Go (https://cloud.google.com/go/) Guides

Getting started with Go

This tutorial is intended for those new to building apps in the cloud, such as engineers and web developers, who want to learn key app development concepts as they apply to Google Cloud.

Objectives

- Learn basic Google Cloud tools, such as the Google Cloud Console (https://cloud.google.com/cloud-console) and `gcloud` (https://cloud.google.com/sdk/gcloud).
- Deploy your app to the App Engine standard environment (https://cloud.google.com/appengine/docs/standard).
- Persist your data with Cloud Firestore (https://cloud.google.com/firestore).
- Store file uploads in Cloud Storage (https://cloud.google.com/storage).
- Monitor your app using Stackdriver (https://cloud.google.com/stackdriver).

For other language-specific tutorials for building your apps, see the following guides:

- Deploying an app to Google Kubernetes Engine (https://cloud.google.com/kubernetes-engine/docs/quickstarts/deploying-a-language-specific-app).

Costs

This tutorial uses the following billable components of Google Cloud:

- App Engine (https://cloud.google.com/appengine/pricing)

- Cloud Storage (https://cloud.google.com/storage/pricing)
- Cloud Firestore (https://cloud.google.com/firestore/pricing)
- Stackdriver (https://cloud.google.com/stackdriver/pricing)

The tutorial is designed to keep your resource usage within the limits of Google Cloud's Always Free (https://cloud.google.com/free/docs/frequently-asked-questions#always-free) tier. To generate a cost estimate based on your projected usage, use the pricing calculator (https://cloud.google.com/products/calculator). New Google Cloud users might be eligible for a free trial (https://cloud.google.com/free-trial).

When you finish this tutorial, you can avoid continued billing by deleting the resources you created. For more information, see Cleaning up (#clean-up).

Before you begin

1. Sign in (https://accounts.google.com/Login) to your Google Account.

   If you don't already have one, sign up for a new account (https://accounts.google.com/SignUp).

2. In the Cloud Console, on the project selector page, select or create a Google Cloud project.

   Note: If you don't plan to keep the resources that you create in this procedure, create a project instead of selecting an existing project. After you finish these steps, you can delete the project, removing all resources associated with the project.

   GO TO THE PROJECT SELECTOR PAGE (HTTPS://CONSOLE.CLOUD.GOOGLE.COM/PROJECTSELECT

3. Make sure that billing is enabled for your Google Cloud project. Learn how to confirm billing is enabled for your project (https://cloud.google.com/billing/docs/how-to/modify-project).

4. To create a Cloud Firestore database in Native mode, complete the following steps:

   a. In the Cloud Console, go to the **Cloud Firestore viewer** page.

      GO TO THE CLOUD FIRESTORE VIEWER (HTTPS://CONSOLE.CLOUD.GOOGLE.COM/FIRESTORE

   b. From the **Select a Cloud Firestore mode** screen, click **Select Native Mode**.

   c. Select a location (https://cloud.google.com/firestore/docs/locations#types) for your Cloud Firestore database. This location setting is the default Google Cloud resource location for your Google Cloud project (https://cloud.google.com/firestore/docs/locations#default-cloud-location). This location is used for Google Cloud services in your Google Cloud project that require a location setting, specifically, your default Cloud Storage (https://cloud.google.com/storage/docs) bucket and your App Engine (https://cloud.google.com/appengine/docs/) app.

Warning: After you set the default resource location for your Google Cloud project, you cannot change it.

d. Click **Create Database**.

5. Enable the App Engine Admin, Cloud Storage, Stackdriver Logging, and Stackdriver Error Reporting APIs.

   ENABLE THE APIS (HTTPS://CONSOLE.CLOUD.GOOGLE.COM/FLOWS/ENABLEAPI?APIID=APPENGIN

6. In Cloud Shell, open the app's source code.

   GO TO CLOUD SHELL (HTTPS://CLOUD.GOOGLE.COM/CONSOLE/CLOUDSHELL/OPEN?GIT_BRANCH

   Cloud Shell provides command-line access to your Google Cloud resources directly from the browser.

7. To download the sample code and change into the app directory, click **Proceed**.
8. In Cloud Shell, configure the `gcloud` tool to use your new Google Cloud project:

```
# Configure gcloud for your project
gcloud config set project PROJECT_ID
```

   Replace ***PROJECT_ID*** with the Google Cloud project ID that you created using the Cloud Console.

   The `gcloud` command-line tool (https://cloud.google.com/sdk/gcloud/) is the primary way you interact with your Google Cloud resources from the command line. In this tutorial, you use the `gcloud` tool to deploy and monitor your app.

Running your app

1. Build the app, which automatically downloads dependencies as needed:

```
go build
```

2. Run the app:

   ```
   GOOGLE_CLOUD_PROJECT=PROJECT_ID ./bookshelf
   ```

   Replace ***PROJECT_ID*** with the Google Cloud project ID that you created.

3. In Cloud Shell, click **Web preview**, and select **Preview on port 8080**. This opens a new window with your running app.

Deploying your app to App Engine

Google Cloud offers several options for running your code (https://cloud.google.com/hosting-options/). For this example, you use App Engine (https://cloud.google.com/appengine/docs/standard/) to deploy a scalable app to Google Cloud. With zero-configuration deployments and zero server management, App Engine lets you focus on writing code. Plus, App Engine automatically scales to support sudden traffic spikes.

The `app.yaml` file is your main configuration file for deploying to App Engine:

getting-started/bookshelf/app.yaml (https://github.com/GoogleCloudPlatform/golang-samples/blob/master/getting-started/bookshelf/app.yaml)

)GLECLOUDPLATFORM/GOLANG-SAMPLES/BLOB/MASTER/GETTING-STARTED/BOOKSHELF/APP.YAML)

```
runtime: go112
```

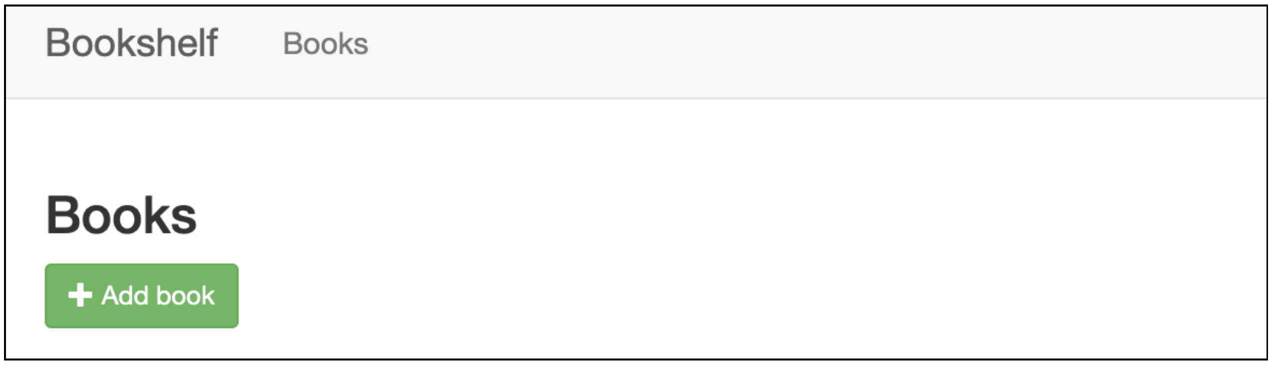
1. In your terminal window, deploy the app to App Engine using the `gcloud` tool:

   ```
   # on the command-line
   gcloud app deploy
   ```

2. Your app is now viewable at the following URL, where ***PROJECT_ID*** is the Google Cloud project ID that you created at the beginning of this tutorial:

   ```
   https://PROJECT_ID.appspot.com
   ```

In your web browser, enter the URL to view the app.



Note: This SSL-protected domain is created automatically, and is useful for development. You can set up a custom domain (https://cloud.google.com/appengine/docs/standard/go112/mapping-custom-domains) with App Engine as well.

For more information on deploying to App Engine, see the Go 1.12 runtime environment (https://cloud.google.com/appengine/docs/standard/go112/runtime).

Persisting your data with Cloud Firestore

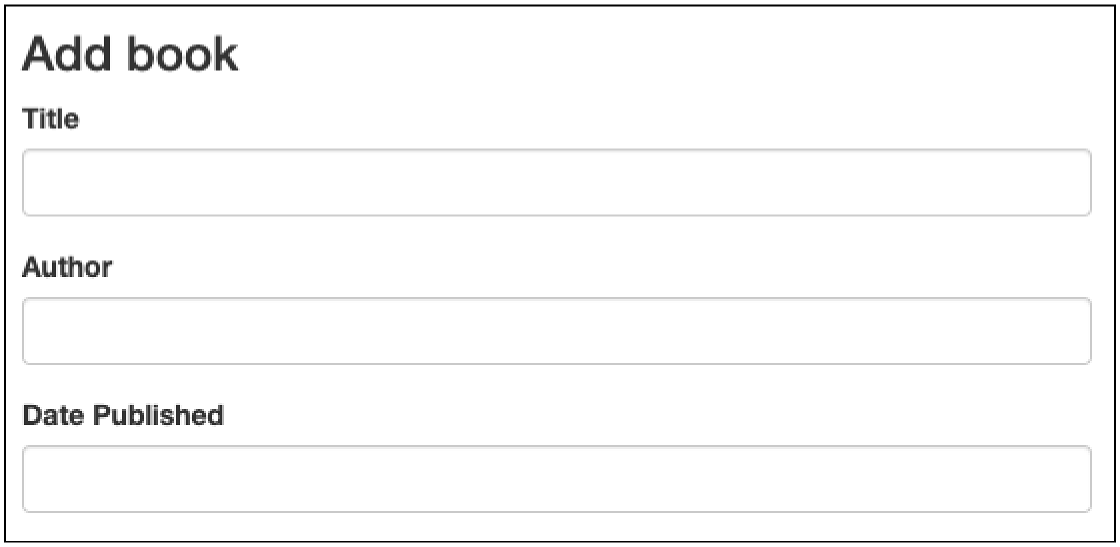
You cannot store information on your App Engine instances, because it is lost if the instance is restarted, and doesn't exist when new instances are created. Instead, you use a database that all your instances read from and write to.

Google Cloud offers several options for storing your data (https://cloud.google.com/products/storage/). In this example, you use Cloud Firestore to store the data for each book. Cloud Firestore is a fully managed, serverless, NoSQL document database that lets you store and query data. Cloud Firestore auto scales to meet your app needs, and scales to zero when you're not using it. Add your first book now.

1. In your browser, go to the following URL, where ***PROJECT_ID*** is the project ID you created at the beginning of the tutorial.

   ```
   https://PROJECT_ID.appspot.com
   ```

2. To create a book for your deployed app, click **Add book**.

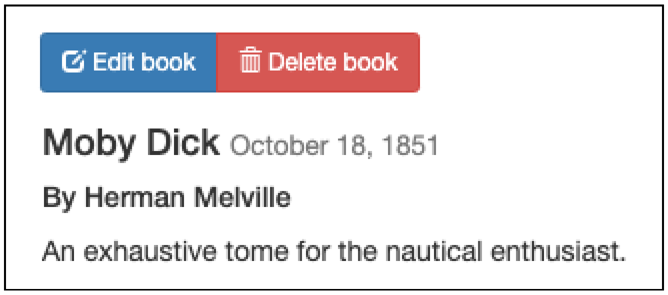

Add book

Title

Author

Date Published

3. In the **Title** field, enter `Moby Dick`.
4. In the **Author** field, enter `Herman Melville`.
5. Click **Save**. There is now an entry to your Bookshelf app.



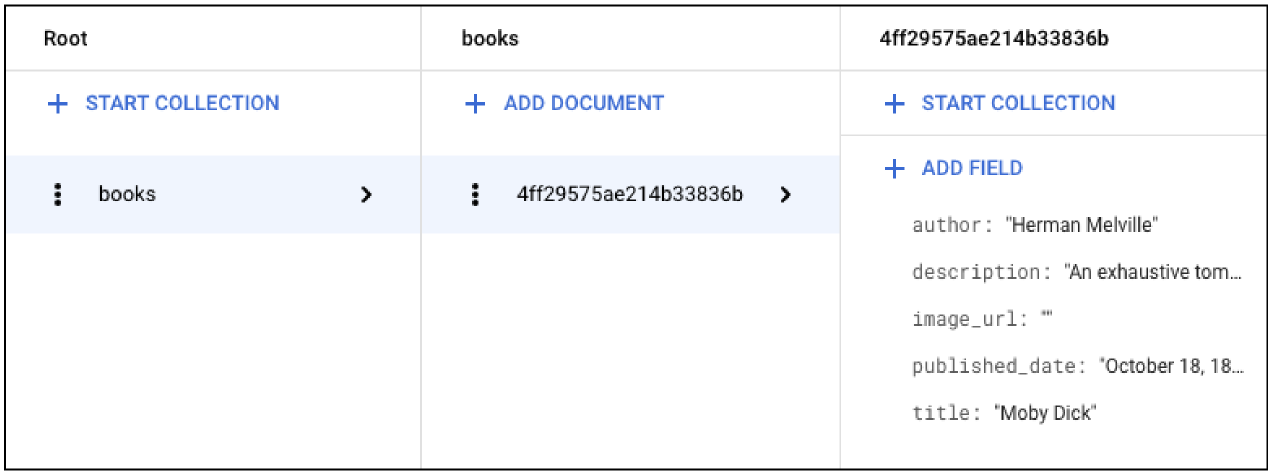
Moby Dick October 18, 1851

By Herman Melville

An exhaustive tome for the nautical enthusiast.

6. In the Cloud Console, to refresh the Cloud Firestore page, click **Refresh** ⟳. The data appears in Cloud Firestore. The Bookshelf app stores each book as a Cloud Firestore document (https://cloud.google.com/firestore/docs/data-model#documents) with a unique ID, and all these documents are stored in a Cloud Firestore collection (https://cloud.google.com/firestore/docs/data-model#collections). For the purposes of this

tutorial, the collection is called books.



Root	books	4ff29575ae214b33836b
+ START COLLECTION	+ ADD DOCUMENT	+ START COLLECTION
books	4ff29575ae214b33836b	+ ADD FIELD
		author: "Herman Melville"
		description: "An exhaustive tom…
		image_url: ""
		published_date: "October 18, 18…
		title: "Moby Dick"

Cloud Firestore stores the books by using the Cloud Firestore Client Library (http://googleapis.github.io/google-cloud-go/#/docs/google-cloud/latest/firestore/readme). Here is an example of fetching a Cloud Firestore document:

getting-started/bookshelf/db_firestore.go (https://github.com/GoogleCloudPlatform/golang-samples/blob/master/getting-started/bookshelf/db_firestore.go)

)UDPLATFORM/GOLANG-SAMPLES/BLOB/MASTER/GETTING-STARTED/BOOKSHELF/DB_FIRESTORE.GO)

```
// newFirestoreDB creates a new BookDatabase backed by Cloud Firestore.
// See the firestore package for details on creating a suitable
// firestore.Client: https://godoc.org/cloud.google.com/go/firestore.
func newFirestoreDB(client *firestore.Client) (*firestoreDB, error) {
        ctx := context.Background()
        // Verify that we can communicate and authenticate with the Firestore
        // service.
        err := client.RunTransaction(ctx, func(ctx context.Context, t *firestore.Tra
                return nil
        })
        if err != nil {
                return nil, fmt.Errorf("firestoredb: could not connect: %v", err)
        }
        return &firestoreDB{
                client: client,
        }, nil
}

// Close closes the database.
```

```
func (db *firestoreDB) Close(context.Context) error {
        return db.client.Close()
}

// Book retrieves a book by its ID.
func (db *firestoreDB) GetBook(ctx context.Context, id string) (*Book, error) {
        ds, err := db.client.Collection("books").Doc(id).Get(ctx)
        if err != nil {
                return nil, fmt.Errorf("firestoredb: Get: %v", err)
        }
        b := &Book{}
        ds.DataTo(b)
        return b, nil
}
```

For more information on using Cloud Firestore, see Adding data to Cloud Firestore (https://cloud.google.com/firestore/docs/manage-data/add-data).

Storing file uploads in Cloud Storage

Now that you've added a book, it's time to add the book cover image. You cannot store files on your instances. A database isn't the right choice for image files. Instead, you use Cloud Storage.

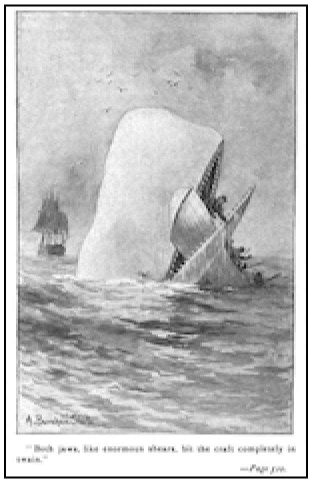
Cloud Storage (https://cloud.google.com/storage/docs/creating-buckets) is the primary blob store for Google Cloud. You can use Cloud Storage to host app assets that you want to share across Google Cloud. To use Cloud Storage, you need to create a Cloud Storage bucket (https://cloud.google.com/storage/docs/key-terms#buckets), a basic container to hold your data.

1. In the Cloud Console, go to the **Cloud Storage Browser** page.

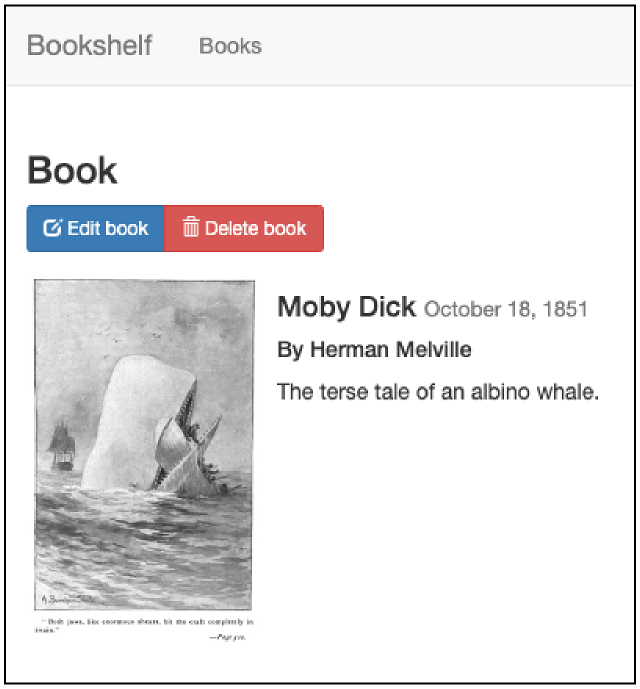
   GO TO THE CLOUD STORAGE BROWSER PAGE (HTTPS://CLOUD.GOOGLE.COM/CONSOLE/STORAGE

2. Click **Create bucket**.
3. In the **Create bucket** dialog, enter a name for your bucket by appending your Google Cloud project ID to the string `_bucket` so the name looks like ***YOUR_PROJECT_ID*_bucket**. This name is subject to the bucket name requirements (https://cloud.google.com/storage/docs/bucket-naming#requirements). All other fields can remain at their default values.
4. Click **Create**.

5. After your bucket is created, click **Edit book**, and select an image to upload as your book's cover. For example, you can use this public domain image:



6. Click **Save**. You're redirected to the homepage, where there is an entry to your Bookshelf app.



Book

Moby Dick October 18, 1851

By Herman Melville

The terse tale of an albino whale.

The bookshelf app sends uploaded files to Cloud Storage by using the Cloud Storage Client Library (http://googleapis.github.io/google-cloud-go/#/docs/google-cloud/latest/storage/readme).

getting-started/bookshelf/main.go (https://github.com/GoogleCloudPlatform/golang-samples/blob/master/getting-started/bookshelf/main.go)

OGLECLOUDPLATFORM/GOLANG-SAMPLES/BLOB/MASTER/GETTING-STARTED/BOOKSHELF/MAIN.GO)

```
// uploadFileFromForm uploads a file if it's present in the "image" form field.
func (b *Bookshelf) uploadFileFromForm(ctx context.Context, r *http.Request) (url st
        f, fh, err := r.FormFile("image")
        if err == http.ErrMissingFile {
                return "", nil
        }
        if err != nil {
                return "", err
        }

        if b.StorageBucket == nil {
                return "", errors.New("storage bucket is missing: check bookshelf.go
        }
        if _, err := b.StorageBucket.Attrs(ctx); err != nil {
                if err == storage.ErrBucketNotExist {
                        return "", fmt.Errorf("bucket %q does not exist: check books
                }
                return "", fmt.Errorf("could not get bucket: %v", err)
        }

        // random filename, retaining existing extension.
        name := uuid.Must(uuid.NewV4()).String() + path.Ext(fh.Filename)

        w := b.StorageBucket.Object(name).NewWriter(ctx)

        // Warning: storage.AllUsers gives public read access to anyone.
        w.ACL = []storage.ACLRule{{Entity: storage.AllUsers, Role: storage.RoleReade
        w.ContentType = fh.Header.Get("Content-Type")

        // Entries are immutable, be aggressive about caching (1 day).
        w.CacheControl = "public, max-age=86400"

        if _, err := io.Copy(w, f); err != nil {
                return "", err
        }
        if err := w.Close(); err != nil {
                return "", err
        }

        const publicURL = "https://storage.googleapis.com/%s/%s"
        return fmt.Sprintf(publicURL, b.StorageBucketName, name), nil
}
```

For more information on using Cloud Storage, see the list of how-to guides (https://cloud.google.com/storage/docs/how-to).

Monitoring your app using Stackdriver

You've deployed your app and created and modified books. To monitor these events for your users, use Stackdriver APM.

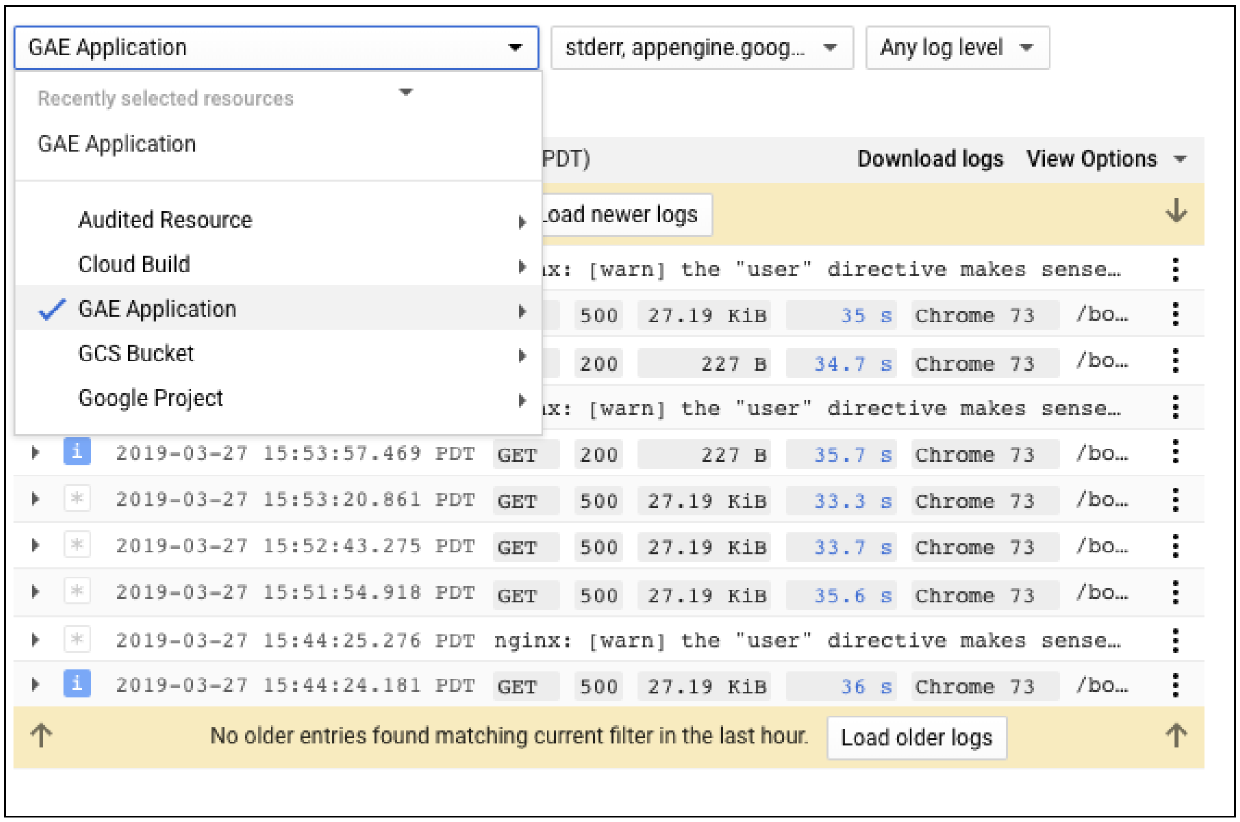
Monitor logs with Stackdriver Logging

CLOUD CONSOLE GCLOUD

1. In your browser, go to the `/logs` URL in your app:

   ```
   https://PROJECT_ID.appspot.com/logs
   ```

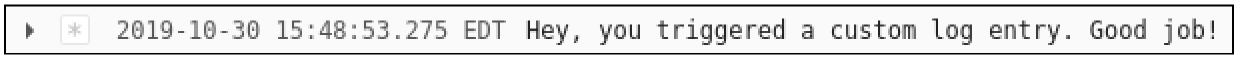
   This sends a custom entry to Stackdriver Logging. The entry contains the message `Hey, you triggered a custom log entry. Good job!`.
2. Go to the Logs Viewer (https://cloud.google.com/console/logs), where you can monitor your app in real time. When something goes wrong, this is one of the first places to look.



```
ıx: [warn] the "user" directive makes sense…
    500  27.19 KiB   35 s   Chrome 73  /bo…
    200    227 B   34.7 s   Chrome 73  /bo…
ıx: [warn] the "user" directive makes sense…
2019-03-27 15:53:57.469 PDT GET 200    227 B   35.7 s  Chrome 73  /bo…
2019-03-27 15:53:20.861 PDT GET 500  27.19 KiB  33.3 s  Chrome 73  /bo…
2019-03-27 15:52:43.275 PDT GET 500  27.19 KiB  33.7 s  Chrome 73  /bo…
2019-03-27 15:51:54.918 PDT GET 500  27.19 KiB  35.6 s  Chrome 73  /bo…
2019-03-27 15:44:25.276 PDT nginx: [warn] the "user" directive makes sense…
2019-03-27 15:44:24.181 PDT GET 500  27.19 KiB   36 s   Chrome 73  /bo…
```

3. In the resource drop-down list, select `GAE Application`.
4. In the logs drop-down list, select **All logs**.

   There is a row for your custom log entry.



```
2019-10-30 15:48:53.275 EDT Hey, you triggered a custom log entry. Good job!
```

Monitor errors with Stackdriver Error Reporting

1. In the Cloud Console, go to the **Error Reporting** page.

   GO TO ERROR REPORTING PAGE (HTTPS://CLOUD.GOOGLE.COM/CONSOLE/ERRORS)

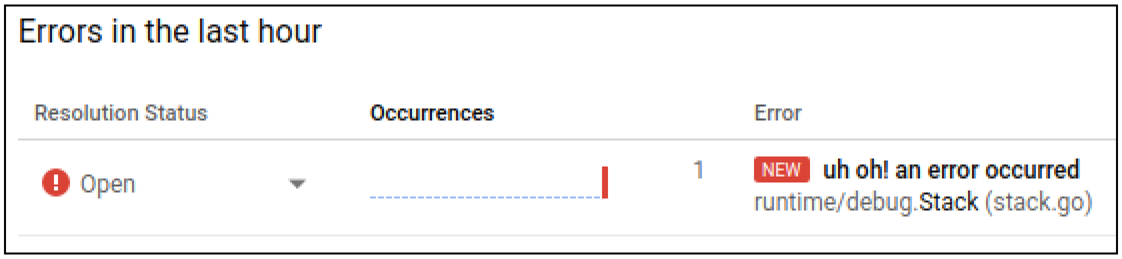
   Stackdriver Error Reporting highlights errors and exceptions in your app and lets you set up alerting around them.

2. In your browser, go to the `/errors` URL in your app.

```
https://PROJECT_ID.appspot.com/errors
```

   This generates a new test exception and sends it to Stackdriver.

3. In the Cloud Console, return to the **Error Reporting** page, and in a few moments the new error is visible. Click **Auto Reload** so you don't need to manually refresh the page.


Errors in the last hour

Resolution Status	Occurrences		Error
Open		1	NEW uh oh! an error occurred runtime/debug.Stack (stack.go)

Note: Stackdriver APM contains many tools to help debug and monitor your apps. For more information, see the tutorials (https://cloud.google.com/stackdriver/docs/tutorials).

Cleaning up

To avoid incurring charges to your Google Cloud Platform account for the resources used in this tutorial:

Delete the project

Caution: Deleting a project has the following effects:

- **Everything in the project is deleted.** If you used an existing project for this tutorial, when you delete it, you also delete any other work you've done in the project.
- **Custom project IDs are lost.** When you created this project, you might have created a custom project ID that you want to use in the future. To preserve the URLs that use the project ID, such as an `appspot.com` URL, delete selected resources inside the project instead of deleting the whole project.

If you plan to explore multiple tutorials and quickstarts, reusing projects can help you avoid exceeding project quota limits.

1. In the Cloud Console, go to the **Manage resources** page.

   GO TO THE MANAGE RESOURCES PAGE (HTTPS://CONSOLE.CLOUD.GOOGLE.COM/IAM-ADMIN/PRC

2. In the project list, select the project you want to delete and click **Delete** 🗑 .

3. In the dialog, type the project ID, and then click **Shut down** to delete the project.

What's next

- Deploying an app to Google Kubernetes Engine (https://cloud.google.com/kubernetes-engine/docs/quickstarts/deploying-a-language-specific-app)