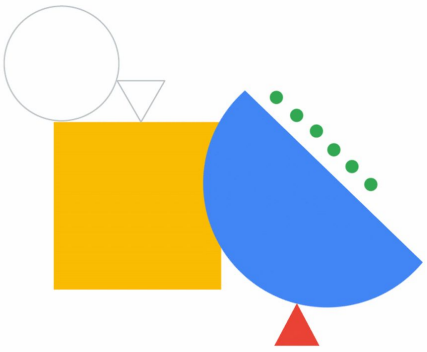
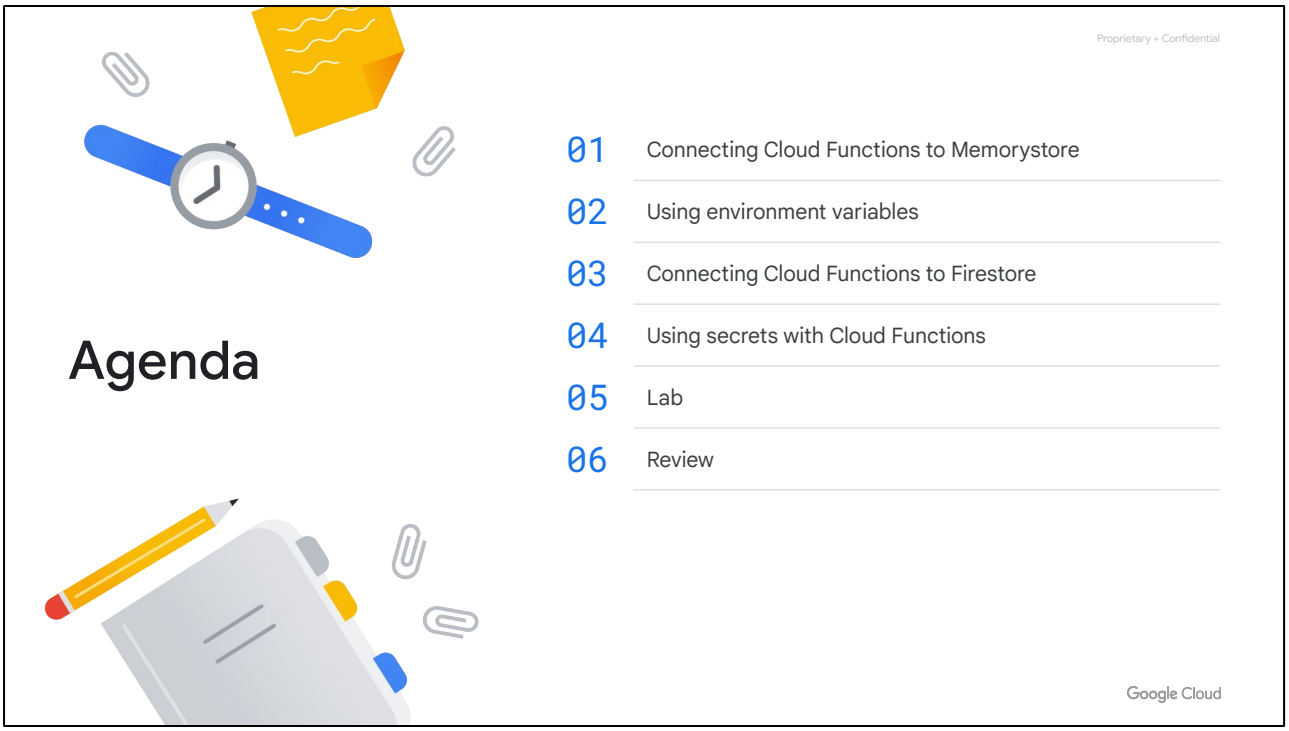
Google Cloud

Integrating with Cloud Databases



In this module, we discuss how to you can integrate your functions with cloud databases.

You learn how to securely connect your functions to read and write data from and to Firestore and Memorystore databases in Google Cloud.

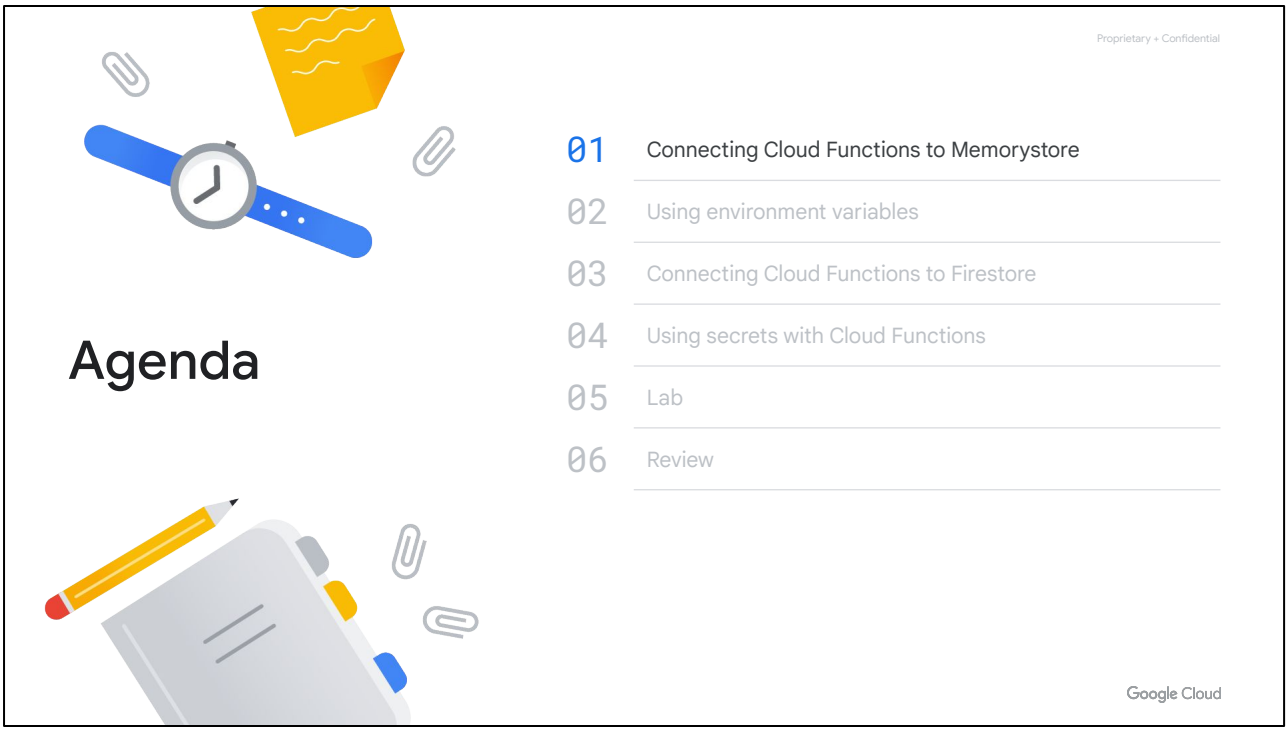


In this module, we first discuss how to connect Cloud Functions to Memorystore, Google Cloud's cache service, and discuss how you can use environment variables with Cloud Functions.

We'll then discuss how you can connect Cloud Functions to Firestore, and how you can use secrets with Cloud Functions.

You'll then complete a lab on integrating Cloud Functions with Firestore.

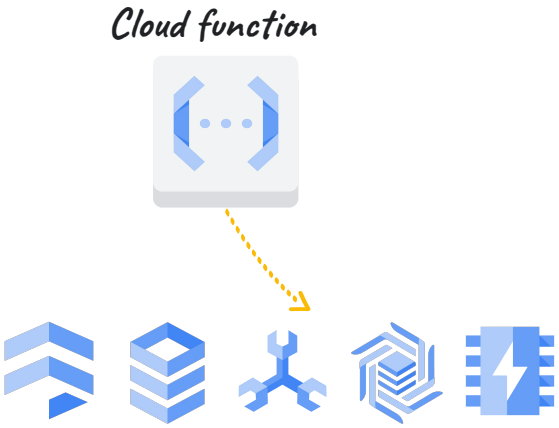
Finally, we review what was discussed in this module.


Proprietary + Confidential
Agenda
01 Connecting Cloud Functions to Memorystore
02 Using environment variables
03 Connecting Cloud Functions to Firestore
04 Using secrets with Cloud Functions
05 Lab
06 Review
Google Cloud

Let’s begin.

Integrate Cloud Functions with Cloud databases

- Firestore
- Cloud SQL
- Cloud Spanner
- Cloud Bigtable
- Memorystore (in-memory cache service)



You can integrate Cloud Functions with:

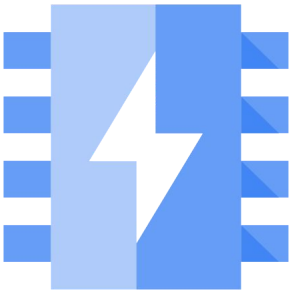
- Firestore
- Cloud SQL
- Cloud Spanner
- Cloud Bigtable

and with Memorystore, Google Cloud's in-memory cache service. In this module, we discuss how you can connect your Cloud Functions to Memorystore and Firestore.

For information about connecting to other Cloud databases, refer to the documentation:

Connect Cloud Functions to Cloud SQL
Connect Cloud Functions to Cloud Bigtable
Connect Cloud Functions to Cloud Spanner

Memorystore



- Fully managed in-memory cache solution
- Supports Redis and Memcached
- Automates provisioning, replication, failover, and patching
- Integrated with IAM and Cloud Monitoring

Memorystore is a Google Cloud service that provides a highly available, scalable, and secure in-memory cache solution for Redis and Memcached.

It's a fully managed service that automates provisioning, replication, failover, and patching.

It's also integrated with IAM for secure access, and with Cloud Monitoring for service monitoring and alerting.

For a complete list of features, see the Memorystore documentation.

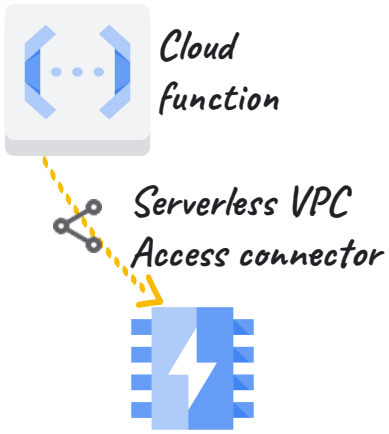
Redis is an open source in-memory data structure store used as a database, cache, message broker, and streaming engine.

Memcached is an open source distributed memory object caching system.

Connect Cloud Functions to Memorystore (Redis)

To access Memorystore from Cloud Functions:

- Determine your Redis instance's authorized VPC network.
- Create a Serverless VPC Access connector.
- Attach the connector to the Redis instance's authorized VPC network.

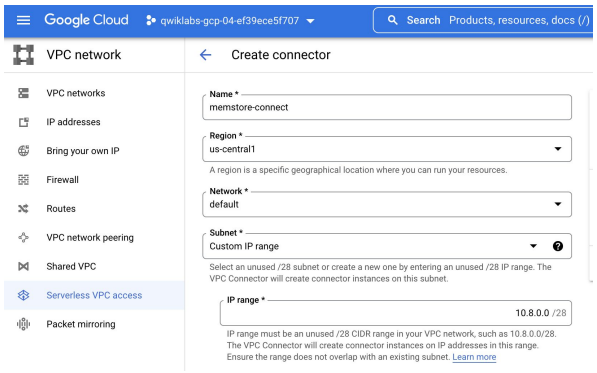


You can connect to a Redis instance from Cloud Functions by using Serverless VPC Access.

Once you've determined your Redis instance's authorized VPC network, you create a Serverless VPC Access connector in the same region as your function.

Then, attach the connector to the Redis instance's authorized VPC network.

Creating the VPC connector



gcloud CLI

```
gcloud compute networks vpc-access
connectors create CONNECTOR_NAME \
--network VPC_NETWORK \
--region REGION \
--range IP_RANGE


gcloud compute networks vpc-access
connectors describe CONNECTOR_NAME \
--region REGION
```


Specify the network, region, and IP address range when the VPC connector is created.

Ensure that the connector is in a Ready state before using it.

Connect Cloud Functions to Memorystore (Redis)

Deploy the function:

- Specify the path and name of the connector.
- Set environment variables for the function code to connect to the Redis host and port.

gcloud CLI

```
gcloud functions deploy visit_count \
--runtime python37 \
--trigger-http \
--region [REGION] \
--vpc-connector
projects/[PROJECT_ID]/locations/[REGI
ON]/connectors/[CONNECTOR_NAME] \
--set-env-vars
REDISHOST=[REDIS_IP],REDISPORT=[REDIS_
PORT]
```


Deploy the function specifying the path and name of the connector, and environment variables for the Redis host IP address and port.

Your function code can then use these environment variables to instantiate a client that connects to the Redis service.

Invoke the function

To invoke the function:

- Send an HTTP GET request to the function url.

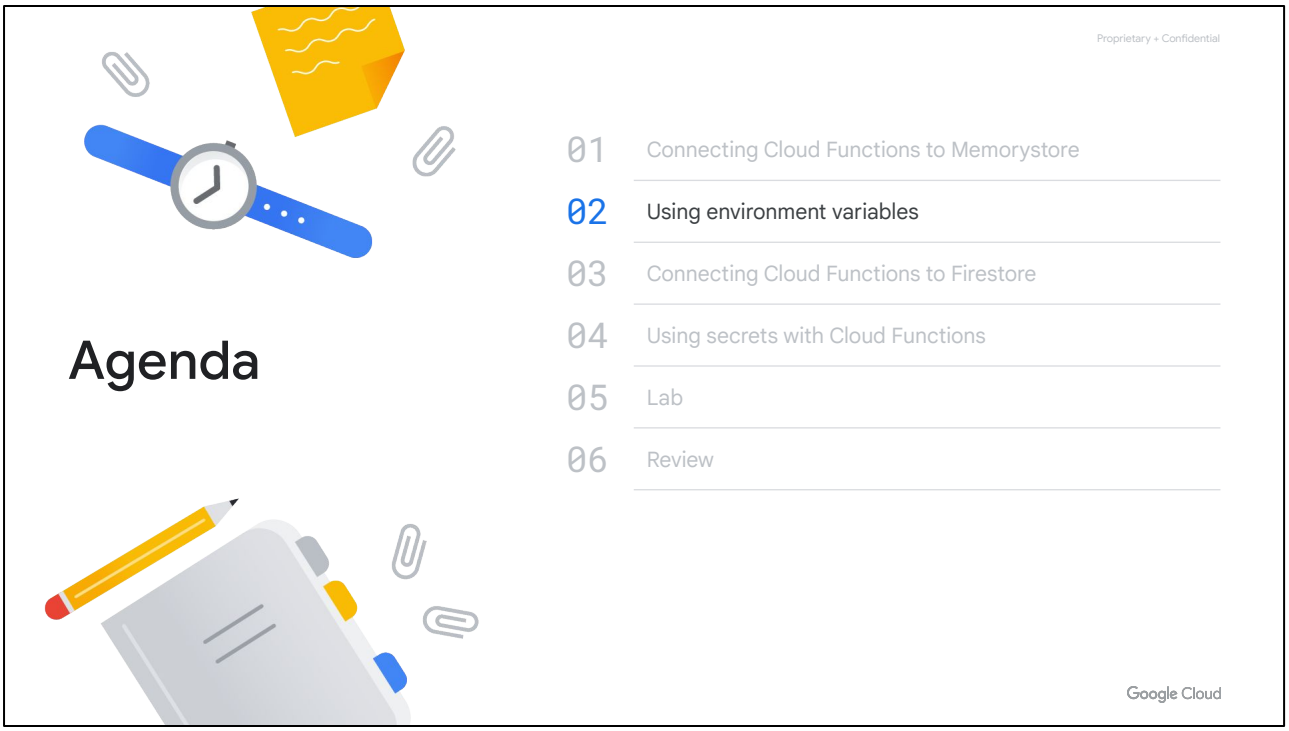
Function source code on GitHub.

gcloud CLI

```
curl -H "Authorization: bearer $(gcloud
auth print-identity-token)" \

https://[REGION]-[PROJECT_ID].cloudfunc
tions.net/visit_count
```


To invoke the function, send an HTTP GET request to the functions URL endpoint.

The source code for this function can be found on GitHub.



Cloud Functions supports the use of environment variables.

Environment variables

gcloud CLI

```
gcloud functions deploy FUNCTION_NAME
--set-env-vars FOO=bar,BAZ=boo
FLAGS...

# from a file
gcloud functions deploy FUNCTION_NAME
--env-vars-file env.yaml FLAGS…
```

```
# contents of file env.yaml
FOO: bar
BAZ: boo
```

Cloud Functions environment variables are:

- Key-value pairs.
- Set up during function deployment.
- Accessed by function code at runtime.
- Stored in the Cloud Functions backend.
- Bound or scoped to a single function.
- Added, updated, or removed using the Google Cloud console or the gcloud CLI.

Environment variables are key-value pairs that can be set for Cloud Functions at deployment time. The variables are accessed by your function code at runtime, or as configuration information for the buildpack system.

They are stored in the Cloud Functions backend, are bound to a single function, and exist within the same function lifecycle.

You can provide the environment variable key-value pairs when you deploy your function with the gcloud CLI or in the Google Cloud console.

You can also store them in a YAML file in source control and provide the name of the file during function deployment.

For more information on using environment variables with Cloud Functions, see the documentation.

Retrieving environment variables in your function

Python

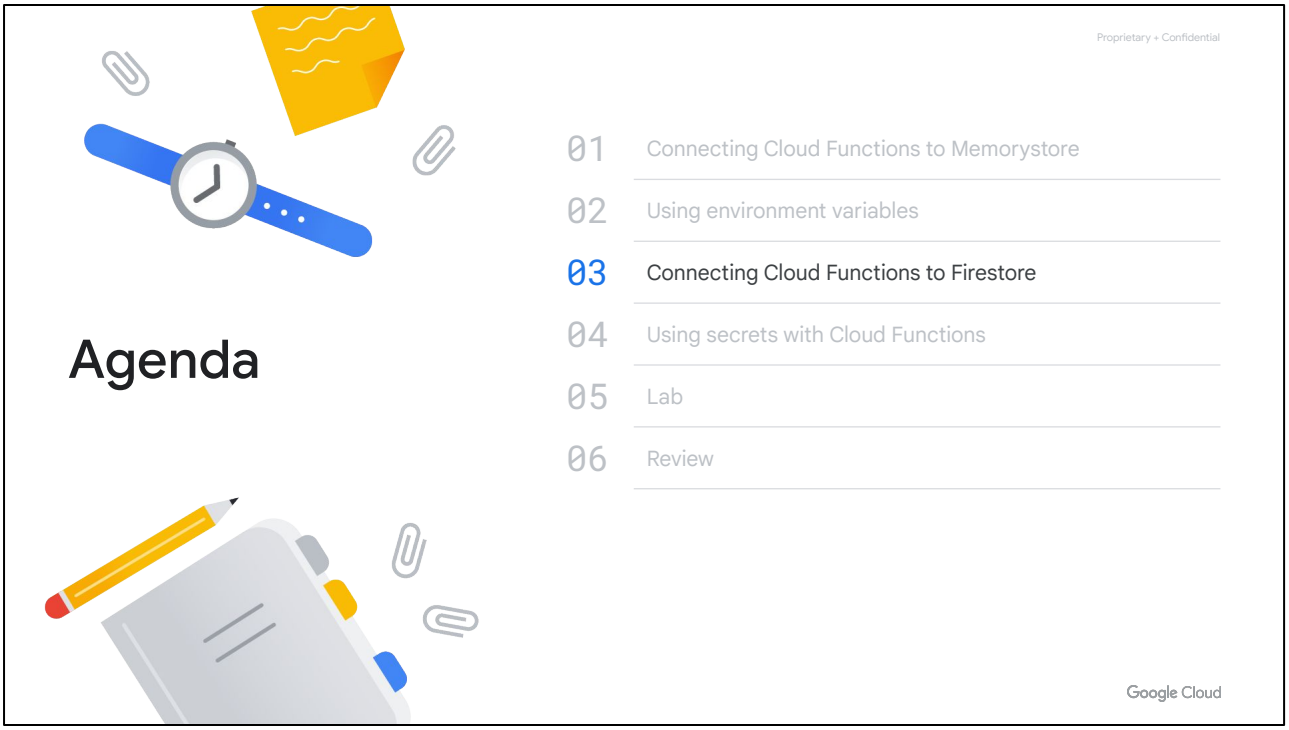
```
import os

def process(request):
    foo_var = os.environ.get('FOO',
'Specified environment variable is not
set.')

    return 'FOO: {}'.format(foo_var)
```

To access runtime environment variables in your function:

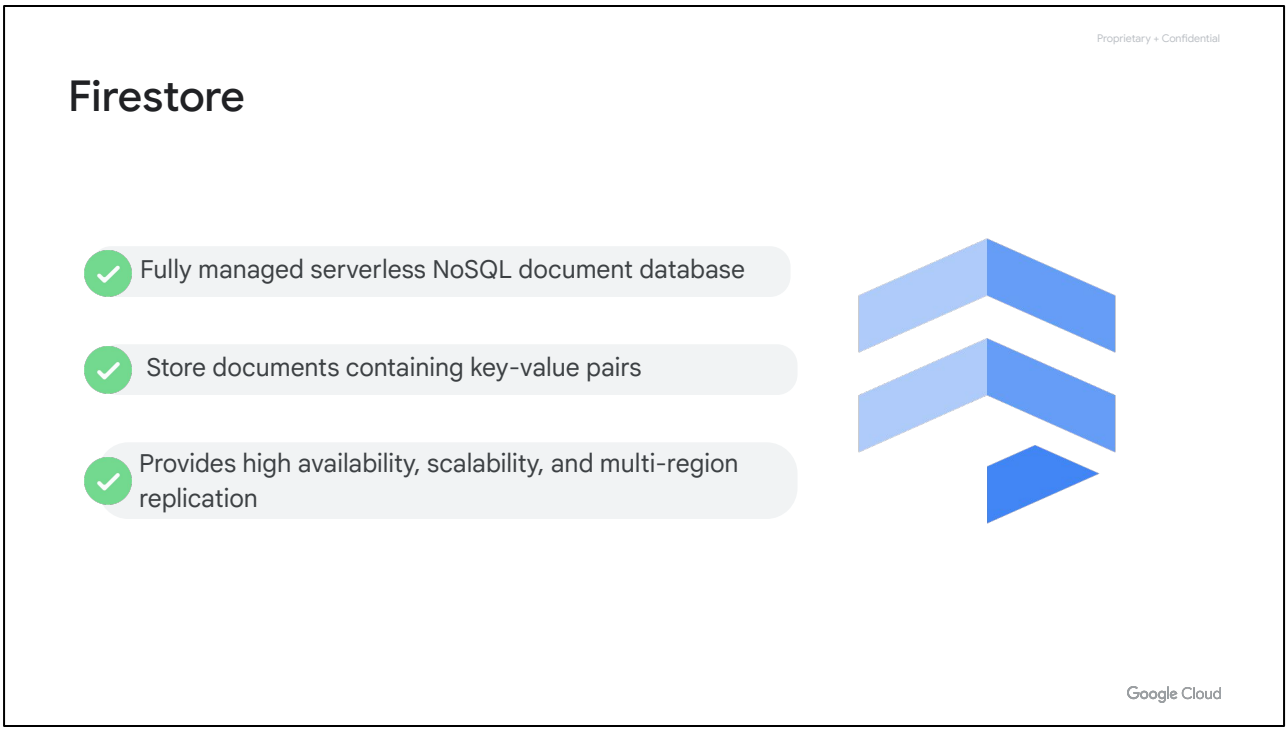
- Use the `os` module in Python.
- Use the `process.env` property in Node.js.

To access runtime environment variables in your function written in Python, use the `os` module.

To access environment variables in other language runtimes, view the samples in the documentation on the Cloud Functions website.



Let’s now discuss how you can connect Cloud Functions to Firestore.



Firestore is a Google Cloud service that provides a fully managed serverless NoSQL document database.

It provides high availability, scalability with no maintenance windows or downtime required, and multi-region replication.

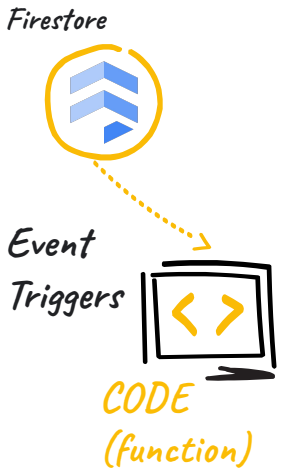
You store a set of key-value pairs known as a document in Firestore and all documents are stored in collections.

For a complete list of features, see the Firestore documentation.

Extend Firestore with Cloud Functions

Use Cloud Functions to extend Firestore's capabilities:

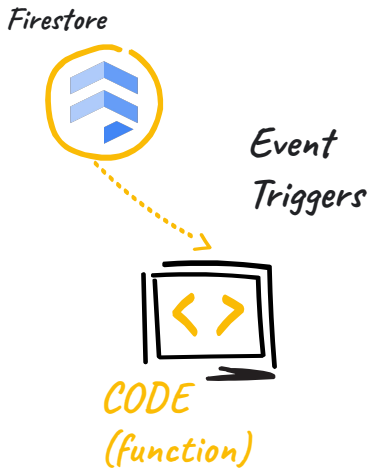
- Handle events that are triggered by changes in the Firestore database.
- Implement server-side function code for your app without running your own servers.



You can extend Firestore's capabilities with Cloud Functions by handling events that are triggered by changes in your Firestore database.

By implementing function code to handle these events, you can easily add server-side functionality to your application without running your own servers.

Firestore function triggers



- onCreate: Document is created.
- onUpdate: Document has any value changed.
- onDelete: Document with data is deleted.
- onWrite: Any of the events above occur.

You can implement your function code to handle Firestore events that occur when a document is created, updated, deleted, or when any of these events occur.

These events are exposed by the Cloud Functions for Firebase SDK that you use in your function source code.

Firestore triggers for Cloud Functions are available only for Firestore in Native mode. It is not available for Firestore in Datastore mode.

Writing functions for Firestore events

- To trigger a function, specify:
  - a document path
  - an event type
- A document path can reference:
  - A specific document
  - A wildcard pattern

Node.js

```
// Listen for changes
in document `john` in
the `users` collection.

exports.changeUser =
functions.firestore

.document('users/john')
.onWrite((change,
context) => {
  // ... Your code here
 });
```

```
// Listen for changes in
all documents in the
`users` collection.

exports.createUser =
functions.firestore

.document('users/{userId}')
.onCreate((change, context)
=> {
   // ... Your code here
 });
```

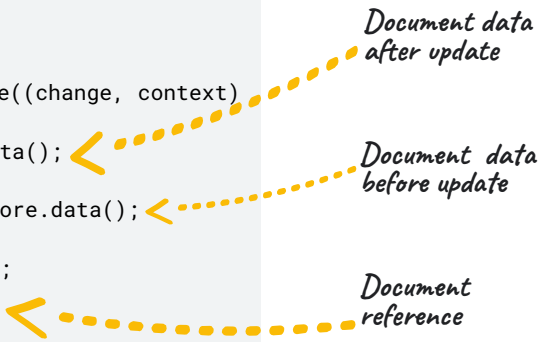

Functions that are triggered on Firestore events must specify a document path, and an event type.

The document path can reference a specific document or a wildcard pattern, and must not contain a trailing slash.

Reading and writing Firestore data

Node.js

```
exports.updateUser =

functions.firestore
.document('users/{userId}').onUpdate((change, context)
=> {
   const newValue = change.after.data();

   const previousValue = change.before.data();

   return change.after.ref.set(...);

 });
```

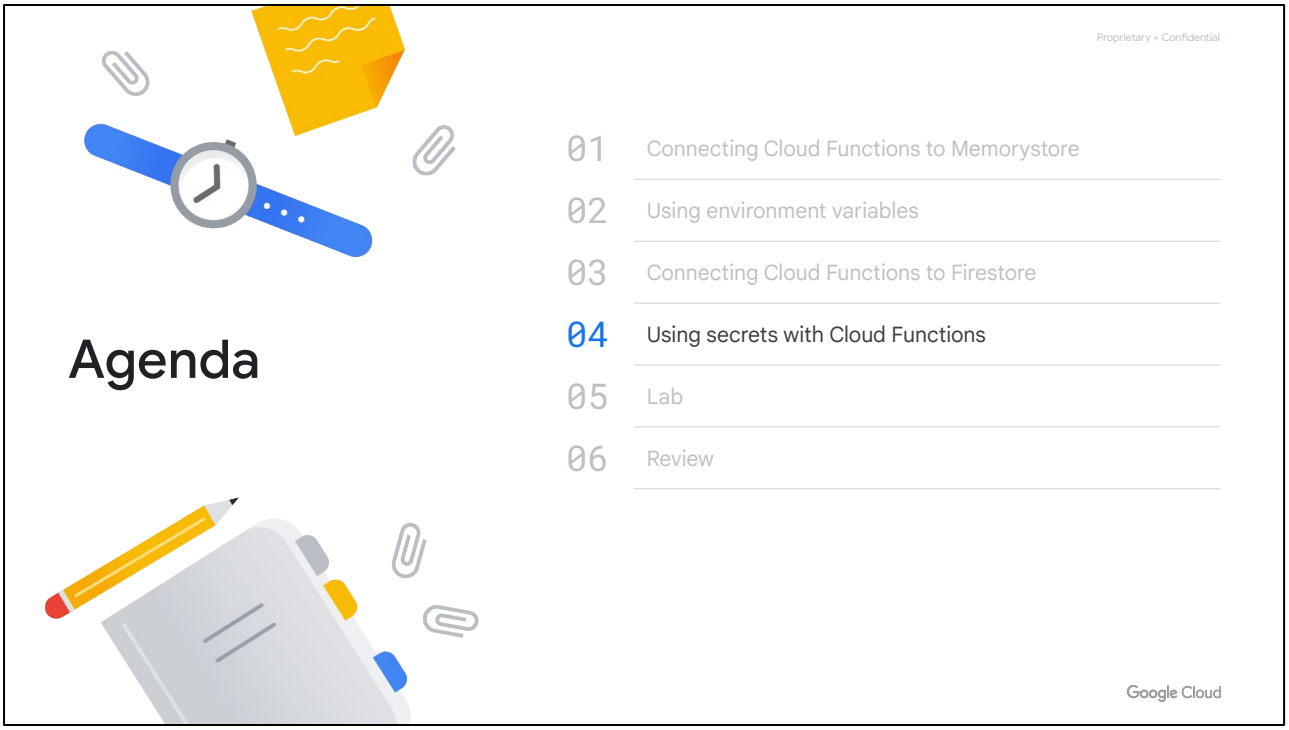


When a function is triggered, a snapshot of the data related to the event is available to the function. You can use this snapshot to read from or write to the document that triggered the event. The document snapshot data before and after the update is available to the function.

Each function invocation is associated with a specific document in your Firestore database. You can access that document as a DocumentReference in the ref property of the snapshot returned to your function.

This DocumentReference comes from the Firestore Node.js SDK and includes methods that enable you to modify the document that triggered the function.

You can also read and write data of documents other than the one that triggered the function using the Firebase Admin SDK.

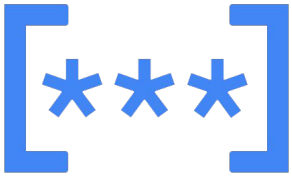


Cloud Functions supports the use of secrets. Let's review how you can use secrets with Cloud Functions.

Secrets

A secret is an object that contains:

- A collection of metadata that includes:
  - Replication locations
  - Labels
  - Permissions
- Secret versions that store the secret data.



Secret Manager:

- A service that enables you to store, manage, and access secrets.

When your function code needs to access certain databases or APIs, it will need to provide credentials like a database username/password or API key.

This kind of sensitive information should be securely stored and accessed by the function when it executes.

You can use secrets and Google Cloud's Secret Manager to store this information.

A secret is an object that contains a collection of metadata like replication locations, labels, permissions, and other information; and the secret versions.

A secret version stores the actual secret data such as an API key or password as a text string or binary blob.

To create and manage secrets, you must enable the Secret Manager API.

Accessing secrets from Cloud Functions

To access a secret from your function:

- Grant the function's runtime service account `roles/secretmanager.secretAccessor` role on the secret.
- Make the secret available to the function as:
  - A file by mounting the secret as a volume.
  - An environment variable.

gcloud CLI

```
# secret mounted as a volume

gcloud functions deploy FUNCTION_NAME
--runtime RUNTIME --set-secrets \
'SECRET_FILE_PATH=SECRET:VERSION'

# secret passed as an environment
variable

gcloud functions deploy FUNCTION_NAME
--runtime RUNTIME --set-secrets \
'ENV_VAR_NAME=SECRET:VERSION'
```


To access a secret, your function must first be granted access to the secret. This is achieved by granting the appropriate role (`roles/secretmanager.secretAccessor`) to the function's runtime service account on the secret.

To make the secret available to your function, you can:

- Mount the secret as a volume so that the function can access it from a file.
- Pass the secret to the function as an environment variable.

Because environment variables are resolved at function instance startup time, with this method, your function would have access to a specific version of the secret.

Mounting the secret as a volume allows your function to reference the latest version of the secret each time the file is read.

Accessing secrets from a different project

- Grant the function's runtime service account `roles/secretmanager.secretAccessor` role on the secret.
- Make the secret available to the function by specifying the secret's resource path with the format:

  `projects/PROJECT_ID/secrets/SECRET_NAME`

gcloud CLI

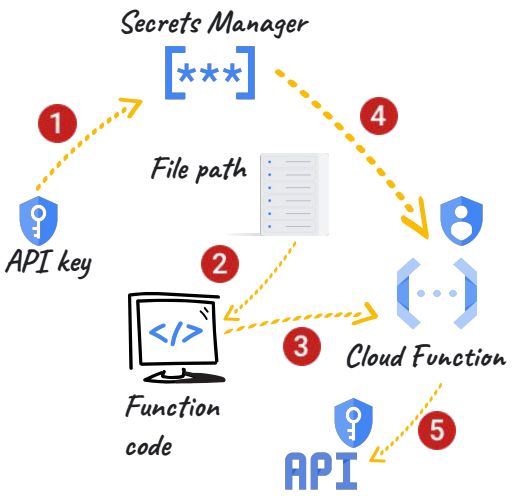
```
# secret in a different project
mounted as a volume

gcloud functions deploy FUNCTION_NAME
--runtime RUNTIME --set-secrets
'SECRET_FILE_PATH=SECRET_RESOURCE_PATH
:VERSION'
```


To provide your function access to a secret that is in a different project than your function:

- Grant your function's runtime service account access to the secret as previously described.
- Make the secret available to the function by specifying the secret's resource path that includes the project ID and secret name.

Using a secret

1. Use Secrets Manager to create and store a secret whose value is an API key.
2. Write your function code to access the secret.
3. Deploy the function setting the secret and the access method.
4. To access the secret, grant access to the function's runtime service account.
5. Call the API with the API key.



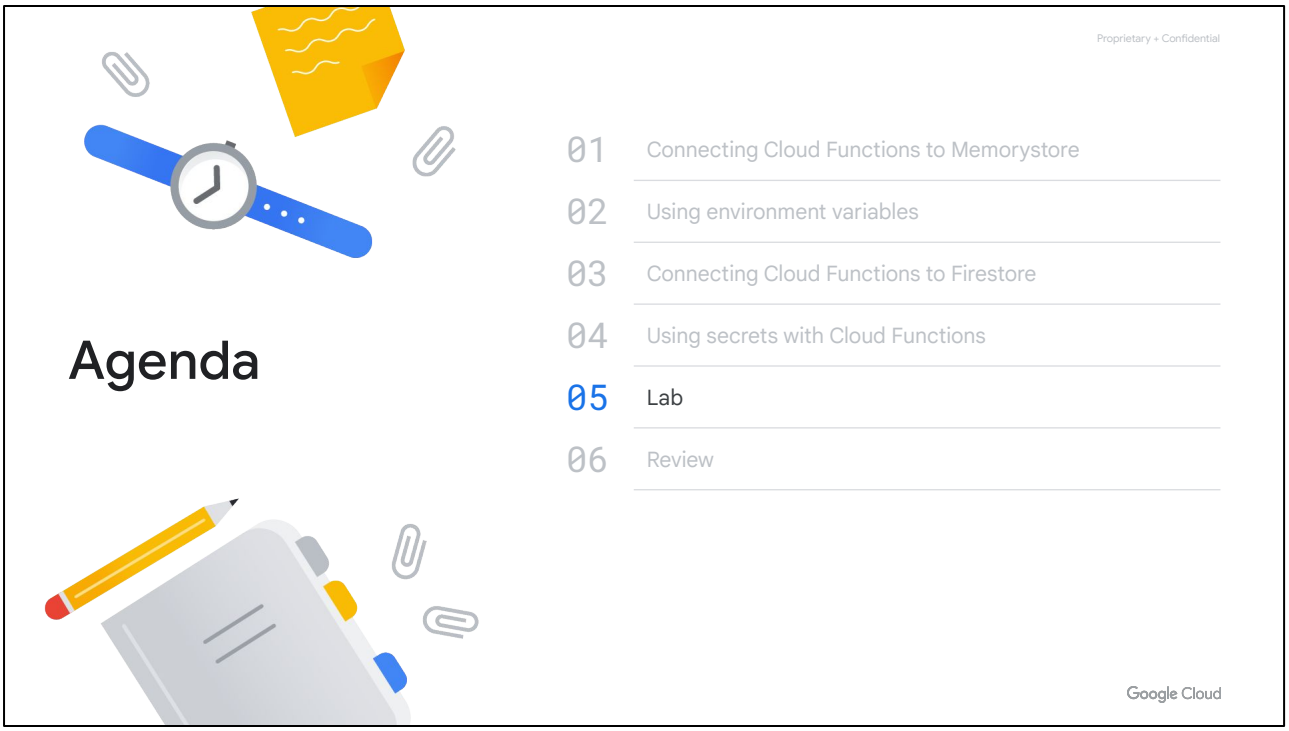
A sample use case of using a secret is when your function must access an external service or API, that requires an API key to identify the calling application.
The key is considered a sensitive piece of information so it is stored as a secret using Secrets Manager.

Write your function code to access the secret by reading the contents of a file or environment variable. The file path is provided when the function is deployed.

When deploying the function, provide the secret name and the method to access the secret. The method can be a mounted file path or environment variable.

To access the secret, the function's runtime service account must be granted the *Secret Manager Secret Accessor* role on the secret.

Call the API from the function with the secret value which is the API key.



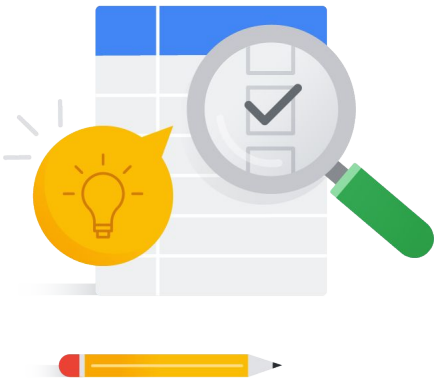
You'll now complete a lab on integrating Cloud Functions with Firestore.

Lab

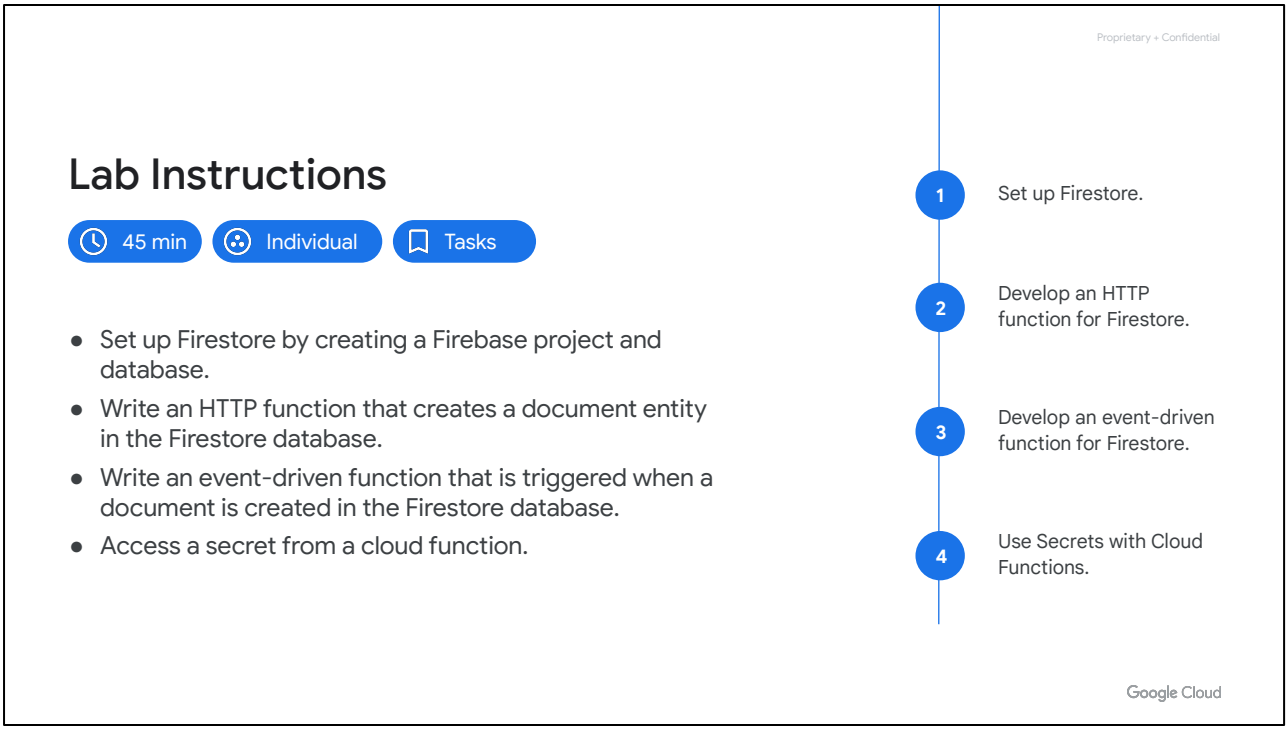
45 min | Individual

Integrating Cloud Functions with Firestore

Develop a function to read, write, and update data in a Firestore database.



In this lab, you develop a Cloud function to read and write a document to a Firestore database, and update that document by responding to create events in Firestore.

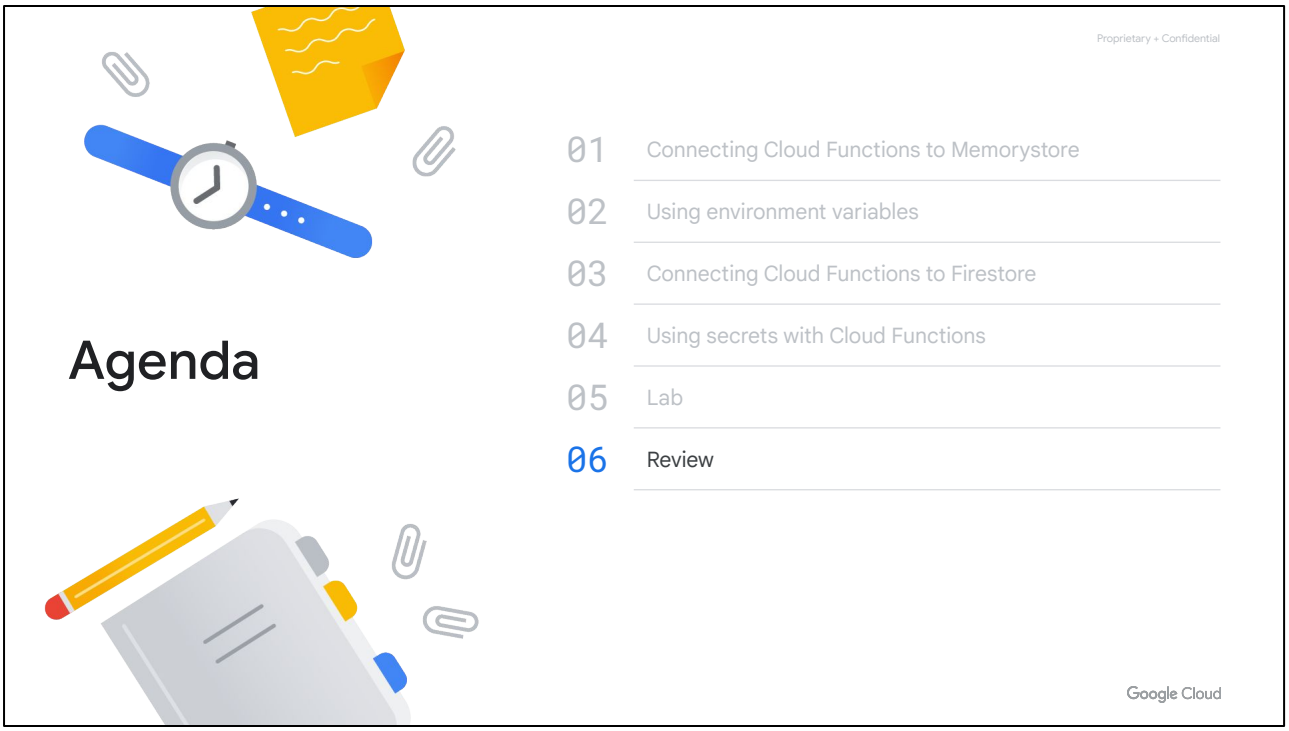


You first set up Firestore by creating and initializing a Firebase project and database.

You then write and deploy an HTTP function that creates a document entity in the Firestore database.

Next, you write an event-driven function that is triggered when a document is created in the Firestore database. This function will update the data in the document that was originally created.

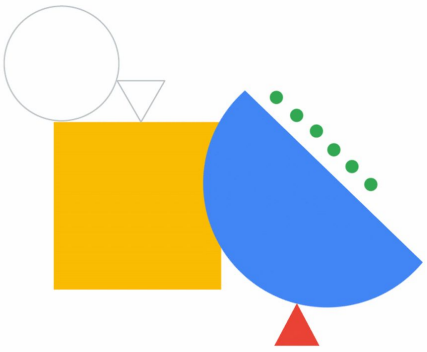
Finally, you create a secret using Secret Manager, and then access that secret in your Cloud function.



Let’s review the topics that were discussed in this module.

Google Cloud

Review: Integrating with Cloud Databases



In this module, you learned how to connect Cloud Functions to cloud databases.

We discussed how Cloud Functions can use environment variables, and access secrets stored in Secret Manager.

You also completed a lab on integrating Cloud Functions with Firestore.

In this module, you learned about:

01	Connecting Cloud Functions to Memorystore
02	Using environment variables
03	Connecting Cloud Functions to Firestore
04	Using secrets with Cloud Functions
05	Lab: Integrating Cloud Functions with Firestore

In this module, you learned how to connect Cloud Functions to Memorystore, Google Cloud's in-memory cache service.

We discussed the ways in which you can provide environment variable key-value pairs to Cloud Functions during deployment.

We also discussed how you can use event-driven functions to integrate Firestore database events with Cloud Functions, and how Cloud Functions can access sensitive values stored as secrets in Google Cloud.

You also completed a lab to integrate Cloud Functions with Firestore.