test**. The **Configure Test Event** dialog box is displayed.
- Step 5** Set the parameters described in [Table 7-3](#) and click **Save**.

Table 7-3 Test event information

Parameter	Description
Configure Test Event	You can choose to create a test event or edit an existing one. Use the default option Create new test event .
Event Template	Select lts-event-template .
Event Name	The event name can contain 1 to 25 characters and must start with a letter and end with a letter or digit. Only letters, digits, underscores (_), and hyphens (-) are allowed. For example, lts-123test .
Event data	The system automatically loads the built-in LTS event template, which is used in this example without modifications.

- Step 6** Click **Test**. The function test result is displayed.

----End

7.7 Using a CTS Trigger

This section describes how to create a CTS trigger for a function, and invoke the function in response to cloud resource operations recorded by CTS.

Prerequisites

You have created an agency on IAM. For details, see [Configuring Agency Permissions](#).

Creating a CTS Trigger

Step 1 Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 On the **Function List** page, click **Create Function** in the upper right corner.

Step 3 Set the following parameters:

- **Function Name:** Enter a function name, for example, **HelloWorld**.
- **Agency:** Select **Use no agency**.
- **Enterprise Project:** Select **default**.
- **Runtime:** Select **Python 2.7**.

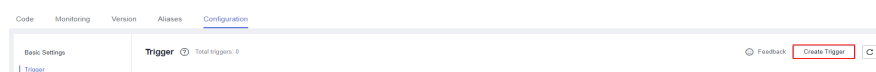
Step 4 Click **Create Function**.

Step 5 On the **Code** tab page, copy the following code to the code window and click **Deploy**.

```
# -*- coding:utf-8 -*-
"""
CTS trigger event:
{
  "cts": {
    "time": "",
    "user": {
      "name": "userName",
      "id": "",
      "domain": {
        "name": "domainName",
        "id": ""
      }
    }
  },
  "request": {},
  "response": {},
  "code": 204,
  "service_type": "FunctionGraph",
  "resource_type": "",
  "resource_name": "",
  "resource_id": {},
  "trace_name": "",
  "trace_type": "ConsoleAction",
  "record_time": "",
  "trace_id": "",
  "trace_status": "normal"
}
"""
def handler(event, context):
    trace_name = event["cts"]["resource_name"]
    timeinfo = event["cts"]["time"]
    print(timeinfo+' '+trace_name)
```

Step 6 Choose **Configuration > Triggers** and click **Create Trigger**.

Figure 7-9 Creating a trigger



Step 7 Configure the trigger information.

Table 7-4 Trigger information

Parameter	Description
Trigger Type	Select Cloud Trace Service (CTS) .
Event Notification Name	Enter a notification name, for example, Test .
Service Type	Select FunctionGraph .
Resource Type	Resource types supported by the selected service, such as triggers, instances, and functions.
Trace Name	Operations that can be performed on the selected resource type, such as creating or deleting a trigger.

Step 8 Click **OK**.

----End

Configuring a CTS Event to Trigger the Function

Step 1 Return to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.

Step 2 Click the function to be configured to go to the function details page.

Step 3 On the function details page, select a version, and click **Test**. The **Configure Test Event** dialog box is displayed.

Step 4 Set the parameters described in [Table 7-5](#) and click **Save**.

Table 7-5 Test event information

Parameter	Description
Configure Test Event	You can choose to create a test event or edit an existing one. Use the default option Create new test event .
Event Template	Select cts-event-template .
Event Name	Enter an event name, for example, cts-test .
Event data	The system automatically loads the event data in the CTS event template. You can modify the event data as required.

Step 5 Click **Test**. The function test result is displayed.

----End

7.8 Cron Expressions for a Function Timer Trigger

You can configure a cron expression in the following formats for a function timer trigger:

- @every format

The format is "@every *N*unit". *N* is a positive integer. **unit** can be ns, μ s, ms, s, m, or h. An @every expression means to invoke a function every *N* time units, as shown in [Table 7-6](#).

Table 7-6 Example expressions

Expression	Meaning
@every 30m	Triggers a function every 30 minutes.
@every 1.5h	Triggers a function every 1.5 hours.
@every 2h30m	Triggers a function every 2.5 hours.

- Standard format

The format is "*seconds minutes hours day-of-month month day-of-week*". *day-of-week* is optional. The fields must be separated from each other using a space. [Table 7-7](#) describes the fields in a standard cron expression.

Table 7-7 Parameter description

Parameter	Mandatory	Value Range	Special Characters Allowed
Seconds	Yes	0-59	, - * /
Minutes	Yes	0-59	, - * /
Hours	Yes	0-23	, - * /
Day-of-month	Yes	1-31	, - * ? /
Month	Yes	1-12 or Jan-Dec. The value is case-insensitive, as shown in Table 7-8 .	, - * /
Day-of-week	No	0-6 or Sun-Sat. The value is case-insensitive, as shown in Table 7-9 . 0 means Sunday.	, - * ? /

Table 7-8 Value description of the month field

Month	Digit	Abbreviation
January	1	Jan
February	2	Feb
March	3	Mar
April	4	Apr
May	5	May
June	6	Jun
July	7	Jul
August	8	Aug
September	9	Sep
October	10	Oct
November	11	Nov
December	12	Dec

Table 7-9 Value description of the day-of-week field

Day of Week	Digit	Abbreviation
Monday	1	Mon
Tuesday	2	Tue
Wednesday	3	Wed
Thursday	4	Thu
Friday	5	Fri
Saturday	6	Sat
Sunday	0	Sun

Table 7-10 describes the special characters that can be used in a cron expression.

Table 7-10 Special character description

Special Character	Meaning	Description
*	Used to specify all values within a field.	* in the minutes field means every minute.
,	Used to specify multiple values, which can be discontinuous.	For example, "Jan,Apr,Jul,Oct" or "1,4,7,10" in the month field and "Sat,Sun" or "6,0" in the day-of-week field.
-	Used to specify a range.	For example, "0-3" in the minutes field.
?	Used to specify something in one of the two fields in which the character is allowed, but not the other.	You can specify something only in the day-of-month or day-of-week field. For example, if you want your function to be executed on a particular day (such as the 10th) of the month, but do not care what day of the week that is, then put "10" in the day-of-month field and "?" in the day-of-week field.
/	Used to specify increments. The character before the slash indicates when to start, and the one after the slash represents the increment.	For example, "1/3" in the minutes field means to trigger the function every 3 minutes starting from 00:01:00 of the hour.

Table 7-11 describes several example cron expressions.

Table 7-11 Example cron expressions

Function Scheduling Example	Cron Expression (UTC Time)
12:00 every day	0 0 4 * * *
12:30 every day	0 30 4 * * *
26th, 29th, and 33rd minutes of each hour	0 26,29,33 * * * *
12:30 from Monday to Friday	0 30 4 ? * MON-FRI
Every 5 minutes during 12:00 and 14:00 from Monday to Friday	0 0/5 4-6 ? * MON-FRI

Function Scheduling Example	Cron Expression (UTC Time)
12:00 every day from January to April	0 0 4 ? JAN,FEB,MAR,APR *

8 Invoking the Function

8.1 Synchronous Invocation

When triggering a function, clients wait for the result before proceeding. Currently, functions with APIG (dedicated) triggers are executed synchronously. Alternatively, you can use the API described in section "Executing a Function Synchronously" to trigger a function synchronously. In this scenario, a function is executed for up to 15 minutes.

8.2 Asynchronous Invocation

When a client triggers a function, FunctionGraph persists the request and sends a response immediately to the client. The client proceeds without waiting for the execution result. You cannot know the result in real time. FunctionGraph queues the asynchronous requests and processes them when the server is idle. To obtain asynchronous processing results or to retry when an asynchronous request fails, [configure asynchronous settings](#).

- The following triggers are invoked asynchronously by default and the invocation mode cannot be changed.

Table 8-1 Invocation mode

Event Source	Invocation Mode
SMN	Asynchronous
OBS	Asynchronous
DIS	Asynchronous
Timer	Asynchronous
LTS	Asynchronous
CTS	Asynchronous

Event Source	Invocation Mode
DMS for Kafka	Asynchronous

- APIG and APIG (dedicated) triggers can be configured for asynchronous invocation on their console. You can also use the asynchronous execution API instead. In this scenario, the maximum execution duration of a function is 12 hours (configured in the whitelist).

NOTE

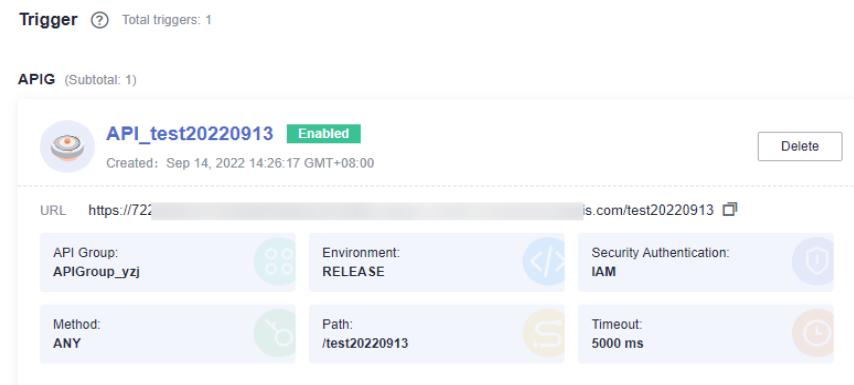
If the E2E function execution latency exceeds 90s, asynchronous invocation is recommended. If synchronous invocation is used, no responses can be received after 90s due to gateway restrictions.

Example

The following procedure uses the APIG trigger of a function as an example.

1. Go to the function details page, and choose **Configuration > Triggers**.
2. Click the APIG trigger name to go to the APIG console.

Figure 8-1 Clicking a trigger name



3. Click **Edit** in the upper right.

Figure 8-2 Clicking Edit



4. Click **Next** until the **Define Backend Request** page is displayed. Then change **Invocation Mode** to **Asynchronous**.

Figure 8-3 Changing the invocation mode

The screenshot shows the 'Backend Type' configuration interface. At the top, there are three tabs: 'HTTP/HTTPS', 'FunctionGraph', and 'Mock'. The 'FunctionGraph' tab is selected. Below the tabs, a text box states: 'FunctionGraph is a compute service that hosts event-driven functions.' Below this, a section titled 'You can add backend policies with different conditions. Only requests that meet the conditions will be forwarded to the corresponding backend.' indicates 'Available backend policies for creation: 5'. There is a 'Default Backend' button and a '+ Add Backend Policy' button. The 'Basic Information' section contains the following fields:

- * Function URN: A text input field with a 'Select Function URN' button.
- * Version: A dropdown menu set to 'LATEST'.
- * Invocation Mode: A dropdown menu set to 'Asynchronous', which is highlighted with a red box.

5. Click **Finish** to save the settings.

8.3 Retry Mechanism

If synchronous or asynchronous invocation fails, do as follows:

- Synchronous invocation
Try again.
- Asynchronous invocation

You can set the maximum number of retries and the maximum message validity period (up to 24 hours) by referring to [Configuring Asynchronous Execution Notification](#). FunctionGraph will retry a function based on these two parameters.

Idempotency

In programming, idempotency means that an application or component can identify duplicate events and prevent duplication, inconsistency, and data loss. If you want to keep a function idempotent, you need to design the function logic to correctly handle repeated events.

Idempotent function logic helps reduce the following problems:

- Unnecessary API calls
- Code processing time
- Data inconsistency
- Restrictions
- Latency

Ensure that your function code can process the same event multiple times without causing duplicate transactions or other unnecessary side effects in case of abnormal calls, retry of client, or retry within dependent functions.

9 Monitoring

9.1 Metrics

9.1.1 Function Monitoring

FunctionGraph is interconnected with Cloud Eye, allowing you to view function metrics without the need for any configurations.

Viewing Function Metrics

FunctionGraph collects function metrics and displays aggregated results. Switch to your target function version before viewing metrics.

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the function to be configured to go to the function details page.
3. Choose **Monitoring > Metrics**, select an interval (last day, last 3 days, or custom), and check the running status of the function.

 **NOTE**

The following metrics are displayed: invocations, errors, duration (maximum, average, and minimum durations), throttles, and instance statistics.

Metric Description

[Table 9-1](#) describes the function metrics.

Table 9-1 Function metrics

Metric	Unit	Description
Invocations	Count	Total number of invocation requests, including invocation errors and throttled invocations. In case of asynchronous invocation, the count starts only when a function is executed in response to a request.
Duration	ms	Maximum Duration: the maximum duration a function is executed within a period. Minimum Duration: the minimum duration a function is executed within a period. Average Duration: the average duration a function is executed within a period.
Errors	Count	Number of times that your functions failed with error code 200 being returned. Errors caused by function syntax or execution are also included.
Throttles	Count	Number of times that FunctionGraph throttles your functions due to the resource limit.
Instance Statistics	Count	Numbers of concurrent requests and reserved instances.

9.1.2 Function Metrics

Introduction

This section describes the FunctionGraph namespaces, function metrics, and dimensions reported to Cloud Eye. You can view function metrics and alarms by using the Cloud Eye console or calling APIs.

Namespaces

SYS.FunctionGraph

Function Metrics

Table 9-2 Function metrics

Metric ID	Metric Name	Description	Value Range	Monitored Object	Monitoring Period of Raw Data (Minute)
count	Invocations	Number of function invocations Unit: Count	≥ 0 counts	Functions	5
failcount	Errors	Number of invocation errors The following errors are included: <ul style="list-style-type: none"> Function request error (causing an execution failure and returning error code 200) Function syntax or execution error Unit: Count	≥ 0 counts	Functions	5
failRate	Error rate	Percentage of invocation errors to the total invocations Unit: %	$0\% \leq X \leq 100\%$	Functions	5
rejectcount	Throttles	Number of function throttles That is, the number of times that FunctionGraph throttles your functions due to the resource limit. Unit: Count	≥ 0 counts	Functions	5

Metric ID	Metric Name	Description	Value Range	Monitored Object	Monitoring Period of Raw Data (Minute)
concurrency	Number of concurrent requests	Maximum number of concurrent requests during function invocation. Unit: Count	≥ 0 counts	Functions	5
reservedinstances	Number of reserved instances	Number of reserved instances Unit: Count	≥ 0 counts	Functions	5
duration	Average duration	Average duration of function invocation Unit: ms	≥ 0 ms	Functions	5
maxDuration	Maximum duration	Maximum duration of function invocation Unit: ms	≥ 0 ms	Functions	5
minDuration	Minimum duration	Minimum duration of function invocation Unit: ms	≥ 0 ms	Functions	5
systemErrorCount	System errors	Number of 200 errors that cause a failure in executing function requests. Unit: Count	≥ 0	Functions	5
functionErrorCount	Function errors	Number of syntax and execution errors. Unit: Count	≥ 0	Functions	5
payPerUseInstance	Number of elastic instances.	Number of elastic instances. Unit: Count	≥ 0	Functions	5

Dimensions

Key	Value
package-functionname	<i>App name-Function name</i> Example: default-myfunction_Python
projectId	Project ID of the tenant

9.1.3 Creating an Alarm Rule

After creating a function and trigger, you can monitor the invocation and running statuses of the function in real time.

Viewing Function Metrics

FunctionGraph differentiates the metrics of a function by version, allowing you to query the metrics of a specific function version.

Procedure

Create an alarm rule for a function to report metrics to Cloud Eye so that you can view monitoring graphs and alarm messages on the Cloud Eye console.

- Step 1** Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
- Step 2** Click the name of the desired function.
- Step 3** On the displayed function details page, select a function version or alias, and choose **Monitoring > Metrics**.
- Step 4** Click **Create Alarm Rule**.
- Step 5** Set alarm parameters and click **Next** as shown in [Figure 9-1](#).

Figure 9-1 Creating an alarm rule

The screenshot shows the 'Creating an alarm rule' form with the following fields and values:

- Name:** alarm-f6ew
- Metric:** Invocations
- Alarm Policy:** Average, 5 minutes, 1 period, ≥
- Severity:** Major (selected), Critical, Minor, Informational
- Alarm Notification:** Disabled (toggle switch)
- Description:** Empty text area (0/255 characters)

Step 6 Enter a rule name and click **OK**.

----End

 **CAUTION**

After a function is deleted, the alarm rules created for it will not be updated in real time on the Cloud Eye console and may continue to be displayed there for a maximum of seven days.

Function Metrics

Table 9-3 lists the function metrics that can be monitored by Cloud Eye.

Table 9-3 Function metrics

Metric	Display Name	Description	Unit	Upper Limit	Lower Limit	Recommended Threshold	Value Type	Dimension
count	Invocations	Number of function invocations	Count	-	0	-	int	package-functionname
failcount	Errors	Number of invocation errors	Count	-	0	-	int	package-functionname
rejectcount	Throttles	Number of function throttles	Count	-	0	-	int	package-functionname
duration	Average Duration	Average duration of function invocation	ms	-	0	-	int	package-functionname
maxDuration	Maximum Duration	Maximum duration of function invocation	ms	-	0	-	int	package-functionname

Metric	Display Name	Description	Unit	Upper Limit	Lower Limit	Recommended Threshold	Value Type	Dimension
minDuration	Minimum Duration	Minimum duration of function invocation	ms	-	0	-	int	package-functionname

9.2 Logs

9.2.1 Querying Function Logs

FunctionGraph is interconnected with LTS, allowing you to view function logs without the need for any configurations.

Viewing Function Logs

On the FunctionGraph console, view function logs in the following ways:

- Viewing logs on the execution result page
After creating a function, test it and view test logs on the execution result page. For details, see [Online Debugging](#).
The execution result page displays a maximum of 2 KB logs. To view more logs of the function, go to the **Logs** tab page.
- Viewing logs on the **Logs** tab page
On the function details page, choose **Monitoring** > **Logs** to query log information. For details, see [Managing Function Logs](#).

9.2.2 Managing Function Logs

Using LTS to Manage Function Logs

You can enable LTS to better manage function logs. After you enable LTS, FunctionGraph automatically creates a log group starting with **functiongraph**. When you create a function, a log stream starting with the function name is generated.

NOTE

- By default, 20 log streams are created, which cannot be customized. On the **Logs** tab page of the function, press **F12** to find out the log stream ID of the **query** API, and then locate the corresponding log stream ID in LTS.



- Deleting a function log group by mistake on the LTS console will not be detected by FunctionGraph, and the historical log data can no longer be retrieved. To use a log group, modify the function description and save the changes. A new log group will be created.

Step 1 Enable LTS.

Step 2 Set filter criteria.

- Request List:** Filter requests by request ID, result (success or failure), or cause (initialization failed, load failed, system error, timed out, out of memory, out of disk space, or code error).
- Request Log:** Filter logs by keyword, request ID, or instance ID.

Table 9-4 Invocation result

Result	Description
Execution successful	Log printed when a function is successfully executed.
Execution failed	Log printed when a function fails to be executed due to invocation timeout, memory or disk threshold exceeded, or code errors. To view the logs about invocation timeout, select Invocation timed out from the drop-down list. The methods for viewing the other three types of logs are the same.

Table 9-5 Cause analysis

Cause	Description
Initialization failed	Log printed when the function initialization fails.
Load failed	Log generated when the runtime fails to load your function file.
System error	Internal error.
Invocation timed out	Log printed when the function invocation period is longer than the preset limit.

Cause	Description
Memory threshold exceeded	Log printed when the function memory size exceeds the preset limit.
Disk threshold exceeded	Log printed when the disk size exceeds the preset limit.
Code error	Log printed when a code error occurs.

 NOTE

- You can view logs of the last hour, last day, last 3 days, or a custom time period.
- To manage function logs, go to the LTS console.
- Max. 10 MB logs can be retained for common instances during initialization. When this limit is reached, the latest logs replace the old ones.

----End

10 Function Management

Overview

Function is a combination of code, runtime, resources, and settings required to achieve a specific purpose. It is the minimum unit that can run independently. A function can be triggered by triggers and automatically schedule required resources and environments to achieve expected results.

Exporting a Function

You can export the functions that you created.

- Step 1** Log in to the FunctionGraph console, and choose **Functions > Function List** in the navigation pane.
- Step 2** Click a function name.
- Step 3** On the displayed function details page, choose **Operation > Export Function** in the upper right corner.

NOTE

- A user can export only one function at a time.
- The exported function resource package cannot exceed 50 MB.
- The name of the exported function resource package is in the format of *function name + MD5 value of function code.zip*.
- The exported function resource package does not include alias information.
- If a function is disabled or enabled, all versions of the function will be disabled or enabled.

----End

Disabling a Function

Disabled functions can no longer be executed.

- Step 1** Return to the FunctionGraph console, and choose **Functions > Function List** in the navigation pane.
- Step 2** Click the name of the function you want to disable.

Step 3 On the displayed function details page, click **Disable Function** in the upper right corner.

Step 4 On the displayed page, click **Yes**. The function is disabled.

 **NOTE**

- Only functions of the latest version can be disabled.
- Versions published based on the disabled latest version of a function are also disabled and can never be enabled.
- After disabling a function, you can modify its code but cannot execute the function.

----End

Enabling a Function

Disabled functions can be enabled again as required.

Step 1 Return to the FunctionGraph console, and choose **Functions > Function List** in the navigation pane.

Step 2 Click the name of the function you want to enable.

Step 3 On the displayed function details page, click **Enable Function** in the upper right corner.

----End

Deleting a Function

You can delete unused functions to release resources.

Step 1 Return to the FunctionGraph console, and choose **Functions > Function List** in the navigation pane.

Step 2 In the **Function List**, locate the row that contains the target function and click **Delete** in the operation column. In the displayed dialog box, enter **DELETE** and click **OK**.

----End

11 Dependency Management

11.1 Configuring Dependency Packages

Overview

Generally, the code of a function consists of public libraries and service logic. The public libraries can be packaged as a dependency and shared among functions, reducing the size of the function code package for easy deployment and update.

FunctionGraph also provides some public dependencies, which are cached internally for quick loading. These dependencies are recommended.

FunctionGraph enables you to manage dependencies in a unified manner. You can upload dependencies from a local path, or through OBS if they are too large, and specify names for them. Dependencies can be iterated. Each dependency can have multiple versions.

For details, see [How Do I Create Function Dependencies?](#)

NOTE

- The name of each file in the dependency package cannot end with a tilde (~).
- A dependency package can contain up to 30,000 files.
- If your function uses a large private dependency, increase the execution timeout by choosing **Configuration** > **Basic Settings** on the function details page.

Creating a Dependency

Step 1 Log in to the FunctionGraph console, and choose **Functions** > **Dependencies** in the navigation pane.

Step 2 Click **Create Dependency**.

Step 3 Set the following parameters:

Table 11-1 Dependency configuration parameters

Parameter	Description
Name	Dependency name.
Code Entry Mode	Upload a ZIP file directly or upload a file from OBS. <ul style="list-style-type: none"> • Upload ZIP: Click Select File to upload one. • Upload from OBS: Specify an OBS link URL.
Runtime	Select a runtime.
Description	Description of the dependency. This parameter is optional.

Step 4 Click **OK**. By default, a new dependency is version **1**.

Step 5 Click the dependency name, and view all versions and related information on the displayed page. Each dependency can have multiple versions.

- To create a dependency version, click **Create Version** in the upper right corner of the page.
- To view the address of a version, click the version.
- To delete a version, click the delete icon in the same row.

Figure 11-1 Deleting a dependency version



----End

Configuring Dependencies for a Function

Step 1 Return to the FunctionGraph console, and choose **Functions > Function List** in the navigation pane.

Step 2 Click the name of the desired function.

Step 3 On the displayed function details page, click the **Code** tab, click **Add** in the **Dependencies** area.

Step 4 On the displayed **Select Dependency** dialog box, select dependencies and click **OK**.

Table 11-2 Dependency configuration

Parameter	Description
Runtime	Runtime of this function. It cannot be changed.
Type	Add a Public or Private dependency.
Name	Select a dependency.
Version	Select a version to be added.

NOTE

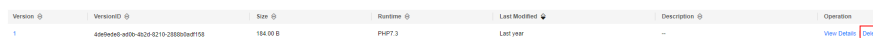
- You can add a maximum of 20 dependencies for a function.
- Except your private dependencies, FunctionGraph provides some public dependencies, which you can choose when creating a function.

----End

Deleting a Dependency

To delete a dependency, just delete all of its versions.

- Step 1** Return to the FunctionGraph console, and choose **Functions > Dependencies** in the navigation pane.
- Step 2** Click the name of the target dependency to go to the **Versions** page.
- Step 3** Click the delete icon in the row of a version. Repeat this operation if the dependency has multiple versions.

Figure 11-2 Deleting a dependency version

Version ID	Version ID	Size	Runtime	Last Modified	Description	Operation
1	4069e9ed-4f5c-4b2d-8210-28808a0d1158	184.00 B	PHP7.3	Last year	-	View Details Delete

NOTE

Dependencies referenced by functions cannot be deleted.

----End

11.2 Dependent Libraries

Supported Dependent Libraries

FunctionGraph supports both standard and third-party libraries.

- Standard libraries
When using standard libraries, you can import them to your inline code or package and upload them to FunctionGraph.
- Supported non-standard libraries
FunctionGraph provides built-in third-party components listed in [Table 11-3](#) and [Table 11-4](#). You can import these libraries to your inline code in the same way as you import standard libraries.

Table 11-3 Third-party components integrated with the Node.js runtime

Name	Usage	Version
q	Asynchronous method encapsulation	1.5.1
co	Asynchronous process control	4.6.0

Name	Usage	Version
lodash	Common tool and method library	4.17.10
esdk-obs-nodejs	OBS sdk	2.1.5
express	Simplified web-based application development framework	4.16.4
fgs-express	Provides a Node.js application framework for FunctionGraph and APIG to run serverless applications and REST APIs. This component provides an example of using the Express framework to build serverless web applications or services and RESTful APIs.	1.0.1
request	Simplifies HTTP invocation and supports HTTPS and redirection.	2.88.0

Table 11-4 Non-standard libraries supported by the Python runtime

Module	Usage	Version
dateutil	Date and time processing	2.6.0
requests	HTTP library	2.7.0
httplib2	httpclient	0.10.3
numpy	Mathematical computing	For pip 2.7, numpy==1.16.6. For pip 3.10, numpy==1.24.2. For pip 3.9, numpy==1.18.5. For pip 3.6, numpy==1.18.5.
redis	Redis client	2.10.5
obsclient	OBS client	-
smnsdk	SMN access	1.0.1

- Other third-party libraries (FunctionGraph has no built-in non-standard third-party libraries except those listed in the preceding table.)

Package the dependency third-party libraries and upload them to an OBS bucket or on the function details page. These libraries will then be used in your function code.

Importing Dependent Libraries

Importing a dependency for Python:

```
from com.obs.client.obs_client import ObsClient
```

Importing a dependency for Node.js:

```
const ObsClient = require('esdk-obs-nodejs');
```

For standard libraries and supported non-standard libraries, you can directly use them in your function.

For non-standard third-party libraries that are not provided by FunctionGraph, you can use them by performing the following steps:

1. Package the dependent libraries into a ZIP file, upload the ZIP file to an OBS bucket, and obtain the OBS link URL.
2. Log in to the FunctionGraph console, and choose **Functions > Dependencies** in the navigation pane.
3. Click **Create Dependency**.
4. Set the dependency name and runtime, specify the OBS link URL, and click **OK**.

Figure 11-3 Setting the dependency

Create Dependency

★ Name
Enter 1 to 96 characters, starting with a letter and ending with a letter or digit. Only letters, digits, hyphens (-), periods (.), and underscores (_) are allowed.

★ Code Entry Mode
If the code to be uploaded contains sensitive information (such as account passwords), encrypt the code to prevent information leakage.

★ OBS Link URL
Paste the OBS link URL of a ZIP file. [View OBS console](#)

★ Runtime

Description
0/512

5. On the function details page, click the **Code** tab, click **Add** in the **Dependencies** area, select the dependency created in 4, and click **OK**.

Figure 11-4 Selecting a dependency

The screenshot shows a form for selecting a dependency. It includes the following fields and options:

- Runtime:** A text input field containing "Node.js10.16".
- Type:** Two radio buttons labeled "Public" and "Private". The "Private" button is selected and highlighted in blue.
- Name:** A dropdown menu with "abc" selected. This field is highlighted with a red box.
- Version:** A dropdown menu with "3" selected. This field is also highlighted with a red box.

⚠ WARNING

Each dependency package cannot contain a file with the same name as a code file. Otherwise, the two files may be incorrectly merged or overwritten. For example, if dependency package **depends.zip** contains a file named **index.py**, the handler of a function cannot be set to **index.handler**. Otherwise, a code file also named **index.py** will be generated.

12 Reserved Instance Management

Introduction

FunctionGraph provides on-demand and reserved instances.

- On-demand instances are created and released by FunctionGraph based on actual function usage. When receiving requests to call functions, FunctionGraph automatically allocates execution resources to the requests.
- Reserved instances can be created and released by you as required. After you create reserved instances for a function, FunctionGraph preferentially forwards requests to the reserved instances. If the number of requests exceeds the processing capability of the reserved instances, FunctionGraph will forward the excessive requests to on-demand instances and automatically allocates execution resources to these requests.

After reserved instances are created for a function, the code, dependencies, and initializer of the function are automatically loaded. Reserved instances are always alive in the execution environment, eliminating the influence of cold starts on your services. (Do not execute one-time services using the initializer of reserved instances.)

You can configure [a fixed number of reserved instances](#) or [scheduled scaling policies](#).

Configuring a Fixed Number of Reserved Instances

Ensure that the function for which you want to create reserved instances already exists on the FunctionGraph console.

1. Log in to the FunctionGraph console. In the navigation pane, choose **Functions > Function List**.
2. Click the target function to go to the details page.
3. Choose **Configuration > Concurrency**, and click **Add**.

Figure 12-1 Clicking Add



4. Set parameters by referring to [Table 12-1](#).

You can create a specified number of reserved instances for a function version or alias. This number cannot exceed the maximum number of requests per instance or the maximum number of instances per function.

Figure 12-2 Basic settings

Basic Settings

Function Name: test_obs

Type: Version Aliases

Version:

Reserved Instances:

FunctionGraph reserves instances based on this setting. The instances keep running unless you change the value to 0.

Idle Mode:

This mode saves costs as CPU resources are not used when reserved instances are not invoked.

Table 12-1 Basic settings

Parameter	Description
Function Name	Name of the current function.
Type	Select Version or Aliases .
Version	Set this parameter when you select Version for Type .
Alias	Set this parameter when you select Aliases for Type .
Min. Instances	Minimum number of instances. Max.: 1000 . FunctionGraph reserves the specified number of instances for the function. These instances will always run unless you change Min. Instances to 0 .
Idle Mode	This mode saves costs as CPU resources are not used when reserved instances are not invoked.

 **NOTE**

- Reserved instances cannot be configured for both a function alias and the corresponding version. For example, if the alias of the latest version is 1.0 and reserved instances have been configured for this version, no more instances can be configured for alias 1.0.
- After the idle mode is enabled, reserved instances are initialized and the mode change needs some time to take effect. You will still be billed at the price of reserved instances for non-idle mode in this period.
- If the function concurrency is greater than the number of reserved instances, the excess requests will be allocated to on-demand instances, which involve a cold start.

- Click **OK**. The new policy is displayed in the reserved instance policy list.

Figure 12-3 Policy list

	Type	Min. Instances	Policy	Operation
latest	Version	1	No auto scaling policy configured	Edit / Delete

Configuring a Scheduled Scaling Policy

Configure the number of reserved instances that will run in a specified period and a cron expression. During this period, FunctionGraph adjusts the number of reserved instances based on the cron expression. When the period expires, the fixed number of instances will be reserved.

- Configure the basic settings by referring to [Table 12-1](#), and then click **Add Policy**.

Figure 12-4 Clicking Add Policy

Basic Settings

Function Name: test_obs1

Type: Version Aliases

Version: latest

Min. Instances: 1

?

Auto Scaling Policies Add Policy

Policy Name	Policy Type
No data available.	

- Set parameters by referring to [Table 12-2](#).

Table 12-2 Scheduled scaling policy parameters

Parameter	Description
Policy Name	Policy name.
Cron Expression (UTC)	Set this parameter by referring to Cron Expressions for a Function Timer Trigger .

Parameter	Description
Validity	Local time when the cron expression is effective. The scheduled scaling policy is effective only during this validity period. In other time, the Min. Instances in the basic settings is used.
Min. Instances	The number of reserved instances to be created when the policy is effective. Set a number that meets your service requirements. NOTE The number must be greater than or equal to the Min. Instances in the basic settings.

- Click **OK**. The new policy is displayed in the reserved instance policy list.

Figure 12-5 Policy list

Name	Type	Min. Instances	Policy	Operation
Useful	Version	1	scheme-h5jtr	Edit Delete

- To modify the reserved instance policy, click **Edit** in the **Operation** column. Then modify or add scheduled scaling policies.
- To delete a reserved instance policy under a function version or alias, click **Delete** in the **Operation** column.
- To view concurrent instances, click a quantifier in the reserved instance policy list, and click a scheduled scaling policy name.

NOTE

Multiple scheduled policies can be configured. For example, the number of reserved instances at 08:00 and 21:00 is updated to 100 and 10 respectively.

13 Audit

13.1 Operations Logged by CTS

Table 13-1 lists the FunctionGraph operations that can be logged by CTS.

Table 13-1 Operations logged by CTS

Operation	Resource Type	Event Name
Creating a function	Function	createFunction
Deleting a function	Function	deleteFunction
Modifying function information	Function	updateFunctionConfig
Publishing a function version	Function version	publishFunctionVersion
Deleting a function version alias	Function version alias	deleteVersionAlias
Deleting a function trigger	Trigger	deleteTrigger
Creating a function trigger	Trigger	createTrigger
Disabling a function trigger	Trigger	disableTrigger
Enabling a function trigger	Trigger	enableTrigger

13.2 Querying Real-Time Traces


Scenarios




After you enable CTS and the management tracker is created, CTS starts recording operations on cloud resources. After a data tracker is created, the system starts recording operations on data in OBS buckets. CTS stores operation records generated in the last seven days.

This section describes how to query and export operation records of the last seven days on the CTS console.




- [Viewing Real-Time Traces in the Trace List of the New Edition](#)
- [Viewing Real-Time Traces in the Trace List of the Old Edition](#)

Viewing Real-Time Traces in the Trace List of the New Edition

1. Log in to the management console.
2. Click  in the upper left corner and choose Management & Deployment > **Cloud Trace Service**. The CTS console is displayed.
3. Choose **Trace List** in the navigation pane on the left.
4. On the **Trace List** page, use advanced search to query traces. You can combine one or more filters.
 - **Trace Name:** Enter a trace name.
 - **Trace ID:** Enter a trace ID.
 - **Resource Name:** Enter a resource name. If the cloud resource involved in the trace does not have a resource name or the corresponding API operation does not involve the resource name parameter, leave this field empty.
 - **Resource ID:** Enter a resource ID. Leave this field empty if the resource has no resource ID or if resource creation failed.
 - **Trace Source:** Select a cloud service name from the drop-down list.
 - **Resource Type:** Select a resource type from the drop-down list.
 - **Operator:** Select one or more operators from the drop-down list.
 - **Trace Status:** Select **normal**, **warning**, or **incident**.
 - **normal:** The operation succeeded.
 - **warning:** The operation failed.
 - **incident:** The operation caused a fault that is more serious than the operation failure, for example, causing other faults.
 - Time range: Select **Last 1 hour**, **Last 1 day**, or **Last 1 week**, or specify a custom time range.
5. On the **Trace List** page, you can also export and refresh the trace list, and customize the list display settings.

- Enter any keyword in the search box and press Enter to filter desired traces.
 - Click **Export** to export all traces in the query result as an .xlsx file. The file can contain up to 5000 records.
 - Click  to view the latest information about traces.
 - Click  to customize the information to be displayed in the trace list. If **Auto wrapping** is enabled (), excess text will move down to the next line; otherwise, the text will be truncated. By default, this function is disabled.
6. For details about key fields in the trace structure, see section "Trace References" > "Trace Structure" and section "Trace References" > "Example Traces".
 7. (Optional) On the **Trace List** page of the new edition, click **Go to Old Edition** in the upper right corner to switch to the **Trace List** page of the old edition.

Viewing Real-Time Traces in the Trace List of the Old Edition

1. Log in to the management console.
2. Click  in the upper left corner and choose **Management & Deployment** > **Cloud Trace Service**. The CTS console is displayed.
3. Choose **Trace List** in the navigation pane on the left.
4. Each time you log in to the CTS console, the new edition is displayed by default. Click **Go to Old Edition** in the upper right corner to switch to the trace list of the old edition.
5. Set filters to search for your desired traces. The following filters are available:
 - **Trace Type, Trace Source, Resource Type, and Search By:** Select a filter from the drop-down list.
 - If you select **Resource ID** for **Search By**, specify a resource ID.
 - If you select **Trace name** for **Search By**, specify a trace name.
 - If you select **Resource name** for **Search By**, specify a resource name.
 - **Operator:** Select a user.
 - **Trace Status:** Select **All trace statuses, Normal, Warning, or Incident**.
 - Time range: You can query traces generated during any time range in the last seven days.
 - Click **Export** to export all traces in the query result as a CSV file. The file can contain up to 5000 records.
6. Click **Query**.
7. On the **Trace List** page, you can also export and refresh the trace list.
 - Click **Export** to export all traces in the query result as a CSV file. The file can contain up to 5000 records.
 - Click  to view the latest information about traces.
8. Click  on the left of a trace to expand its details.

Trace Name	Resource Type	Trace Source	Resource ID	Resource Name	Trace Status	Operator	Operation Time	Operation
createDockerConfig	dockerlogincmd	SWR	-	dockerlogincmd	normal		Nov 16, 2023 10:54:04 GMT+08:00	View Trace

request	
trace_id	
code	200
trace_name	createDockerConfig
resource_type	dockerlogincmd
trace_rating	normal
api_version	
message	createDockerConfig, Method: POST Url=/v2/manager/utils/secret, Reason:
source_ip	
domain_id	
trace_type	ApiCall

- Click **View Trace** in the **Operation** column. The trace details are displayed.

View Trace ×

```
{
  "request": "",
  "trace_id": " ",
  "code": "200",
  "trace_name": "createDockerConfig",
  "resource_type": "dockerlogincmd",
  "trace_rating": "normal",
  "api_version": "",
  "message": "createDockerConfig, Method: POST Url=/v2/manager/utils/secret, Reason:",
  "source_ip": " ",
  "domain_id": " ",
  "trace_type": "ApiCall",
  "service_type": "SWR",
  "event_type": "system",
  "project_id": " ",
  "response": "",
  "resource_id": "",
  "tracker_name": "system",
  "time": "Nov 16, 2023 10:54:04 GMT+08:00",
  "resource_name": "dockerlogincmd",
  "user": {
    "domain": {
      "name": " ",
      "id": " "
    }
  }
}
```

- For details about key fields in the trace structure, see section "Trace References" > "Trace Structure" and section "Trace References" > "Example Traces" in the *CTS User Guide*.
- (Optional) On the **Trace List** page of the old edition, click **New Edition** in the upper right corner to switch to the **Trace List** page of the new edition.

14 FAQs

14.1 General FAQs

14.1.1 What Is FunctionGraph?

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.

14.1.2 Do I Need to Apply for Any Compute, Storage, or Network Services When Using FunctionGraph?

When using FunctionGraph, you do not need to apply for or pre-configure any computing, storage, or network services, but need to upload and run code in supported runtimes. FunctionGraph provides and manages underlying compute resources, including server CPUs, memory, and networks. It performs configuration and resource maintenance, code deployment, automatic scaling, load balancing, secure upgrade, and resource monitoring.

14.1.3 Do I Need to Deploy My Code After Programming?

After programming, you only need to package your code into a ZIP file (Java, Node.js, Python, and Go) or JAR file (Java), and upload the file to FunctionGraph for execution.

When creating a ZIP file, place the handler file under the **root** directory to ensure that your code can be run normally after being decompressed.

If you edit code in Go, zip the compiled file, and ensure that the name of the dynamic library file is consistent with the plugin name of the handler. For example, if the name of the dynamic library file is **testplugin.so**, set the handler to **testplugin.Handler**.

14.1.4 What Runtimes Does FunctionGraph Support?

[Table 14-1](#) lists the runtimes supported by FunctionGraph.

Table 14-1 Supported runtimes and versions

Runtime	Version
Python	2.7, 3.6, 3.9, 3.10
Node.js	6.10, 8.10, 10.16, 12.13, 14.18, 16.17, 18.15
Java	8, 11
Go	1.x
C#.NET Core	2.1, 3.1
PHP	7.3

14.1.5 How Much Disk Space Is Allocated to Each FunctionGraph Function?

Each FunctionGraph function is allocated 512 MB ephemeral disk space. You can upload deployment packages up to 10 GB in size. For more information, see [Notes and Constraints](#).

14.1.6 Does FunctionGraph Support Function Versioning?

Yes. For details, see [Managing Versions](#).

14.1.7 How Does a Function Read or Write Files?

Background

A function can read files in the code directory. The working directory of a function is the upper-level directory of the handler file. Assume that you have uploaded a folder named **backend**. To read its **test.conf** file in the same level of directory as the handler file, use relative path **code/backend/test.conf** or use a full path (that is, the value of the **RUNTIME_CODE_ROOT** environment variable). To write a file (for example, to create or download a file), go to the **/tmp** directory or use the file system mounting feature provided by FunctionGraph.

NOTE

- If containers are reclaimed, file read/written content will become invalid.
- Currently, FunctionGraph does not support instance persistence.

Typical Scenarios

- Download files stored in Object Storage Service (OBS) to the **/tmp** directory for processing.
- To store function execution data in OBS, create a file in the **/tmp** directory, write the data into the file, and then upload the file to OBS.

14.1.8 Does FunctionGraph Support Function Extension?

FunctionGraph has integrated non-standard libraries such as redis, http, and obs_client. You can directly use these libraries when developing functions.

Alternatively, use your own dependencies. For more information, see [Dependency Management](#).

14.1.9 Which Permissions Are Required for an IAM User to Use FunctionGraph?

If you are prompted insufficient permissions when creating, deleting, modifying, or querying functions and triggers in FunctionGraph as an IAM user, contact the administrator to grant permissions to your user group. If you want to invoke other cloud services, such as OBS, configure an agency with the required permissions. For security purpose, do this by following the principle of least privilege.

14.1.10 How Can I Create an ODBC Drive-based Python Dependency Package for Database Query?

For OS-dependent packages (for example, unixODBC), download the source code to compile dependency packages.

1. Log in to your ECS on the ECS console (ensure that the GCC and Make tools have been installed), and run the following command to download the source code package:

```
wget source_code_path
```

If you downloaded a **.zip** file, run the following command to decompress it:

```
unzip xxx/xx.zip
```

If you downloaded a **tar.gz** file, run the following command to decompress it:

```
tar -zxvf xxx/xx.tar.gz
```
2. Run the following command to create the **/opt/function/code** directory:

```
mkdir /opt/function/code
```
3. Go to the destination directory and run the following command:

```
./configure --prefix=/opt/function/code --sysconfdir=/opt/function/code;make;make install
```
4. Go to **/opt/function/code/lib/pkgconfig** and check whether the prefix directory is **/opt/function/code**.

```
cd /opt/function/code/lib/pkgconfig
```
5. Copy all files in **/opt/function/code/lib** to **/opt/function/code**.

```
cp -r /opt/function/code/lib/* /opt/function/code
```
6. Switch to **/opt/function/code** and compress all files in it to a **.zip** package.

```
cd /opt/function/code  
zip -r xxx.zip *
```

14.1.11 What Is the Quota of FunctionGraph?

For details about the resource quota of FunctionGraph, see [Notes and Constraints](#).

14.1.12 How Does a Container Image-based Function Resolve a Private DNS Domain Name?

FunctionGraph functions created with a container image cannot directly parse private Domain Name Service (DNS) domain names. However, you can call DNS APIs to achieve this purpose.


Resolving a Private DNS Domain Name

1. Obtain a private domain name and zone ID.

This procedure uses a domain name with a record set as an example.

- a. Log in to the DNS console.
- b. Obtain a zone ID.



Click , and select **Domain Name** in the search box to obtain a zone ID.

- c. Obtain the private domain name corresponding to a recording set.

Click the domain name to go to the record set list, and select a record set.

2. Compile the resolution logic.

Debug the API used to [query record sets in a zone](#).

- Set **zone_id** to the zone ID obtained in the preceding step, and click **Debug**. The IP address of the private domain name is displayed in the response body.
- Switch to the **Sample Code** tab to obtain the complete code. For details about the dependencies, click **View SDK Details**.

14.1.13 How Do I Use a Domain Name to Access an API Registered with API Gateway (Dedicated)?

The domain name **www.test.com** is used as an example. The procedure is as follows:

- Step 1** Log in to the API Gateway console, choose **Dedicated Gateways** in the navigation pane, and click the target gateway name. On the **Gateway Information** page, view **EIP** in the **Inbound Access** area to obtain the IP address of the API gateway.
- Step 2** On the DNS console, configure an IPv4 rule for mapping **www.test.com** to an API gateway address.
- Step 3** Configure domain name resolution. In this way, you can access the API registered with the API gateway by using domain name **www.test.com**.

----End

14.1.14 What Are the Common Application Scenarios of FunctionGraph?

1. Web applications: mini programs, web pages/apps, chatbots, and Backends for Frontends (BFF).
2. Event-driven applications: file processing, image processing, live video streaming/transcoding, real-time data stream processing, and IoT rule/event processing.
3. AI applications: third-party service integration, AI inference, and license plate recognition.

14.1.15 Why Can't the API Gateway Domain Name Bound to a Service Be Resolved During Function Invocation?

Currently, FunctionGraph resolves only DNS domain names and POD domain names.

14.1.16 Does FunctionGraph Support Synchronous Transmission at the Maximum Intranet Bandwidth?

Not currently.

14.1.17 What If the VPC Quota Is Used Up?

A tenant can create up to 4 VPCs. To create more VPCs, submit a service ticket.

14.1.18 How Can I Print Info, Error, or Warn Logs?

Take Java as an example. You can use this demo to print logs.

14.1.19 Can I Set the Domain Name of an API to My Own Domain Name?

Yes. The procedure is as follows:

- Step 1** Log in to the APIG console and bind a domain name by referring to section "Binding a Domain Name" in the *API Gateway User Guide*.
- Step 2** On the **Domain Names** tab page of the created API group, click **Bind Independent Domain Name**. For example, set `xxx.apig.x` to `test.com/user/get`.
----End

14.1.20 Can I Change the Runtime?

No. Once a function is created, its runtime cannot be changed.

14.1.21 Can I Change a Function's Name?

No. A function's name cannot be changed once the function is created.

14.1.22 Why Is Message "failed to mount exist system path" Displayed?

When you see this message, mount the file to a new path.

User ID/user group ID: Can be any number except 1000. The value `-1` will be automatically converted to `1003`. The two IDs control the directory permissions for accessing a remote file system.

File system/ECS name: Name of the file system or ECS to create. Ensure that you have specified a VPC and agency that you have been authorized to access.

Shared directory: To configure a remote shared directory for the mounted ECS, see [Creating an NFS Shared Directory on an ECS](#).

Access path: Location where the file system is to be mounted in the function. Set a new two-level directory that starts with `/mnt`. For example, `/mnt/test`.

14.1.23 How Do I Obtain Uploaded Files?

Take Python as an example. If you use `os.getcwd()` to query the current directory, the directory will be `/opt/function`. However, code has actually been uploaded to `/opt/function/code`.

You can use either of the following methods to obtain uploaded files:

1. Run the `cd` command to switch to `/opt/function/code`.
2. Access the full path (value of the `RUNTIME_CODE_ROOT` environment variable).

NOTE

You can obtain uploaded files by referring to the preceding methods when other languages are used.

14.1.24 Why Can't I Receive Responses for Synchronous Invocation?

If the E2E function execution latency exceeds 90s, asynchronous invocation is recommended. If synchronous invocation is used, no responses can be received after 90s due to gateway restrictions.

14.1.25 What Should I Do If the `os.system("command &")` Execution Logs Are Not Collected?

Do not use `os.system("command &")`. The background command output will not be collected. To obtain the command output, use `subprocess.Popen` instead.

14.1.26 Which Directories Can Be Accessed When a Custom Runtime Is Used?

By default, only the `/tmp` directory can be accessed, for example, for creating or downloading files.

14.1.27 Which Minor Versions of Python 3.6 and 3.9 Are Supported?

3.6.8 and 3.9.2.

14.1.28 Which Actions Can Be Used Instead of a VPC Administrator Agency for VPC Access?

The actions listed in [Table 14-2](#) can be used.

Table 14-2 Actions

Permission	Action
Deleting a port	vpc:ports:delete
Querying a port	vpc:ports:get
Creating a port	vpc:ports:create
Querying a VPC	vpc:vpcs:get
Querying a subnet	vpc:subnets:get

14.1.29 What Are the Possible Causes for Function Timeout?

- The code logic timed out. In this case, optimize the code or increase the timeout.
- The network timed out. To fix this issue, increase the timeout.
- It took a long time to load Java classes during cold start. In this case, increase the timeout or memory.

14.1.30 How Do I Obtain the Code of a Function?

1. Log in to the FunctionGraph console, and click the name of the target function to go to the details page. Choose **Operation** > **Export function** in the upper right, and click **Export Code**.
2. Alternatively, call the function export API.

14.1.31 Do You Have Sample Code for Initializers?

Yes. See the following examples:

- Node.js

```
exports.initializer = function(context, callback) {
  callback(null, "");
};
```

- **Python**

```
def my_initializer(context):
    print("hello world!")
```
- **Java**

```
public void my_initializer(Context context)
{
    RuntimeLogger log = context.getLogger();
    log.log(String.format("ak:%s", context.getAccessKey()));
}
```
- **PHP**

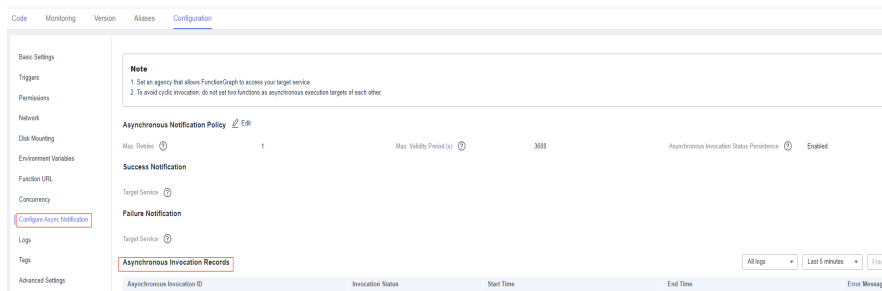
```
<?php
Function my_initializer($context) {
    echo 'hello world' . PHP_EOL;
}
?>
```

14.1.32 How Do I Enable Structured Log Query?

Scenario

To check the status of asynchronous invocation requests, view the records by choosing **Configuration > Configure Async Notification** on the function details page, as shown in [Figure 14-1](#).

Figure 14-1 Asynchronous invocation records



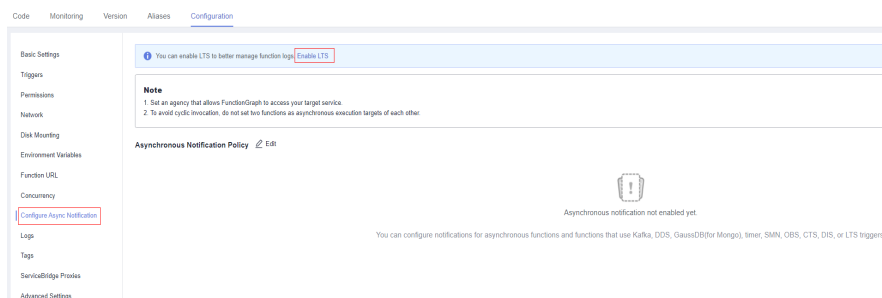
Prerequisites

You have enabled asynchronous invocation status persistence.

Procedure

- Step 1** Contact customer service to add your account to the whitelist of this feature.
- Step 2** On the **Configure Async Notification** page, click **Enable LTS**, as shown in [Figure 14-2](#).

Figure 14-2 Enabling LTS



Step 3 Click **Edit** next to **Asynchronous Notification Policy**, and enable **Asynchronous Invocation Status Persistence**, as shown in **Figure 14-3** and **Figure 14-4**.

Figure 14-3 Configuring asynchronous notification policy

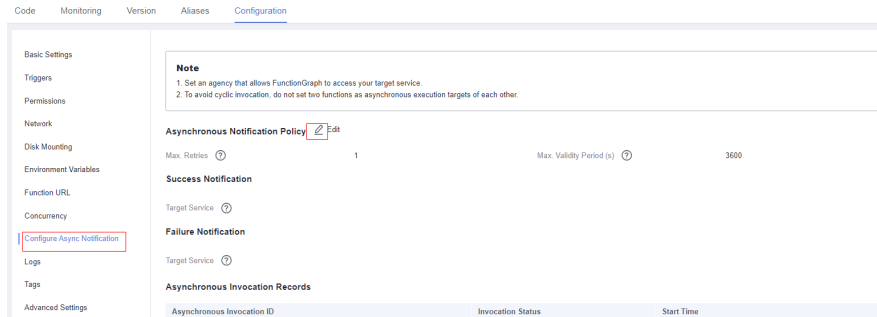
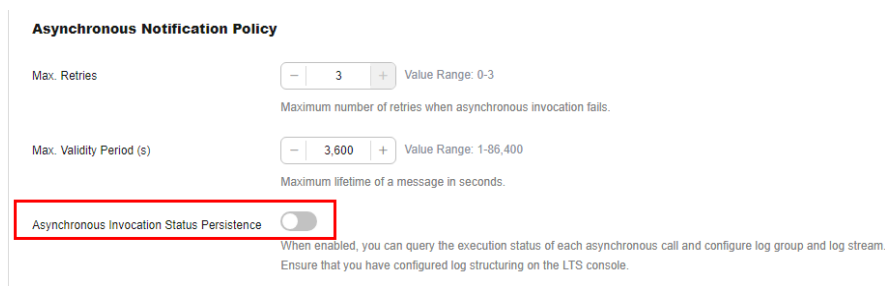


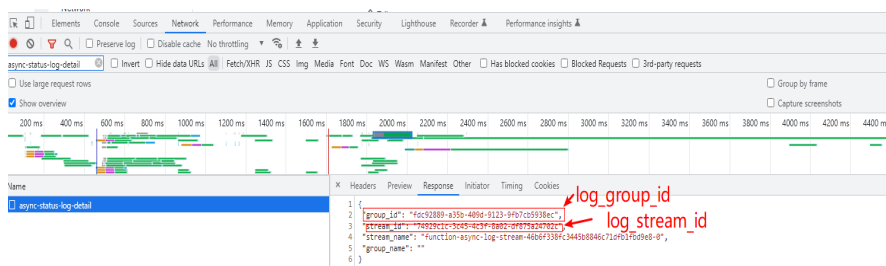
Figure 14-4 Enabling asynchronous invocation status persistence



Step 4 Configure structured query on the LTS console.

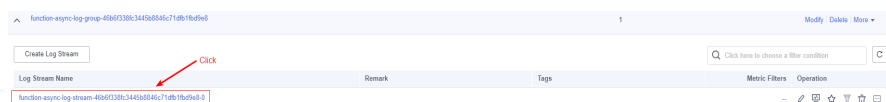
1. On the function details page, view the log group and log stream. Press **F12**, choose **Network**, enter filter **async-status-log-detail**, and obtain the log group ID and log stream ID, as shown in **Figure 14-5**.

Figure 14-5 Obtaining log group ID and log stream ID



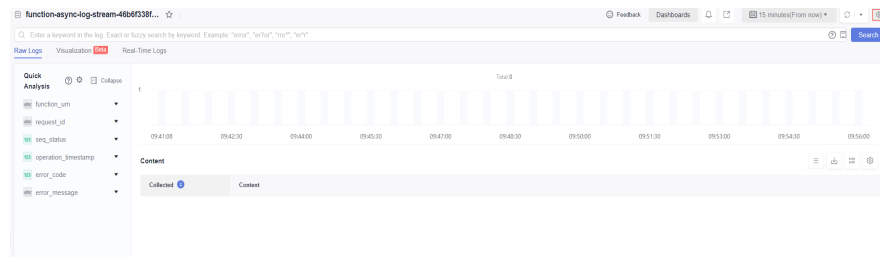
2. On the LTS console, locate the log group and log stream by their IDs, as shown in **Figure 14-6**.

Figure 14-6 Viewing log stream



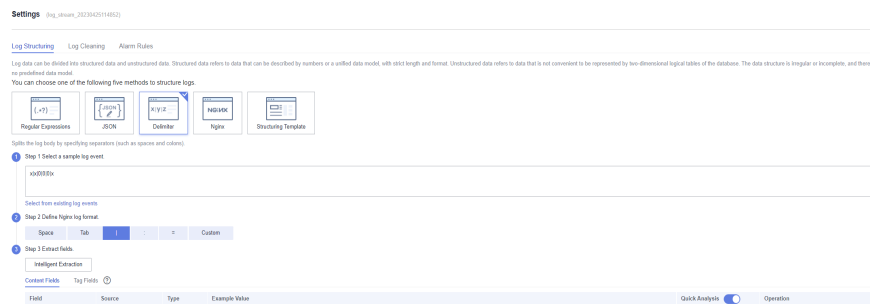
3. On the log stream details page, click the gear icon in the upper right, as shown in **Figure 14-7**.

Figure 14-7 Clicking the gear icon



4. Configure log structuring, as shown in [Figure 14-8](#).


Figure 14-8 Configuring log structuring



5. Click **Intelligent Extraction**, as shown in [Figure 14-9](#).

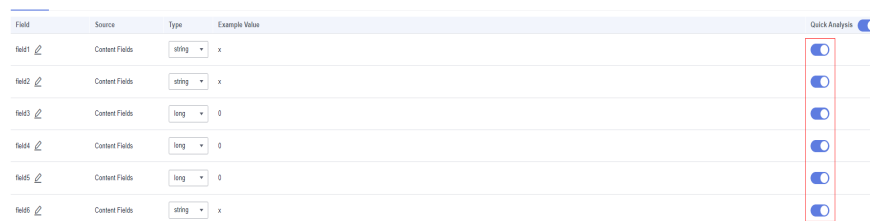
Figure 14-9 Intelligent Extraction



6. Click  to modify the field definition as follows:
 - a. Change **field1** to **function_urn** and its type to **string**.
 - b. Change **field2** to **request_id** and its type to **string**.
 - c. Change **field3** to **seq_status** and its type to **long**.
 - d. Change **field4** to **operation_timestamp** and its type to **long**.
 - e. Change **field5** to **error_code** and its type to **long**.
 - f. Change **field6** to **error_message** and its type to **string**.

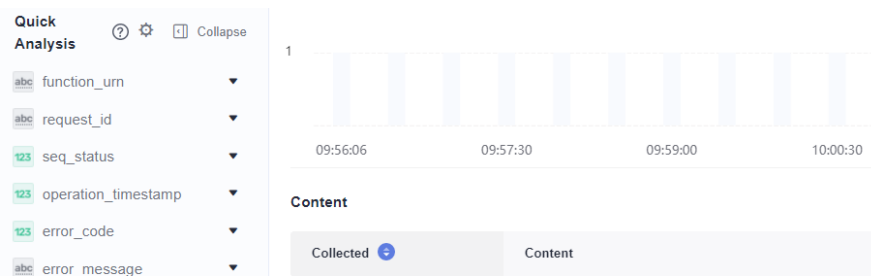
Enable **Quick Analysis**, as shown in [Figure 14-10](#).

Figure 14-10 Enabling quick analysis



7. Click **Save**. [Figure 14-11](#) shows the configuration.

Figure 14-11 Saved configuration



----End

14.1.33 Can I Enable a Listening Port in a Function to Receive External TCP Requests via EIP?

No. FunctionGraph does not support this feature currently. Functions are about serverless computing, and compute resources are allocated while functions are running. Customizing a listening port is not suitable.

14.2 Function Creation FAQs

14.2.1 Can I Add Threads and Processes in Function Code?

You can create additional threads and processes in your function by using runtime and OS features.

14.2.2 What Are the Rules for Packaging a Function Project?

In addition to inline code editing, you can create a function by uploading a ZIP or JAR file, or uploading a ZIP file from OBS. For details, see [Packaging Rules](#) and [Example ZIP Project Packages](#).

Packaging Rules

In addition to inline code editing, you can create a function by uploading a local ZIP file or JAR file, or uploading a ZIP file from Object Storage Service (OBS). [Table 14-3](#) describes the rules for packaging a function project.

Table 14-3 Function project packaging rules

Runtime	JAR File	ZIP File	ZIP File on OBS
Node.js	Not supported.	<ul style="list-style-type: none"> • If the function project files are saved under the ~/Code/ directory, select and package all files under this directory to ensure that the function handler is under the root directory after the ZIP file is decompressed. • If the function project uses third-party dependencies, package the dependencies into a ZIP file, and import the ZIP file on the function code page. Alternatively, package the third-party dependencies and the function project files together. 	Compress project files into a ZIP file and upload it to an OBS bucket.

Runtime	JAR File	ZIP File	ZIP File on OBS
PHP	Not supported.	<ul style="list-style-type: none"> • If the function project files are saved under the ~/Code/ directory, select and package all files under this directory to ensure that the function handler is under the root directory after the ZIP file is decompressed. • If the function project uses third-party dependencies, package the dependencies into a ZIP file, and import the ZIP file on the function code page. Alternatively, package the third-party dependencies and the function project files together. 	Compress project files into a ZIP file and upload it to an OBS bucket.

Runtime	JAR File	ZIP File	ZIP File on OBS
Python 2.7	Not supported.	<ul style="list-style-type: none"> • If the function project files are saved under the ~/Code/ directory, select and package all files under this directory to ensure that the function handler is under the root directory after the ZIP file is decompressed. • If the function project uses third-party dependencies, package the dependencies into a ZIP file, and import the ZIP file on the function code page. Alternatively, package the third-party dependencies and the function project files together. 	Compress project files into a ZIP file and upload it to an OBS bucket.

Runtime	JAR File	ZIP File	ZIP File on OBS
Python 3.6	Not supported.	<ul style="list-style-type: none"> • If the function project files are saved under the ~/Code/ directory, select and package all files under this directory to ensure that the function handler is under the root directory after the ZIP file is decompressed. • If the function project uses third-party dependencies, package the dependencies into a ZIP file, and import the ZIP file on the function code page. Alternatively, package the third-party dependencies and the function project files together. 	Compress project files into a ZIP file and upload it to an OBS bucket.
Java 8	If the function does not reference third-party components, compile only the function project files into a JAR file.	If the function references third-party components, compile the function project files into a JAR file, and compress all third-party components and the function JAR file into a ZIP file.	Compress project files into a ZIP file and upload it to an OBS bucket.

Runtime	JAR File	ZIP File	ZIP File on OBS
Go 1.8	Not supported.	Compress project files into a ZIP file, and ensure that the name of the dynamic library file is consistent with the handler plugin name. For example, if the name of the dynamic library file is testplugin.so , set the handler plugin name to testplugin.Handler . Handler indicates the function handler.	Compress project files into a ZIP file and upload it to an OBS bucket.
Go 1.x	Not supported.	Zip the compiled file and ensure that the name of the binary file is consistent with that of the handler. For example, if the name of the binary file is Handler , set the name of the handler to Handler .	Compress project files into a ZIP file and upload it to an OBS bucket.
C#	Not supported.	Compress project files into a ZIP file. The ZIP file must contain the following files: <i>Project_name.deps.js on</i> , <i>Project_name.dll</i> , <i>Project_name.runtim econfig.json</i> , <i>Project_name.pdb</i> , and HC.Serverless.Functi on.Common.dll .	Compress project files into a ZIP file and upload it to an OBS bucket.
Custom	Not supported.	Compress project files into a ZIP file. The ZIP file must contain a bootstrap file.	Compress project files into a ZIP file and upload it to an OBS bucket.

Example ZIP Project Packages

- Example directory of a Nods.js project package

Example.zip	Example project package
--- lib	Service file directory
--- node_modules	NPM third-party component directory
--- index.js	.js handler file (mandatory)
--- package.json	NPM project management file
- Example directory of a PHP project package

Example.zip	Example project package
--- ext	Extension library directory
--- pear	PHP extension and application repository
--- index.php	PHP handler file
- Example directory of a Python project package

Example.zip	Example project package
--- com	Service file directory
--- PLI	Third-party dependency PLI directory
--- index.py	.py handler file (mandatory)
--- watermark.py	.py file for image watermarking
--- watermark.png	Watermarked image
- Example directory of a Java project package

Example.zip	Example project package
--- obstest.jar	Service function JAR file
--- esdk-obs-java-3.20.2.jar	Third-party dependency JAR file
--- jackson-core-2.10.0.jar	Third-party dependency JAR file
--- jackson-databind-2.10.0.jar	Third-party dependency JAR file
--- log4j-api-2.12.0.jar	Third-party dependency JAR file
--- log4j-core-2.12.0.jar	Third-party dependency JAR file
--- okhttp-3.14.2.jar	Third-party dependency JAR file
--- okio-1.17.2.jar	Third-party dependency JAR file
- Example directory of a Go project package

Example.zip	Example project package
--- testplugin.so	Service function package
- Example directory of a C# project package

Example.zip	Example project package
--- fssExampleCsharp2.0.deps.json	File generated after project compilation
--- fssExampleCsharp2.0.dll	File generated after project compilation
--- fssExampleCsharp2.0.pdb	File generated after project compilation
--- fssExampleCsharp2.0.runtimeconfig.json	File generated after project compilation
--- Handler	Help file, which can be directly used
--- HC.Serverless.Function.Common.dll	.dll file provided by FunctionGraph
- Custom

Example.zip	Example project package
--- bootstrap	Executable boot file

14.2.3 How Does FunctionGraph Isolate Code?

Each FunctionGraph function runs in its own environment and has its own resources and file system.

14.2.4 How Do I Create the Bootstrap File for an HTTP Function?

To create an HTTP function, create a bootstrap file. For details, see [Creating a Bootstrap File](#).

14.3 Trigger Management FAQs

14.3.1 What If Error Code 500 Is Reported When Functions that Use APIG Triggers Return Strings?

Ensure that the function response for an invocation by API Gateway has been encapsulated and contains **body(String)**, **statusCode(int)**, **headers(Map)**, and **isBase64Encoded(boolean)**.

The following is an example response returned by a Node.js function that uses an APIG trigger:

```
exports.handler = function (event, context, callback) {
  const response = {
    'statusCode': 200,
    'isBase64Encoded': false,
    'headers': {
      "Content-type": "application/json"
    },
    'body': 'Hello, FunctionGraph with APIG',
  }
  callback(null, response);
}
```

The following is an example response returned by a Java function that uses an APIG trigger:

```
import java.util.Map;

public HttpTriggerResponse index(String event, Context context){
  String body = "<html><title>FunctionStage</title>"
    + "<h1>This is a simple APIG trigger test</h1><br>"
    + "<h2>This is a simple APIG trigger test</h2><br>"
    + "<h3>This is a simple APIG trigger test</h3>"
    + "</html>";
  int code = 200;
  boolean isBase64 = false;
  Map<String, String> headers = new HashMap<String, String>();
  headers.put("Content-Type", "text/html; charset=utf-8");
  return new HttpTriggerResponse(body, headers, code, isBase64);
}

class HttpTriggerResponse {
  private String body;
  private Map<String, String> headers;
  private int statusCode;
  private boolean isBase64Encoded;
  public HttpTriggerResponse(String body, Map<String,String> headers, int statusCode,
boolean isBase64Encoded){
    this.body = body;
    this.headers = headers;
    this.statusCode = statusCode;
    this.isBase64Encoded = isBase64Encoded;
  }
}
```

14.3.2 What Do LATEST and TRIM_HORIZON Mean in DIS Trigger Configuration?

Cursors **LATEST** and **TRIM_HORIZON** specify the start points for reading data in Data Ingestion Service (DIS) streams.

- **TRIM_HORIZON**: Data is read from the earliest valid record stored in the partition.
For example, a tenant used a DIS stream to upload three pieces of data A1, A2, and A3. Assuming that A1 expires but A2 and A3 are still valid after a period of time, if the tenant specifies **TRIM_HORIZON** for downloading data, only A2 and A3 can be downloaded.
- **LATEST**: Data is read from the latest record in the partition. This option ensures that the most recent data in the partition is read.

14.3.3 Why Can't I Enable or Disable OBS Triggers by Calling APIs?

OBS does not support pull triggers. Therefore, OBS triggers cannot be enabled or disabled.

14.3.4 How Do I Use an APIG Trigger to Invoke a Function?

For details, see [Using an APIG Trigger](#).

14.3.5 How Does a Function Obtain the Request Path or Parameters When Using an APIG Trigger?

By default, the request path or parameters are included in **event**. A function invokes APIG using its event template. You can obtain the request path or parameters from the function execution result.

Example:

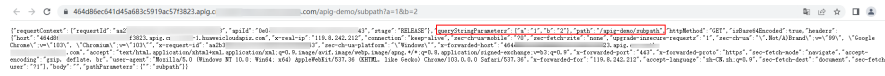
```
{ requestContext:  
  { requestId: ████████████████████████████████████████,  
    apiId: ████████████████████████████████████████,  
    stage: 'RELEASE' },  
  queryStringParameters: { a: '1', b: '2' },  
  path: '/apig-demo/subpath',  
  httpMethod: 'GET',  
  isBase64Encoded: true,
```

- **queryStringParameters**: parameters following the question mark (?), separated with ampersands (&). These parameters are added in the URL of a GET request, and will be transferred in the URL string format when a GET request is initiated.
- **path**: API URL.

You can call an API using its request path. Example: **https://464d86ec641d45a683c5919ac57f3823.apig.projectID.com/apig-demo/subpath**

Alternatively, you can call an API by adding request parameters. Example:

`https://464d86ec641d45a683c5919ac57f3823.apig.projectID.com/apig-demo/
subpath?a=1&b=2`



14.3.6 Can I Create an OBS Trigger with an Existing Bucket?

Yes. If a message is displayed indicating that the configuration of the current trigger conflicts with that of another one, the two triggers have the same bucket, prefix, and suffix. If you still want to use this bucket for the current trigger, modify the prefix or suffix.

14.4 Dependency Management FAQs

14.4.1 What Is a Dependency?

A dependency is a program package and also an environment required for running a software package. The software package relies on and can only run in the environment.

14.4.2 When Do I Need a Dependency?

When you install a program or develop code that relies on an environment to run, you need to introduce the dependency.

14.4.3 What Are the Precautions for Using a Dependency?

- The name of each file in a dependency cannot end with a tilde (~).
- There should be no more than 30,000 files in a dependency.
- You can upload a ZIP dependency file within 10 MB on the function details page. For a larger dependency (max. 300 MB), upload it using OBS.
- If your function uses a large private dependency, increase the timeout by choosing **Configuration > Basic Settings** on the function details page.

14.4.4 What Dependencies Does FunctionGraph Support?

Supported Dependencies

FunctionGraph supports standard libraries and third-party dependencies.

- Standard libraries

When using standard libraries, you can import them to your inline code, or package and upload them to FunctionGraph.

- Supported non-standard libraries

FunctionGraph provides built-in third-party components, as described in [Table 14-4](#) and [Table 14-5](#). You can import these components to your inline code in the same way as you import standard libraries.

Table 14-4 Third-party components integrated with the Node.js runtime

Name	Description	Version
q	Asynchronous method encapsulation	1.5.1
co	Asynchronous process control	4.6.0
lodash	Common tool and method library	4.17.10
esdk-obs-nodejs	OBS sdk	2.1.5
express	Simplified web-based application development framework	4.16.4
fgs-express	Provides a Node.js application framework for FunctionGraph and APIG to run serverless applications and REST APIs. This component provides an example of using the Express framework to build serverless web applications or services and RESTful APIs.	1.0.1
request	Simplifies HTTP invocation and supports HTTPS and redirection.	2.88.0

Table 14-5 Non-standard libraries supported by the Python runtime

Module	Description	Version
dateutil	Date and time processing	2.6.0
requests	HTTP library	2.7.0
httplib2	httpclient	0.10.3
numpy	Mathematical computation	1.13.1
redis	Redis client	2.10.5
obsclient	OBS client	-
smnsdk	SMN access	1.0.1

- Other third-party libraries
For other third-party libraries not listed in the preceding tables, package and upload them to an OBS bucket or on the function details page. For details, see [How Do I Create a Dependency on the FunctionGraph Console?](#) These libraries will then be used in your function code.

14.4.5 Does FunctionGraph Support Class Libraries?

Yes. FunctionGraph supports both standard libraries and non-standard third-party libraries. For details, see [What Dependencies Does FunctionGraph Support?](#)

14.4.6 How Do I Use Third-Party Dependencies on FunctionGraph?

1. Package third-party libraries into a ZIP package by referring to [How Do I Create Function Dependencies?](#)
2. Create a dependency on the FunctionGraph console by referring to [How Do I Create a Dependency on the FunctionGraph Console?](#)
3. On the function details page, click the **Code** tab, and add the dependency by referring to [How Do I Add a Dependency to a Function?](#) Then you can use the dependency in the function code.

14.4.7 How Do I Create Function Dependencies?

You are advised to create function dependencies in EulerOS. If other OSs are used, an error may occur due to underlying dependent libraries. For example, the dynamic link library cannot be found.

NOTE

If the modules to be installed need dependencies such as .dll, .so, and .a, archive them to a .zip package.

Creating a Dependency for a Python Function

Ensure that the Python version of the packaging environment is the same as that of the function. For Python 2.7, Python 2.7.12 or later is recommended. For Python 3.6, Python 3.6.3 or later is recommended.

To install the PyMySQL dependency for a Python 2.7 function in the local **/tmp/pymysql** directory, run the following command:

```
pip install PyMySQL --root /tmp/pymysql
```

After the command is successfully executed, go to the **/tmp/pymysql** directory:

```
cd /tmp/pymysql/
```

Go to the **site-packages** directory (generally, **usr/lib64/python2.7/site-packages/**) and then run the following command:

```
zip -rq pymysql.zip *
```

The required dependency is generated.

 NOTE

To install the local wheel installation package, run the following command:

```
pip install piexif-1.1.0b0-py2.py3-none-any.whl --root /tmp/piexif
//Replace piexif-1.1.0b0-py2.py3-none-any.whl with the actual installation package name.
```

Creating a Dependency for a Node.js Function

Ensure that the corresponding Node.js version has been installed in the environment.

To install the MySQL dependency for a Node.js 8.10 function, run the following command:

```
npm install mysql --save
```

The **node_modules** folder is generated under the current directory.

- Linux OS

Run the following command to generate a ZIP package.

```
zip -rq mysql-node8.10.zip node_modules
```

The required dependency is generated.

- Windows OS

Compress **node_modules** into a ZIP file.

To install multiple dependencies, create a **package.json** file first. For example, enter the following content into the **package.json** file and then run the following command:

```
{
  "name": "test",
  "version": "1.0.0",
  "dependencies": {
    "redis": "~2.8.0",
    "mysql": "~2.17.1"
  }
}
npm install --save
```

 NOTE

Do not run the **CNPM** command to generate Node.js dependencies.

Compress **node_modules** into a ZIP package. This generates a dependency that contains both MySQL and Redis.

For other Node.js versions, you can create dependencies in the way stated above.

Creating a Dependency for a Java Function

When you compile a function using Java, dependencies need to be compiled locally.

14.4.8 How Do I Create a Dependency on the FunctionGraph Console?

1. Log in to the FunctionGraph console, and choose **Functions > Dependencies** in the navigation pane.
2. Click **Create Dependency**.
3. Set the following parameters.

Table 14-6 Dependency configuration parameters

Parameter	Description
Name	Dependency name.
Code Entry Mode	Upload a ZIP file directly or through OBS. <ul style="list-style-type: none"> • Upload ZIP file: Click Select File to upload a ZIP file. • Upload from OBS: Specify an OBS link URL.
Runtime	Select a runtime.
Description	Description of the dependency. This parameter is optional.

4. Click **OK**. By default, a new dependency is version 1.
5. Click the dependency name, and view all versions and related information on the displayed page. Each dependency can have multiple versions.
 - To create a dependency version, click **Create Version** in the upper right corner of the page.
 - To view the address of a version, click the version.
 - To delete a version, click the delete icon in the same row.



14.4.9 How Do I Add a Dependency to a Function?

1. On the function details page, click the **Code** tab, and click **Add** in the **Dependencies** area.
 - **Public:** Public dependencies are provided by FunctionGraph and can be directly added.
 - **Private:** Private dependencies are those you created and uploaded.
2. Click **OK**.

14.5 Function Execution FAQs

14.5.1 How Long Does It Take to Execute a FunctionGraph Function?

Within 900s for synchronous execution and 72 hours for asynchronous execution.

The default execution timeout is 3s. You can set the timeout (unit: s) to an integer from 3 to 259,200. If you set the timeout of a function to 3s, it will be terminated after 3s.

14.5.2 Which Steps Are Included in Function Execution?

Function execution includes two steps:

1. Select an idle instance with required memory.
2. Run specified code.

14.5.3 How Does FunctionGraph Process Concurrent Requests?

FunctionGraph automatically scales in or out function instances based on the number of requests. If the number of concurrent requests increases, FunctionGraph allocates more function instances to process the requests. If that number decreases, FunctionGraph allocates fewer function instances accordingly.

Number of function instances = Function concurrency/Concurrency per instance

- Function concurrency: the number of requests concurrently executed by a function at a certain time point.
- Concurrency per instance: the maximum number of concurrent requests allowed by a single instance. This is equivalent to the **Max. Requests per Instance** parameter on the **Concurrency** page.

14.5.4 What If Function Instances Have Not Been Executed for a Long Time?

If a function has not been executed for a period of time, all instances related to the function will be released.

14.5.5 How Can I Speed Up Initial Access to a Function?

C# and Go support a lower startup speed than other languages due to mechanism issues. You can use the following methods to speed up initial access to a function:

- Allocate more memory to the function.
- Simplify function code, for example, delete unnecessary dependency packages.
- When using C# in non-concurrent scenarios, you can also:
Create a one-minute timer trigger to ensure that there is at least one active instance.

14.5.6 How Do I Know the Actual Memory Used for Function Execution?

The returned information about a function contains the maximum memory consumed. Alternatively, check the memory usage in the execution result.

14.5.7 Why Is My First Request Slow?

Functions are cold-started. If initialization or a lengthy operation is performed during the first function execution, the first request will be delayed. However,

subsequent requests before container deletion will be faster. If there is no request within one minute, the container will be deleted.

14.5.8 What Do I Do If an Error Occurs When Calling an API?

Rectify the fault by referring to [Error Codes](#). If the fault persists, contact technical support.

14.5.9 How Do I Read the Request Header of a Function?

The first parameter in the function handler contains the request header. You can print the function execution result to obtain required fields.

As shown in the following figure, **event** is the first parameter in the function handler, and **headers** is the request header.



```
index.py x
1  # -*- coding:utf-8 -*-
2  import json
3  def handler (event, context):
4      body = "<html><title>Functiongraph Demo</title><body><p>Hello, FunctionGraph!
5      print(body)
6      return {
7          "statusCode":200,
8          "body":body,
9          "headers": {
10             "Content-Type": "text/html",
11         },
12         "isBase64Encoded": False
13     }
```

14.5.10 Why Does a Function Use More Memory Than Estimated and Even Trigger the Out of Memory Alarm?

1. Event parsing and cache consume extra memory during function invocation.
2. After the invocation is complete, reclaimed memory is often put in the internal pool instead of back to the OS, resulting in high memory usage. This is more obvious in the case of high concurrency.

14.5.11 How Do I Check the Memory Usage When Seeing "runtime memory limit exceeded"?

Check the used memory in the response.

Figure 14-12 Checking the used memory

```
2022-07-21T07:10:22Z Start invoke request '696ca9a9-22d9-4602-a354-decf8c99aac3',
version: latest
2022-07-21T07:10:23Z Finish invoke request '696ca9a9-22d9-4602-a354-
decf8c99aac3'(invoke Failed:RuntimeMemoryExceedLimit), duration: 1266.043ms, billing
duration: 1267ms, memory used: 510.953MB, billing memory: 512MB
```

14.5.12 How Do I Troubleshoot "CrashLoopBackOff"?

The message "CrashLoopBackOff: The application inside the container keeps crashing" is displayed when a custom image execution failure occurs. In this case, perform the following operations:

1. Analyze the causes.

Figure 14-13 Viewing the execution result

```
function invocation exception, error: CrashLoopBackOff: The application inside the container keeps crashing:
Traceback (most recent call last):
  File "app.py", line 1, in <module>
    from flask import Flask, request, g
ModuleNotFoundError: No module named 'flask'
```

2. Verify the container image by referring to [Deploying a Function Using a Container Image](#).
3. Check whether the image uses the Linux x86 architecture. Currently, only Linux x86 images are supported.

14.5.13 After I Updated an Image with the Same Name, Reserved Instances Still Use the Old Image. What Can I Do?

Use a non-latest tag to manage image updates, and do not use the same image name.

14.6 Function Configuration FAQs

14.6.1 Can I Set Environment Variables When Creating Functions?

Yes. Set variables to dynamically pass settings to your function code and libraries without changing your code. For more information, see section "Configuring Environment Variables" in the *FunctionGraph User Guide*.

14.6.2 Can I Enter Sensitive Information in Environment Variables?

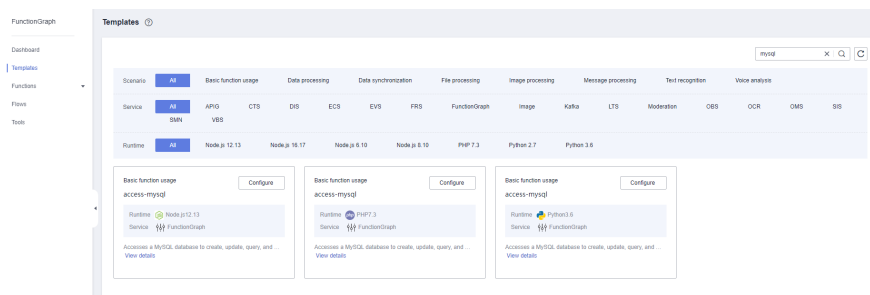
FunctionGraph displays all the information you enter in plain text. Therefore, do not enter insensitive information such as passwords when you define environment variables.

14.7 External Resource Access FAQs

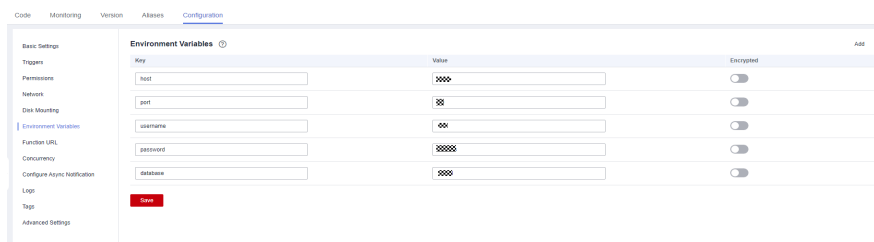
14.7.1 How Does a Function Access the MySQL Database?

Perform the following operations:

1. Check whether the MySQL database is deployed in a VPC.
 - Yes: Configure the same VPC and subnet as the MySQL database for the function by referring to [Configuring VPC Access](#).
 - No: See [How Do I Configure External Network Access?](#)
2. Search for MySQL templates and select the one with the desired runtime, as shown in [Figure 14-14](#). Set the parameters as required and click **Create Function**.

Figure 14-14 Selecting a function template

3. After the MySQL function is created, choose **Configuration > Environment Variables**, enable encryption as required (see [Figure 14-15](#)), and click **Save**.

Figure 14-15 Enabling encryption**NOTE**

If the function needs to access RDS APIs, [create an agency](#) and grant required permissions.

14.7.2 How Does a Function Access Redis?

Perform the following operations:

1. Check whether the Redis instance is deployed in a VPC.
 - If the Redis instance is deployed in a VPC, configure the same VPC and subnet as the Redis instance for the function by referring to [Configuring VPC Access](#).
 - If the Redis instance is built on a public network, obtain its public IP address.
2. Compile code for connecting a function to the Redis instance.

FunctionGraph has integrated third-party library [redis-py](#) in its Python 2.7 and Python 3.6 runtimes. Therefore, you do not need to download any other Redis libraries.

```
# -*- coding:utf-8 -*-
import redis
def handler (event, context):
    r = redis.StrictRedis(host="host_ip",password="passwd",port=6379)
    print(str(r.get("hostname")))
    return "^_^"
```

NOTE

- If the function fails to access to the Redis instance on a public network, perform the following operations:
 - Modify the **redis.conf** file to allow access from any IP addresses.
 - Set a password for accessing the Redis instance in the **redis.conf** file.
 - Disable the firewall.
- If the function needs to access DCS APIs, [create an agency](#) and grant required permissions.

14.7.3 How Do I Configure External Network Access?

By default, functions deployed in a VPC are isolated from the Internet. If a function needs to access both internal and external networks, add a NAT gateway for the VPC.

Prerequisites

1. You have created a VPC and subnet according to [Creating a VPC](#).
2. You have obtained an elastic IP address according to [Assigning an EIP](#).

Procedure of Creating a NAT Gateway

- Step 1** Log in to the NAT Gateway console, and click **Create NAT Gateway**.
- Step 2** On the displayed page, enter gateway information, select a VPC and subnet (for example, **vpc-01**), and confirm and submit the settings to create a NAT gateway. For details, see [Creating a NAT Gateway](#).
- Step 3** Click the NAT gateway name. On the details page that is displayed, click [Add an SNAT Rule](#) and click **OK**.

----End

14.8 Other FAQs

14.8.1 How Do I View the Alarm Rules Configured for a Function?

Log in to the Cloud Eye console and view alarm rules.

14.8.2 Does FunctionGraph Support ZIP Decompiling During Video Transcoding?

No. Please decompile your files before uploading them.

15 Change History

Table 15-1 Change history

Date	Description
2023-5-30	This issue is the first official release.