

Assignment: Exploring Serverless Computing and Cron Jobs in Azure, GCP, and GitHub

Objective

The objective of this assignment is to introduce you to serverless computing and the use of cron jobs in cloud environments. You will deploy serverless functions on both Azure and Google Cloud Platform (GCP), and create a scheduled task using GitHub Actions.

Instructions

1. Deploy a Serverless Function

- **Azure:**
 - Navigate to the Azure portal and create an Azure Function.
 - Choose a simple trigger (e.g., HTTP trigger) and deploy a basic function (e.g., "Hello, World").
- **GCP:**
 - Access the Google Cloud Console and create a Google Cloud Function.
 - Deploy a similar function with an HTTP trigger in GCP.

Create Function in Microsoft Azure

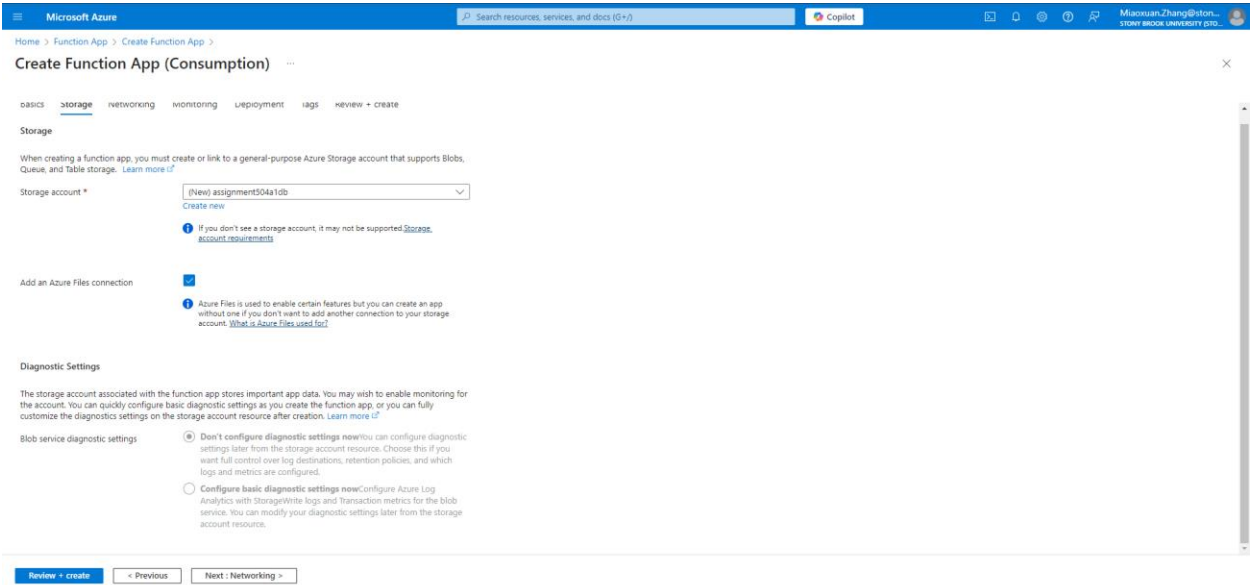
Set up Basics

The screenshot shows the 'Create Function App (Consumption)' page in the Microsoft Azure portal. The page is titled 'Create Function App (Consumption)' and has a breadcrumb trail: 'Home > Function App > Create Function App'. Below the title, there are tabs for 'Basics', 'Storage', 'Networking', 'Monitoring', 'Deployment', 'Tags', and 'Review + create'. The 'Basics' tab is selected. The page contains the following sections:

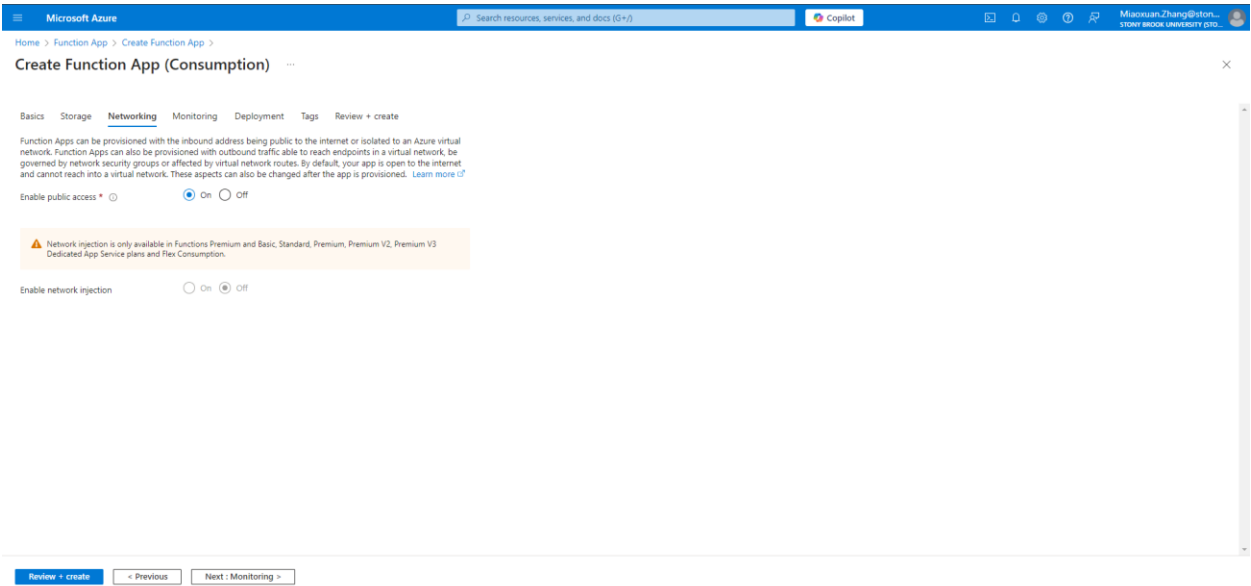
- Project Details:** Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.
 - Subscription: Azure for Students
 - Resource Group: assignment_504 (with a 'Create new' link)
- Instance Details:**
 - Function App name: miao-serverless-testing (with a dropdown arrow and 'azurewebsites.net' as the domain)
 - Runtime stack: Python
 - Version: 3.11
 - Region: East US
 - Operating System: Linux (selected), Windows

At the bottom, there are three buttons: 'Review + create' (in blue), '< Previous', and 'Next: Storage >'.

Storage



Networking



Monitoring

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

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STONY BROOK UNIVERSITY (STO...)

Home > Function App > Create Function App >

Create Function App (Consumption) ...

BasicsStorageNetworkingMonitoringDeploymentTagsReview + create

Application Insights

Azure Monitor application insights is an Application Performance Management (APM) service for developers and DevOps professionals. Enable it below to automatically monitor your application. It will detect performance anomalies, and includes powerful analytics tools to help you diagnose issues and to understand what users actually do with your app. Your bill is based on amount of data used by Application Insights and your data retention settings. [Learn more](#)

[App Insights pricing](#)

Enable Application Insights *

☒ No ☐ Yes

Review + create

< Previous

Next : Deployment >

Deployment

Microsoft Azure

Search resources, services, and docs (G+)

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Home > Function App > Create Function App >

Create Function App (Consumption) ...

Continuous deployment settings

Set up continuous deployment to easily deploy code from your GitHub repository via GitHub Actions. [Learn more](#)

Continuous deployment

☒ Disable ☐ Enable

GitHub settings

Set up GitHub Actions to push content to your app whenever there are code changes made to your repository. Note: Your GitHub account must have write access to the selected repository in order to add a workflow file which manages deployments to your app.

GitHub account

Authorize

Organization

Select organization

Repository

Select repository

Branch

Select branch

Workflow configuration

Click the button below to preview what the GitHub Actions workflow file will look like before setting up continuous deployment.

Complete the Basics tab and the form above to preview the GitHub Actions workflow file.

Preview file

Authentication settings

Choose if you would like to allow basic authentication to deploy code to your app. [Learn more](#)

Basic authentication

☐ Disable ☒ Enable

Review + create

< Previous

Next : Tags >

Create

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

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STONY BROOK UNIVERSITY (STO...

Home >

Microsoft.Web-FunctionApp-Portal-2554b9d9-b7e0 | Overview

Deployment

Search

Delete Cancel Redeploy Download Refresh

Overview

Inputs

Outputs

Template

✓ Your deployment is complete

Deployment name : Microsoft.Web-FunctionApp-Portal-2554b9d9-b7e0
Subscription : Azure for Students
Resource group : assignment_504

Start time : 10/4/2024, 3:06:17 PM
Correlation ID : d853c40e-3b21-452d-b2fb-f340ed7db609

> Deployment details

Next steps

Go to resource

Cost management

Get notified to stay within your budget and prevent unexpected charges on your bill.
Set up cost alerts >

Microsoft Defender for Cloud

Secure your apps and infrastructure
Go to Microsoft Defender for Cloud >

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Work with an expert

Azure experts are service provider partners who can help manage your assets on Azure and be your first line of support.
Find an Azure expert >

Function APP

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

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STONY BROOK UNIVERSITY (STO...

Home >

Function App

Stony Brook University (stonybrook365.onmicrosoft.com)

+ Create Manage view Refresh Export to CSV Open query Assign tags Start Restart Stop Delete

Filter for any field... Subscription equals all Resource group equals all Location equals all Add filter

Showing 1 to 1 of 1 records.

No grouping List view

Name	Status	Location	Pricing Tier	App Service Plan	Subscription	App Type
miao-serverless-testing	Running	East US	Dynamic	ASP-assignment504-adf3	Azure for Students	Function App

< Previous Page 1 of 1 Next >

Give feedback

Create Function

Microsoft Azure

Function App

Stony Brook University (stonybrook365.onmicrosoft.com)

Create Manage view

Filter for any field...

Name ↑

miao-serverless-testing

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Microsoft Defender for Cloud

Events (preview)

Better Together (preview)

Functions

App keys

App files

Proxies

Deployment

Settings

Performance

App Service plan

API

Monitoring

Automation

Support + troubleshooting

Essentials

Resource group (move) : assignment_504

Status : Running

Location (move) : East US

Subscription (move) : Azure for Students

Subscription ID : 82148462-f1b5-43b0-a2b9-794830ed812e

Tags (edit) : Add tags

Functions Metrics Properties Notifications (0)

Create in Azure portal

Best optimized for:

- Getting started without local se
- Choose from our Function tem

Create function

Create function

1 Select a template 2 Template details

Programming Model v2 Programming Model

Use a template to create a function. Triggers describe the type of events that invoke your functions. [Learn more](#)

Search

Name	Trigger
HTTP trigger	A function that will be run whenever it receives an HTTP request, responding based on data in the body or query string
Timer Trigger	A function that will be run on a specified schedule
Queue trigger	A function that will be run whenever a message is added to a specified Azure Storage queue
ServiceBus Queue trigger	A function that will be run whenever a message is added to a specified Service Bus queue
ServiceBus Topic trigger	A function that will be run whenever a message is added to the specified Service Bus topic
Blob trigger	A function that will be run whenever a blob is added to a specified container
EventHub trigger	A function that will be run whenever an event hub receives a new event
CosmosDB trigger	A function that will be run whenever documents change in a document collection
Dapr Publish Output Binding	A function that will publish message on a topic to message broker using Dapr.
Dapr Service Invocation Trigger	A function that will be invoked by other app or functions using Dapr.
Dapr Topic Trigger	A function that will be invoked when a message is received on a subscribed topic in message broker using Dapr.
EventGrid trigger	A function that will be run whenever an event grid receives a new event

Next Cancel

Select HTTP trigger

Microsoft Azure

Function App

Stony Brook University (stonybrook365.onmicrosoft.com)

Create Manage view

Filter for any field...

Name ↑

miao-serverless-testing

Overview

Activity log

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Tags

Diagnose and solve problems

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Subscription ID : 82148462-f1b5-43b0-a2b9-794830ed812e

Tags (edit) : Add tags

Functions Metrics Properties Notifications (0)

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Next Cancel

Create

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

Home > Function App > miao-serverless-testing >

http.trigger1 | Code + Test

miao-serverless-testing

Code + Test Integration Function Keys Invocations Logs Metrics

Save Discard Refresh Test/Run Get function URL Disable Delete Upload Resource JSON Send us your feedback

```
1 import azure.functions as func
2 import logging
3
4 app = func.FunctionApp(http_auth_level=func.AuthLevel.FUNCTION)
5
6 @app.route(route="http_trigger1")
7 def http_trigger1(req: func.HttpRequest) -> func.HttpResponse:
8     logging.info("Python HTTP trigger function processed a request.")
9
10     name = req.params.get('name')
11     if not name:
12         try:
13             req_body = req.get_json()
14         except ValueError:
15             pass
16         else:
17             name = req_body.get('name')
18
19     if name:
20         return func.HttpResponse(f"Hello, {name}. This HTTP triggered function executed successfully.")
21     else:
22         return func.HttpResponse("This HTTP triggered function executed successfully. Pass a name in the query string or in the request body for a personalized response.")
```

Logs

App Insights Logs Log Level Stop Copy Clear Maximize Send us your feedback

Configure Application Insights to capture invocation logs

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

Home > Function App > miao-serverless-testing >

http.trigger1 | Code + Test

miao-serverless-testing

Code + Test Integration Function Keys Invocations Logs Metrics

Save Discard Refresh Test/Run Get function URL Disable Delete Upload Resource JSON Send us your feedback

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```

Logs

App Insights Logs Log Level Stop Copy Clear Maximize Send us your feedback

Configure Application Insights to capture invocation logs

Test/Run

Input Output

Provide parameters to test the HTTP request. Results can be found in the Output tab.

HTTP method * POST

Key * _master (Host key)

Query parameters

Name	Value

Headers

Name	Value

Body

```
1 {
2   "name": "Hlaoxuan"
3 }
```

Run Close

Create a Function in GCP

Google Cloud

Miaoxuan-Zhang-Nha504

Search (/) for resources, docs, products, and more

Search

Cloud Run functions

Functions

CREATE FUNCTION

REFRESH

LEARN

RELEASE NOTES

We will be integrating Cloud Functions into Cloud Run UI in the upcoming months.

LEARN MORE

GO TO CLOUD RUN

Filter Functions

Environment	Name	Last deployed	Region	Recommendation	Trigger	Runtime	Memory allocated	Executed function	Actions
Cloud Run function	blood-pressure	Oct 4, 2024, 12:47:02 PM	us-central1		HTTP	Python 3.10	256 MB	hello_http	

Now viewing project "Miaoxuan-Zhang-Nha504" in organization "stonybrook.edu"

LEARN Tutorial

Get started with Cloud Run functions

Cloud Run functions overview

Help document

Write simple, single-purpose functions that are triggered by events and run in a fully managed environment.

Quickstart

Tutorial 5 min

Create a function that is triggered by an HTTP request.

Use cases for Cloud Run functions

Help document

Explore use cases, best practices, and industry solutions.

Configuring Cloud Run functions

Help document

Use configuration options to control the behavior of your Cloud Run functions.

Local Development

Help document

Develop your Cloud Run functions locally.

Deploying Cloud Run functions

Help document

Deploy your Cloud Run functions.

Architecture guides for application development

Help document

Google Cloud

Miaoxuan-Zhang-Nha504

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Search

Cloud Run functions

Create function

LEARN

1 Configuration

2 Code

Basics

Environment

Cloud Run function

Function name *

Assignment-504-Function

Region *

us-central1 (Iowa)

Trigger

Trigger type

HTTPS

URL

https://us-central1-miaoxuan-zhang-nha504.cloudfunctions.net/Assignment-504-Function

Function

Authentication

Allow unauthenticated invocations

Check this if you are creating a public API or website.

Require authentication

Manage authorized users with Cloud IAM.

Runtime, build, connections and security settings

NEXT

CANCEL

Now viewing project "Miaoxuan-Zhang-Nha504" in organization "stonybrook.edu"

LEARN Tutorial

Recommended for you

Cloud Run functions overview

Help document

Get an overview of Cloud Run functions features.

Quickstart

Tutorial 5 min

Create a simple HTTP function.

Use cases for Cloud Run functions

Help document

Explore use cases, best practices, and industry solutions.

Writing Cloud Run functions

Help document

Set up your development environment, structure your source code, and specify dependencies for different runtimes.

Deploying Cloud Run functions

Help document

Deploy your Cloud Run functions.

Calling Cloud Run functions

Help document

Call your Cloud Run functions.

Architecture guides for application development

Help document

Discover best practices and reference architectures for application development.

Google Cloud

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Search

Cloud Run functions

Functions

CREATE FUNCTION

REFRESH

LEARN

RELEASE NOTES

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LEARN MORE

GO TO CLOUD RUN

Filter

Filter functions

Environment	Name	Last deployed	Region	Recommendation	Trigger	Runtime	Memory allocated	Executed function	Actions
<input checked="" type="checkbox"/>	Cloud Run function	Assignment-504-Function	Oct 4, 2024, 4:42:09 PM	us-central1	HTTP	Node.js 20	256 MiB	hellohttp	<div></div>
<input checked="" type="checkbox"/>	Cloud Run function	blood-pressure	Oct 4, 2024, 12:47:02 PM	us-central1	HTTP	Python 3.10	256 MiB	hello_http	<div></div>

Cloud Shell

Terminal

miaoxuan-zhang-hha504

+

Open Editor

Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to miaoxuan-zhang-hha504.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
miaoxuan_zhang@cloudshell:~ (miaoxuan-zhang-hha504)\$

Get started with Cloud Run functions

Cloud Run functions overview

Quickstart

Use cases for Cloud Run functions

Configuring Cloud Run functions

Local Development

Deploying Cloud Run functions

Architecture guides for application development

Google Cloud

Miaoxuan-Zhang-hha504

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Search

Cloud Run functions

Function details

EDIT

DELETE

COPY

LEARN

Assignment-504-Function

Cloud Run function

Deployed at Oct 4, 2024, 4:42:09 PM

URL: https://us-central1-miaoxuan-zhang-hha504.cloudfunctions.net/Assignment-504-Function

View in Cloud Run

METRICS

DETAILS

SOURCE

VARIABLES

TRIGGER

PERMISSIONS

LOGS

TESTING

Predefined

1 hour

6 hours

12 hours

1 day

2 days

4 days

7 days

14 days

30 days

Invocations/Second

No data is available for the selected time frame.

UTC-4

4:00 PM

4:10 PM

4:20 PM

4:30 PM

4:40 PM

4:50 PM

4:55 PM

0 time series

Execution time

No data is available for the selected time frame.

UTC-4

4:00 PM

4:10 PM

4:20 PM

4:30 PM

4:40 PM

4:50 PM

4:55 PM

0 time series

Cloud Shell

Terminal

miaoxuan-zhang-hha504

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miaoxuan_zhang@cloudshell:~ (miaoxuan-zhang-hha504)\$

Recommended for you

Configuring Cloud Run functions

Events and Triggers

Authenticating for invocation

Access control with IAM

Writing, Viewing, and Responding to Logs

Testing Basics

Architecture guides for application development

Google Cloud | Miaoxuan-Zhang-hha504 | Search (/) for resources, docs, products, and more

Cloud Run functions | Edit function

Configuration — Code

Runtime: Python 3.10 | Entry point: hello_http | TEST FUNCTION

If you change the runtime language without also updating the source code, the deployment might fail.

Source code: Inline Editor

main.py

```
1 import functions_framework
2
3 @functions_framework.http
4 def hello_http(request):
5     """HTTP Cloud Function.
6
7     Args:
8         request (flask.Request): The request object.
9         <https://flask.palletsprojects.com/en/1.1.x/api/#incoming-request-data>
10
11     Returns:
12         The response text, or any set of values that can be turned into a
13         Response object using 'make_response'
14         <https://flask.palletsprojects.com/en/1.1.x/api/#flask.make_response>.
15     """
16     request_json = request.get_json(silent=True)
17     request_args = request.args
```

PREVIOUS DEPLOY CANCEL

CLOUD SHELL Terminal (miaoxuan-zhang-hha504) | Open Editor

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to miaoxuan-zhang-hha504.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
miaoxuan_zhang@cloudshell:~ (miaoxuan-zhang-hha504)$
```

Recommended for you

- Troubleshooting Cloud Run functions | Help document
- Configuring Cloud Run functions | Help document
- Using Environment Variables | Help document
- Writing Cloud Run functions | Help document
- Deploying Cloud Run functions | Help document
- Calling Cloud Run functions | Help document
- Cloud Run functions Execution Environment | Help document

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Cloud Run functions | Edit function

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PREVIOUS DEPLOY CANCEL

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Recommended for you

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- Cloud Run functions Execution Environment | Help document

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Cloud Run functions | Edit function

Configuration | Code

Runtime: Python 3.10 | Entry point: hello_http | TEST FUNCTION

If you change the runtime language without also updating the source code, the deployment might fail.

Source code: Inline Editor | main.py | requirements.txt

Press Alt+F1 for Accessibility Options.

1 import FunctionsFramework
2
3 @FunctionsFramework.http
4 def hello_http(request):
5 """HTTP Cloud Function.
6
7 Args:
8 request (flask.Request): The request object.
9 <https://flask.palletsprojects.com/en/1.1.x/api/#incoming-request-data>
10 Returns:
11 The response text, or any set of values that can be turned into a
12 Response object using "make_response"
13 <https://flask.palletsprojects.com/en/1.1.x/api/#flask.make_response>.
14 request_json = request.get_json(silent=True)
15 request_args = request.args

Test your function before deploying PREVIEW

To test your function, GCP is initializing Cloud Shell and sets-up the testing environment. This may take from 30 seconds to a minute to complete.

This process includes:

- Installing dependencies (Learn more about the [Functions Framework](#).)
- Syncing embedded code editors local storage with Cloud Shell storage

Your GCP credentials will be used to build and execute the function within Cloud Shell, but you will not be billed for any invocations that occur in this scenario.

Please view Cloud Shell output for complete log information.

Note: After testing you will still need to deploy your function to save changes.

☒ Show this next time

START TESTING CANCEL Open Editor

Cloud Shell Terminal (miaoxuan-zhang-hha504) x GCF Testing x

[9:01:27 PM] - Testing server starting ...

Recommended for you

- Troubleshooting Cloud Run functions
- Configuring Cloud Run functions
- Using Environment Variables
- Writing Cloud Run functions
- Deploying Cloud Run functions
- Calling Cloud Run functions
- Cloud Run functions Execution Environment

Google Cloud | Miaoxuan-Zhang-hha504 | Search (/) for resources, docs, products, and more

Cloud Run functions | Edit function

Configuration | Code

Runtime: Python 3.10 | Entry point: hello_http | TEST FUNCTION

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Source code: Inline Editor | main.py | requirements.txt

Press Alt+F1 for Accessibility Options.

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13 <https://flask.palletsprojects.com/en/1.1.x/api/#flask.make_response>.
14 request_json = request.get_json(silent=True)
15 request_args = request.args

Configure pre-deployment test PREVIEW

Function is ready to be tested.

Triggering event

Press Alt+F1 for Accessibility Options.

1
2 "name": "Hello World"
3

PREVIOUS DEPLOY CANCEL

Cloud Shell Terminal (miaoxuan-zhang-hha504) x GCF Testing x

[builder] Running "python3 -m pip check"
[builder] No broken requirements found.
[builder] Done "python3 -m pip check" (401.461001ms)
[builder] ==> Utils - Label Image (google.utils.label-
[5:03:07 PM] -

Authorize Cloud Shell

Cloud Shell needs permission to use your credentials for the gcloud CLI command.

Click Authorize to grant permission to this and future calls.

Reject Authorize

Recommended for you

- Troubleshooting Cloud Run functions
- Configuring Cloud Run functions
- Using Environment Variables
- Writing Cloud Run functions
- Deploying Cloud Run functions
- Calling Cloud Run functions
- Cloud Run functions Execution Environment

Google Cloud | Miaoxuan-Zhang-h5a504 | Search (/) for resources, docs, products, and more

Cloud Run functions | Edit function

Configuration | Code

Runtime: Python 3.10 | Entry point: hello_http | TEST FUNCTION

If you change the runtime language without also updating the source code, the deployment might fail. [DISMISS](#)

Source code: Inline Editor

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PREVIOUS DEPLOY CANCEL

Cloud Shell Terminal (miaoxuan-zhang-h5a504) x GCF Testing x +

```
[builder] Running "python3 -m pip check"
[builder] No broken requirements found.
[builder] Done "python3 -m pip check" (401.461001ms)
[builder] === Utils - Label image (google.utils.label-image@0.0.2) ===

[5:03:07 PM] - Function is ready to test
```

Configure pre-deployment test [PREVIEW](#)

Function is ready to be tested.

Triggering event

```
1 {
2   "name": "LabelImage"
3 }
```

RUN TEST

Recommended for you

- Troubleshooting Cloud Run functions [Help document](#)
- Configuring Cloud Run functions [Help document](#)
- Using Environment Variables [Help document](#)
- Writing Cloud Run functions [Help document](#)
- Deploying Cloud Run functions [Help document](#)
- Calling Cloud Run functions [Help document](#)
- Cloud Run functions Execution Environment [Help document](#)

Google Cloud | Miaoxuan-Zhang-h5a504 | Search (/) for resources, docs, products, and more

Cloud Run functions | Edit function

Configuration | Code

Runtime: Python 3.10 | Entry point: hello_http | TEST FUNCTION

If you change the runtime language without also updating the source code, the deployment might fail. [DISMISS](#)

Source code: Inline Editor

```
1 import functions_framework
2
3 @functions_framework.http
4 def hello_http(request):
5     """HTTP Cloud Function.
6
7     Args:
8         request (flask.Request): The request object.
9         <https://flask.palletsprojects.com/en/1.1.x/api/#incoming-request-data>
10     Returns:
11         The response text, or any set of values that can be turned into a
12         Response object using 'make_response'
13         <https://flask.palletsprojects.com/en/1.1.x/api/#flask.make_response>.
14     """
15     request_json = request.get_json(silent=True)
16     request_args = request.args
```

PREVIOUS DEPLOY CANCEL

Cloud Shell Terminal (miaoxuan-zhang-h5a504) x GCF Testing x +

```
[builder] No broken requirements found.
[builder] Done "python3 -m pip check" (401.461001ms)
[builder] === Utils - Label image (google.utils.label-image@0.0.2) ===

[5:03:07 PM] - Function is ready to test

[5:05:53 PM] - Execution response: Hello Miaomiao!
```

Configure pre-deployment test [PREVIEW](#)

Last test: Oct 4, 2024, 5:05:53PM (HTTP status: 200)

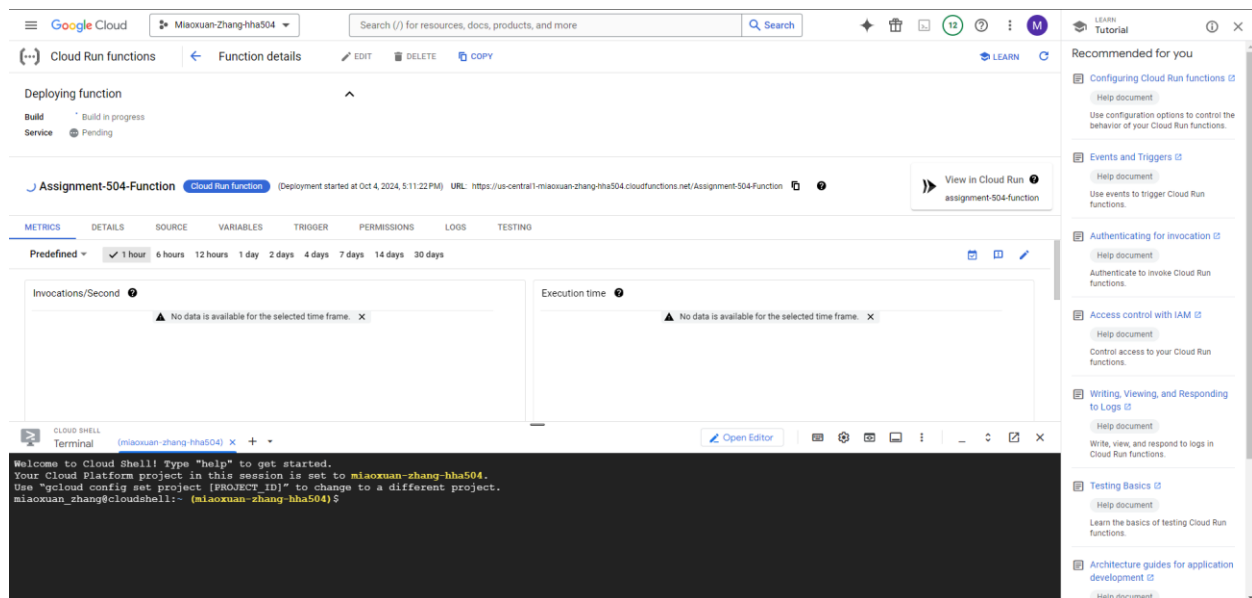
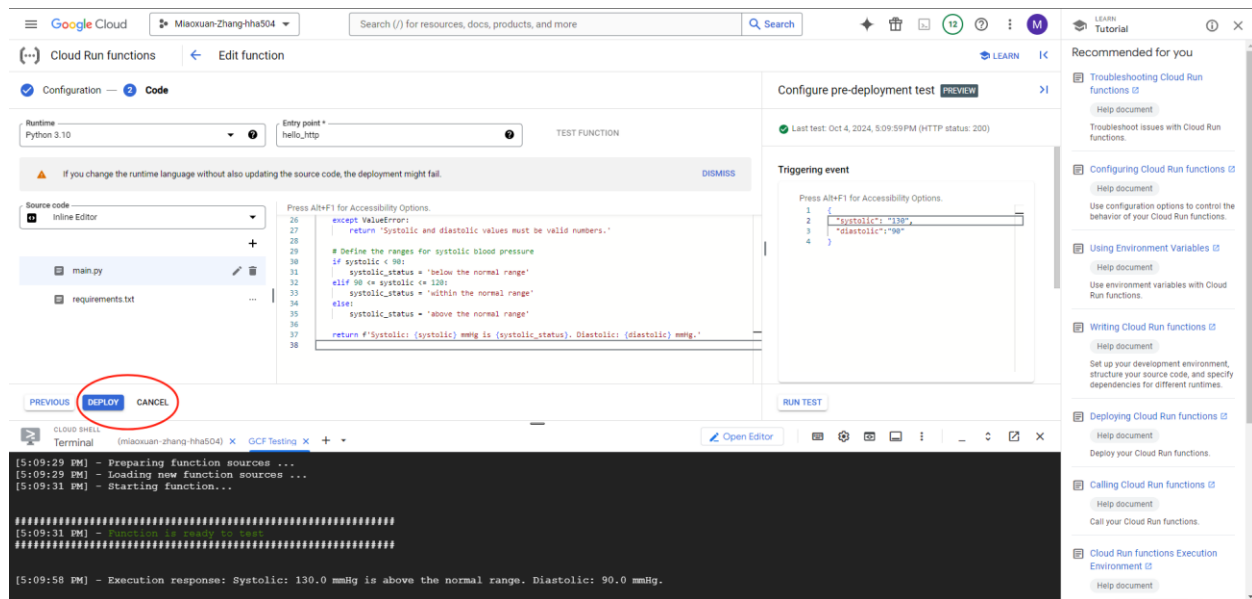
Triggering event

```
1 {
2   "name": "LabelImage"
3 }
```

RUN TEST

Recommended for you

- Troubleshooting Cloud Run functions [Help document](#)
- Configuring Cloud Run functions [Help document](#)
- Using Environment Variables [Help document](#)
- Writing Cloud Run functions [Help document](#)
- Deploying Cloud Run functions [Help document](#)
- Calling Cloud Run functions [Help document](#)
- Cloud Run functions Execution Environment [Help document](#)



3. Explore Functions as a Service (FaaS)

- Reflect on the use cases for serverless functions in cloud environments. Consider the benefits and limitations of using Functions as a Service (FaaS) in both Azure and GCP.

Functions as a Service (FaaS) is a serverless computing model where developers can deploy and run individual functions without having to manage the underlying infrastructure. FaaS allows developers to focus solely on writing the business logic of a function, while the cloud provider handles server provisioning, scaling, and maintenance.

Advantage:

1. **No Server Management:** No need to manage or configure servers; the cloud provider handles everything.
2. **Cost-Efficient:** Only pay for the actual function execution time, which is great for unpredictable workloads.
3. **Fast Deployment:** Functions can be quickly deployed with minimal configuration, making development cycles faster.
4. **Auto-Scaling:** Functions can scale up automatically to meet demand without any intervention from developers.