Getting Started with Cloud KMS

GSP079

Google Cloud Self-Paced Labs

Overview

In this lab you'll learn how to use some advanced features of Google Cloud Security and Privacy APIs, including:

- Setting up a secure Cloud Storage bucket
- Managing keys and encrypted data using Key Management Service
- Viewing Cloud Storage audit logs
  You'll take abridged data from the Enron Corpus, encrypt it, and load it into Cloud Storage.

What you'll learn

- How to encrypt data and manage encryption keys using Key Management Service (KMS).

What you'll use

- Cloud Storage.
- Cloud SDK.

Setup and Requirements

Before you click the Start Lab button

Read these instructions. Labs are timed and you cannot pause them. The timer, which starts when you click **Start Lab**, shows how long Google Cloud resources will be made available to you.

This Qwiklabs hands-on lab lets you do the lab activities yourself in a real cloud environment, not in a simulation or demo environment. It does so by giving you new, temporary credentials that you use to sign in and access Google Cloud for the duration of the lab.

What you need

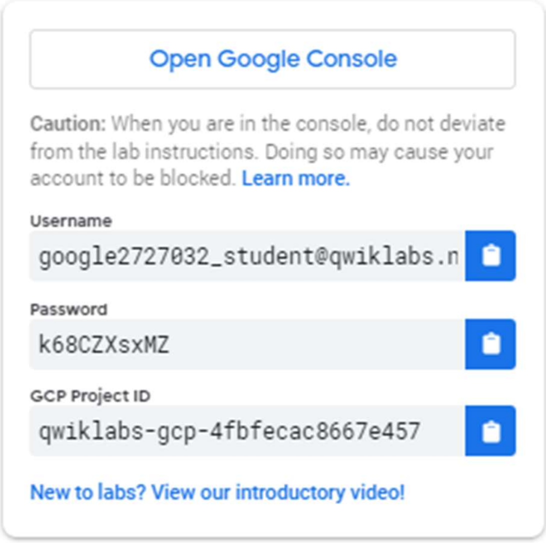
To complete this lab, you need:

- Access to a standard internet browser (Chrome browser recommended).
- Time to complete the lab.
  Note: If you already have your own personal Google Cloud account or project, do not use it for this lab.

Note: If you are using a Pixelbook, open an Incognito window to run this lab.

How to start your lab and sign in to the Google Cloud Console

1. Click the **Start Lab** button. If you need to pay for the lab, a pop-up opens for you to select your payment method. On the left is a panel populated with the temporary credentials that you must use for this lab.



Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

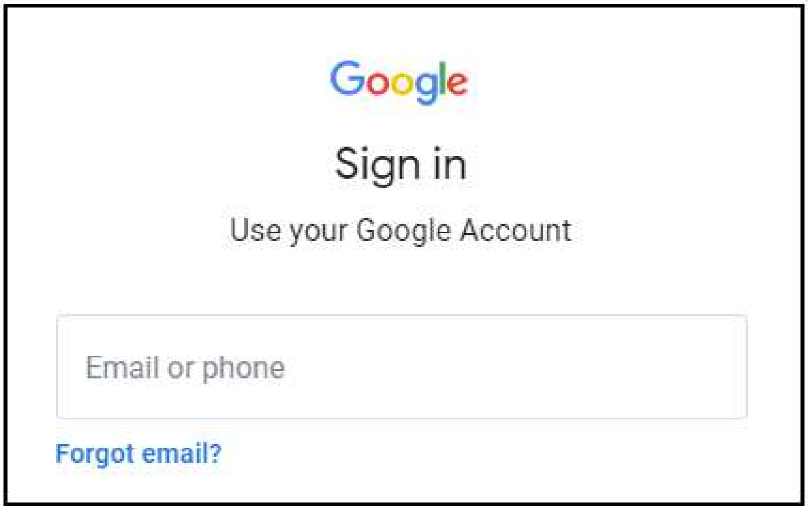
Username: google2727032_student@qwiklabs.n

Password: k68CZXsxMZ

GCP Project ID: qwiklabs-gcp-4fbfecac8667e457

New to labs? View our introductory video!

2. Copy the username, and then click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Sign in** page.

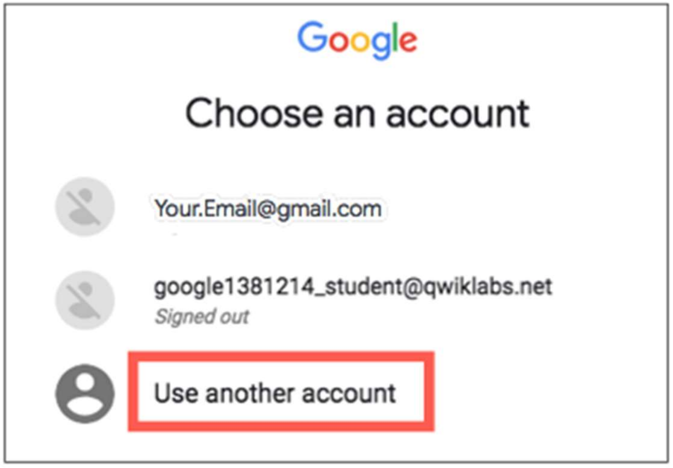


Sign in

Use your Google Account

Tip: Open the tabs in separate windows, side-by-side.

If you see the **Choose an account** page, click **Use Another Account**.



Google

Choose an account

Your.Email@gmail.com

google1381214_student@qwiklabs.net
Signed out

Use another account

3. In the **Sign in** page, paste the username that you copied from the Connection Details panel. Then copy and paste the password.

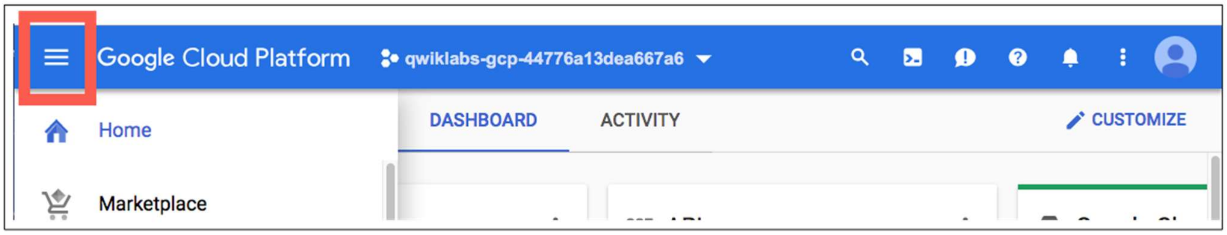
   Important: You must use the credentials from the Connection Details panel. Do not use your Qwiklabs credentials. If you have your own Google Cloud account, do not use it for this lab (avoids incurring charges).

4. Click through the subsequent pages:

   - Accept the terms and conditions.
   - Do not add recovery options or two-factor authentication (because this is a temporary account).
   - Do not sign up for free trials.

After a few moments, the Cloud Console opens in this tab.

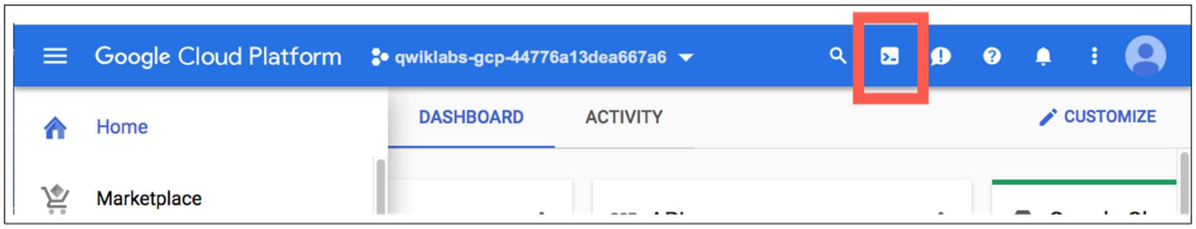
Note: You can view the menu with a list of Google Cloud Products and Services by clicking the **Navigation menu** at the top-left.



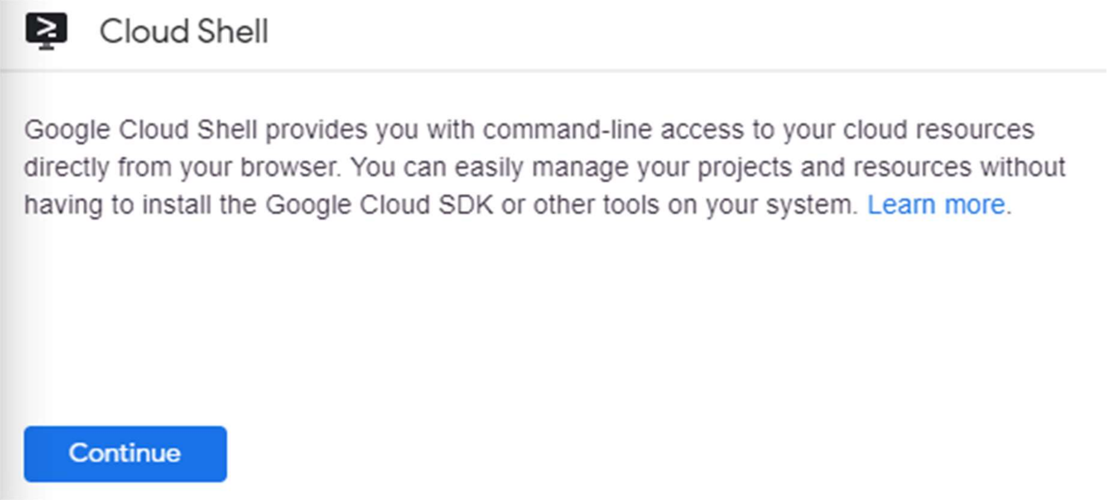
Activate Cloud Shell

Cloud Shell is a virtual machine that is loaded with development tools. It offers a persistent 5GB home directory and runs on the Google Cloud. Cloud Shell provides command-line access to your Google Cloud resources.

In the Cloud Console, in the top right toolbar, click the **Activate Cloud Shell** button.



Click **Continue**.

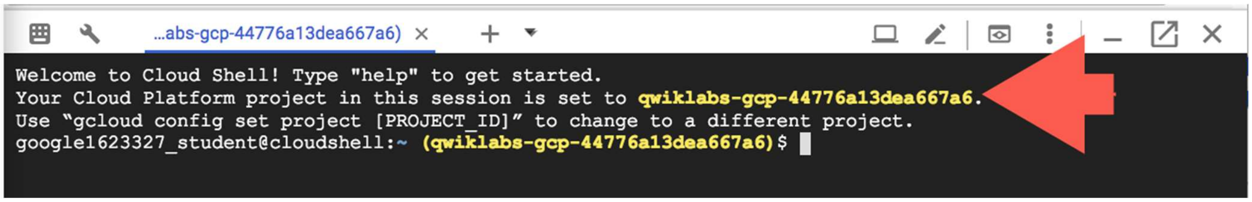


Cloud Shell

Google Cloud Shell provides you with command-line access to your cloud resources directly from your browser. You can easily manage your projects and resources without having to install the Google Cloud SDK or other tools on your system. Learn more.

Continue

It takes a few moments to provision and connect to the environment. When you are connected, you are already authenticated, and the project is set to your *PROJECT_ID*. For example:



```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to qwiklabs-gcp-44776a13dea667a6.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
google1623327_student@cloudshell:~ (qwiklabs-gcp-44776a13dea667a6)$
```

`gcloud` is the command-line tool for Google Cloud. It comes pre-installed on Cloud Shell and supports tab-completion.

You can list the active account name with this command:

```
gcloud auth list
```

(Output)

```
Credentialed accounts:
 - <myaccount>@<mydomain>.com (active)
```

(Example output)

```
Credentialed accounts:
 - google1623327_student@qwiklabs.net
```

You can list the project ID with this command:

```
gcloud config list project
```

(Output)

```
[core]
project = <project_ID>
```

(Example output)

```
[core]
project = qwiklabs-gcp-44776a13dea667a6
```

For full documentation of `gcloud` see the gcloud command-line tool overview.

Create a Cloud Storage bucket

In order to store the data for this lab you need to create your own Cloud Storage bucket.

Pick a name for your Cloud Storage bucket, such as `<YOUR_NAME>_enron_corpus`. For more information on naming buckets, see the Cloud Storage bucket naming guidelines.
Run the following command in Cloud Shell to set a variable to your bucket name:

```
BUCKET_NAME=<YOUR_NAME>_enron_corpus
```

Now create the bucket by running the following command:

```
gsutil mb gs://${BUCKET_NAME}
```

Running this command should also help to verify that you've got the `gsutil` command line client set up correctly, authentication is working, and you have write access to the cloud project you're operating under.

After your bucket has been created, move on to the next step to download the Enron Corpus.

Click **Check my progress** to verify the objective.

Check out the data

The Enron Corpus is a large database of over 600,000 emails generated by 158 employees of the Enron Corporation. This data has been copied to the Cloud Storage bucket `gs://enron_emails/`.

Download one of the source files locally so that you can see what it looks like by running:

```
gsutil cp gs://enron_emails/allen-p/inbox/1. .
```

Now `tail` the downloaded file to verify the email text is there:

```
tail 1.
```

You should receive the following output:

```
Attached is the Delta position for 1/18, 1/31, 6/20, 7/16, 9/24

 << File: west_delta_pos.xls >>

Let me know if you have any questions.
```

This should display the contents of a plaintext mail file. There are two types of files you'll be looking at for: plaintext mail files and image files. If you're interested, use the same mechanism to check out what is in those other files.

Enable Cloud KMS

Cloud KMS is a cryptographic key management service on Google Cloud. Before using KMS you need to enable it in your project. In this lab you have been provisioned KMS should already have been enabled. You can make sure of this by using one of the `gcloud` CLI commands. Run the following in your Cloud Shell session:

```
gcloud services enable cloudkms.googleapis.com
```

Note: KMS and other services can also be enabled on your project using the Cloud Console UI as well.

You shouldn't have received any output. Cloud KMS is now enabled in your project!

Create a Keyring and Cryptokey

In order to encrypt the data, you need to create a KeyRing and a CryptoKey. KeyRings are useful for grouping keys. Keys can be grouped by environment (like **test**, **staging**, and **prod**) or by some other conceptual grouping. For this lab, your KeyRing will be called `test` and your CryptoKey will be called `qwiklab`. Run the following command in Cloud Shell to set environment variables:

```
KEYRING_NAME=test CRYPTOKEY_NAME=qwiklab
```

Execute the `gcloud` command to create the KeyRing. For this lab you will be using a global location, but it could also be set to a specific region.

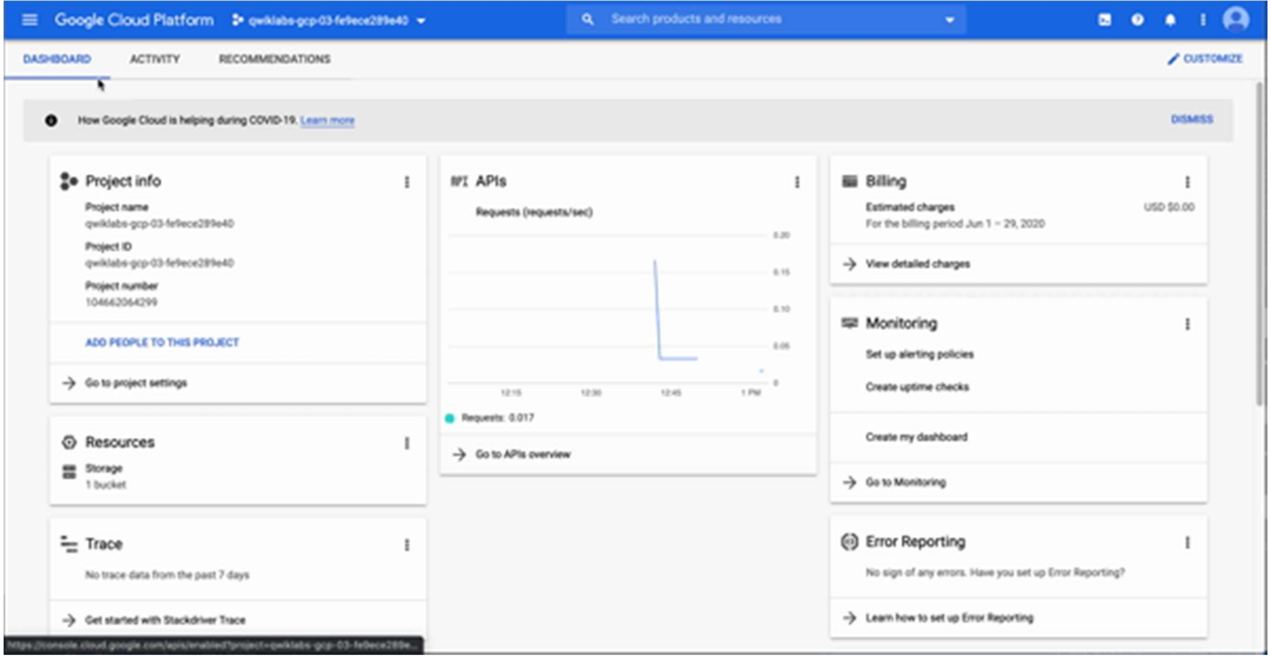
```
gcloud kms keyrings create $KEYRING_NAME --location global
```

Next, using the new KeyRing, create a CryptoKey named `qwiklab`.

```
gcloud kms keys create $CRYPTOKEY_NAME --location global \
      --keyring $KEYRING_NAME \
      --purpose encryption
```

Note: CryptoKeys and KeyRings cannot be deleted in Cloud KMS!
You shouldn't see any output. Just like that, you've created a KeyRing and CryptoKey!

Open the Cryptographic Keys through the Console by going to the **Navigation menu** > **Security** > **Cryptographic keys**:



How Google Cloud is helping during COVID-19. Learn more

Project name: qwiklabs-gcp-03-fe9ece289e40
Project ID: qwiklabs-gcp-03-fe9ece289e40
Project number: 104662064299

Requests: 0.017

Estimated charges USD $0.00
For the billing period Jun 1 – 29, 2020

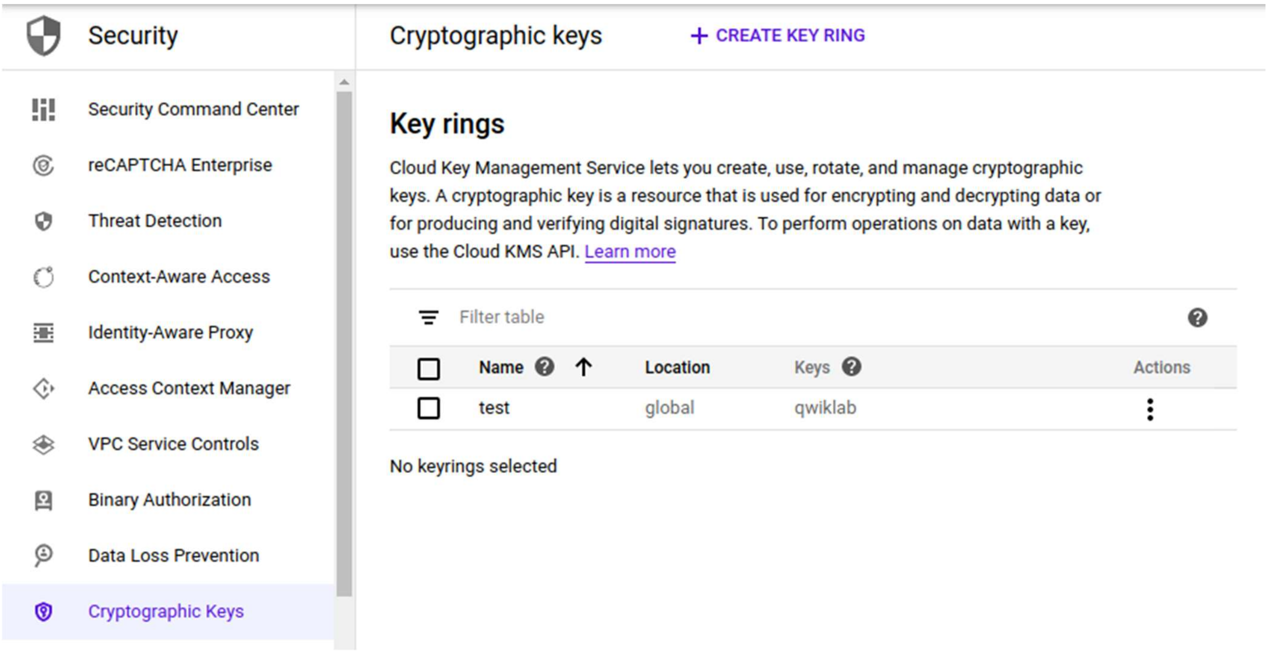
Storage: 1 bucket

No trace data from the past 7 days

No sign of any errors. Have you set up Error Reporting?

https://console.cloud.google.com/apis/enabled?project=qwiklabs-gcp-03-fe9ece289e...

The Key Management web UI allows you to view and manage your CryptoKeys and KeyRings. You will use this UI later when you manage permissions.



Key rings

Cloud Key Management Service lets you create, use, rotate, and manage cryptographic keys. A cryptographic key is a resource that is used for encrypting and decrypting data or for producing and verifying digital signatures. To perform operations on data with a key, use the Cloud KMS API. Learn more

□	Name ↑	Location	Keys	Actions
□	test	global	qwiklab	⋮

No keyrings selected

Click **Check my progress** to verify the objective.

Encrypt Your Data

Next, try to encrypt some data!

Take the contents of the email you looked at earlier and `base64` encode it by running the following:

```
PLAINTEXT=$(cat 1. | base64 -w0)
```

Note: Base-64 encoding allows binary data to be sent to the API as plaintext. This command works for images, videos, or any other kind of binary data.
Using the encrypt endpoint, you can send the base64-encoded text you want to encrypt to the specified key.

Run the following:

```
curl -v "https://cloudkms.googleapis.com/v1/projects/$DEVSHELL_PROJECT_ID/locations/global/keyRings/$KEYRING_NAME/cryptoKeys/$CRYPTOKEY_NAME:encrypt" \
  -d "{\"plaintext\":\"$PLAINTEXT\"}" \
  -H "Authorization:Bearer $(gcloud auth application-default print-access-token)"\
  -H "Content-Type: application/json"
```

Note: The `encrypt` action will return a different result each time even when using same text and key.
The response will be a JSON payload containing the encrypted text in the attribute `ciphertext`.

Now that your data is encrypted, you can save it to a file and upload it to your Cloud Storage bucket. To grab the encrypted text from the JSON response and save it to a file, use the command-line utility jq. The response from the previous call can be piped into jq, which can parse out the `ciphertext` property to the file `1.encrypted`.
Run the following:

```
curl -v "https://cloudkms.googleapis.com/v1/projects/$DEVSHELL_PROJECT_ID/locations/global/keyRings/$KEYRING_NAME/cryptoKeys/$CRYPTOKEY_NAME:encrypt" \
  -d "{\"plaintext\":\"$PLAINTEXT\"}" \
  -H "Authorization:Bearer $(gcloud auth application-default print-access-token)"\
  -H "Content-Type:application/json" \
| jq .ciphertext -r > 1.encrypted
```

To verify the encrypted data can be decrypted, call the `decrypt` endpoint to verify the decrypted text matches the original email. The encrypted data has information on which CryptoKey version was used to encrypt it, so the specific version is never supplied to the decrypt endpoint.

Run the following:

```
curl -v "https://cloudkms.googleapis.com/v1/projects/$DEVSHELL_PROJECT_ID/locations/global/keyRings/$KEYRING_NAME/cryptoKeys/$CRYPTOKEY_NAME:decrypt" \
  -d "{\"ciphertext\":\"$(cat 1.encrypted)\"}" \
  -H "Authorization:Bearer $(gcloud auth application-default print-access-token)"\
  -H "Content-Type:application/json" \
| jq .plaintext -r | base64 -d
```

Note: Usually decryption is performed at the application layer. For a walkthrough on how to encrypt and decrypt data in multiple programming languages, read the Cloud KMS Quickstart.

Now that you have verified the text has been encrypted successfully, upload the encrypted file to your Cloud Storage bucket.

```
gsutil cp 1.encrypted gs://${BUCKET_NAME}
```

Click **Check my progress** to verify the objective.

Configure IAM Permissions

In KMS, there are two major permissions to focus on. One permissions allows a user or service account to **manage KMS resources**, the other allows a user or service account to use keys to **encrypt and decrypt** data.

The permission to manage keys is `cloudkms.admin`, and allows anyone with the permission to create KeyRings and create, modify, disable, and destroy CryptoKeys. The permission to encrypt and decrypt is `cloudkms.cryptoKeyEncrypterDecrypter`, and is used to call the encrypt and decrypt API endpoints.

For this exercise, you will use the current authorized user to assign IAM permissions. To get the current authorized user, run the command below:

```
USER_EMAIL=$(gcloud auth list --limit=1 2>/dev/null | grep '@' | awk '{print $2}')
```

Next, assign that user the ability to manage KMS resources. Run the following `gcloud` command to assign the IAM permission to manage the KeyRing you just created:

```
gcloud kms keyrings add-iam-policy-binding $KEYRING_NAME \
    --location global \
    --member user:$USER_EMAIL \
    --role roles/cloudkms.admin
```

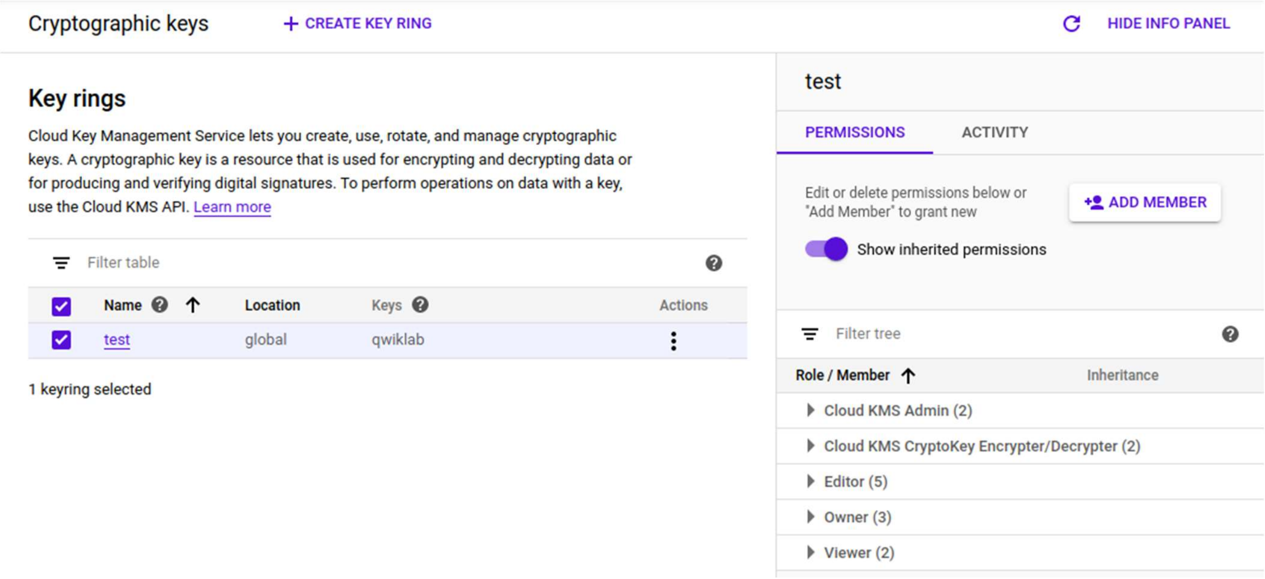
Since CryptoKeys belong to KeyRings, and KeyRings belong to Projects, a user with a specific role or permission at a higher level in that hierarchy inherits the same permissions on the child resources. For example, a user who has the role of Owner on a Project is also an Owner on all the KeyRings and CryptoKeys in that project. Similarly, if a user is granted the `cloudkms.admin` role on a KeyRing, they have the associated permissions on the CryptoKeys in that KeyRing.

Without the `cloudkms.cryptoKeyEncrypterDecrypter` permission, the authorized user will not be able to use the keys to encrypt or decrypt data. Run the following `gcloud` command to assign the IAM permission to encrypt and decrypt data for any CryptoKey under the KeyRing you created:

```
gcloud kms keyrings add-iam-policy-binding $KEYRING_NAME \
    --location global \
    --member user:$USER_EMAIL \
    --role roles/cloudkms.cryptoKeyEncrypterDecrypter
```

Now you can view the assigned permissions in the Cryptographic Keys section of [Key Management](). Check the box by the name of the key ring (`test`), then click **Permissions** in the right column.

This will open up a menu where you can see the accounts and permissions for the key ring you just added.



Key rings

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☑	Name ↑	Location	Keys	Actions
☑	test	global	qwiklab	⋮

1 keyring selected

test

Edit or delete permissions below or "Add Member" to grant new

● Show inherited permissions

Role / Member ↑	Inheritance
▸ Cloud KMS Admin (2)	
▸ Cloud KMS CryptoKey Encrypter/Decrypter (2)	
▸ Editor (5)	
▸ Owner (3)	
▸ Viewer (2)	

Back up data on the Command Line

Now that you have an understanding of how to encrypt a single file, and have permission to do so, you can run a script to backup all files in a directory. For this example, copy all emails for **allen-p**, encrypt them, and upload them to a Cloud Storage bucket.

First, copy all emails for **allen-p** into your current working directory:

```
gsutil -m cp -r gs://enron_emails/allen-p .
```

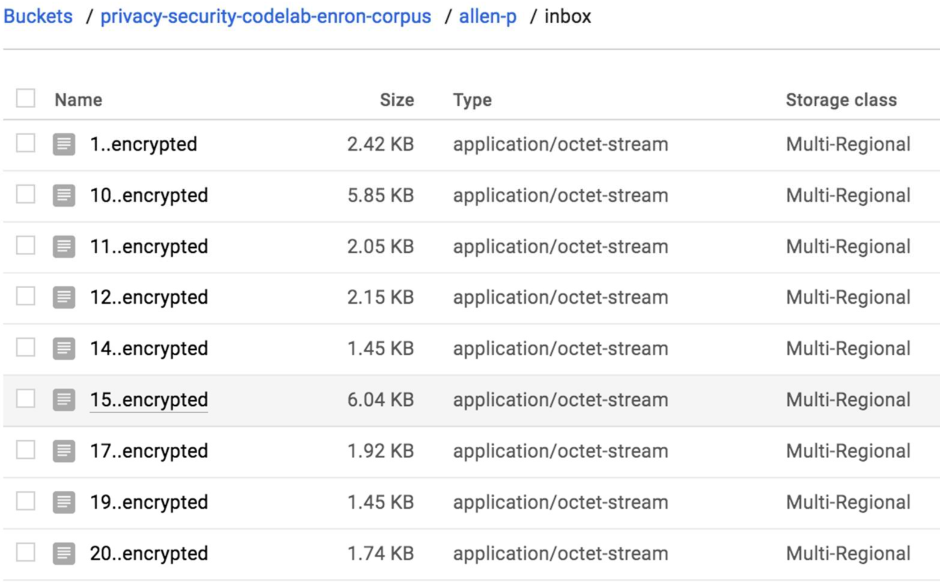
Now copy and paste the following into Cloud Shell to back up and encrypt all the files in the **allen-p** directory to your Cloud Storage bucket:

```
MYDIR=allen-p
FILES=$(find $MYDIR -type f -not -name "*.encrypted")
for file in $FILES; do
  PLAINTEXT=$(cat $file | base64 -w0)
  curl -v
"https://cloudkms.googleapis.com/v1/projects/$DEVSHELL_PROJECT_ID/locations/global/keyR
ings/$KEYRING_NAME/cryptoKeys/$CRYPTOKEY_NAME:encrypt" \
    -d "{\"plaintext\":\"$PLAINTEXT\"}" \
    -H "Authorization:Bearer $(gcloud auth application-default print-access-token)" \
    -H "Content-Type:application/json" \
  | jq .ciphertext -r > $file.encrypted
done
gsutil -m cp allen-p/inbox/*.encrypted gs://${BUCKET_NAME}/allen-p/inbox
```

This script loops over all the files in a given directory, encrypts them using the KMS API, and uploads them to Cloud Storage.

Click **Check my progress** to verify the objective.

After the script completes, you can view the encrypted files when you click Storage from the Console's left menu. To fine the files, go to **Navigation menu** > **Storage** > **Browser** > **YOUR_BUCKET** > **allen-p** > **inbox**. You should see something like this:



Buckets / privacy-security-codelab-enron-corpus / allen-p / inbox

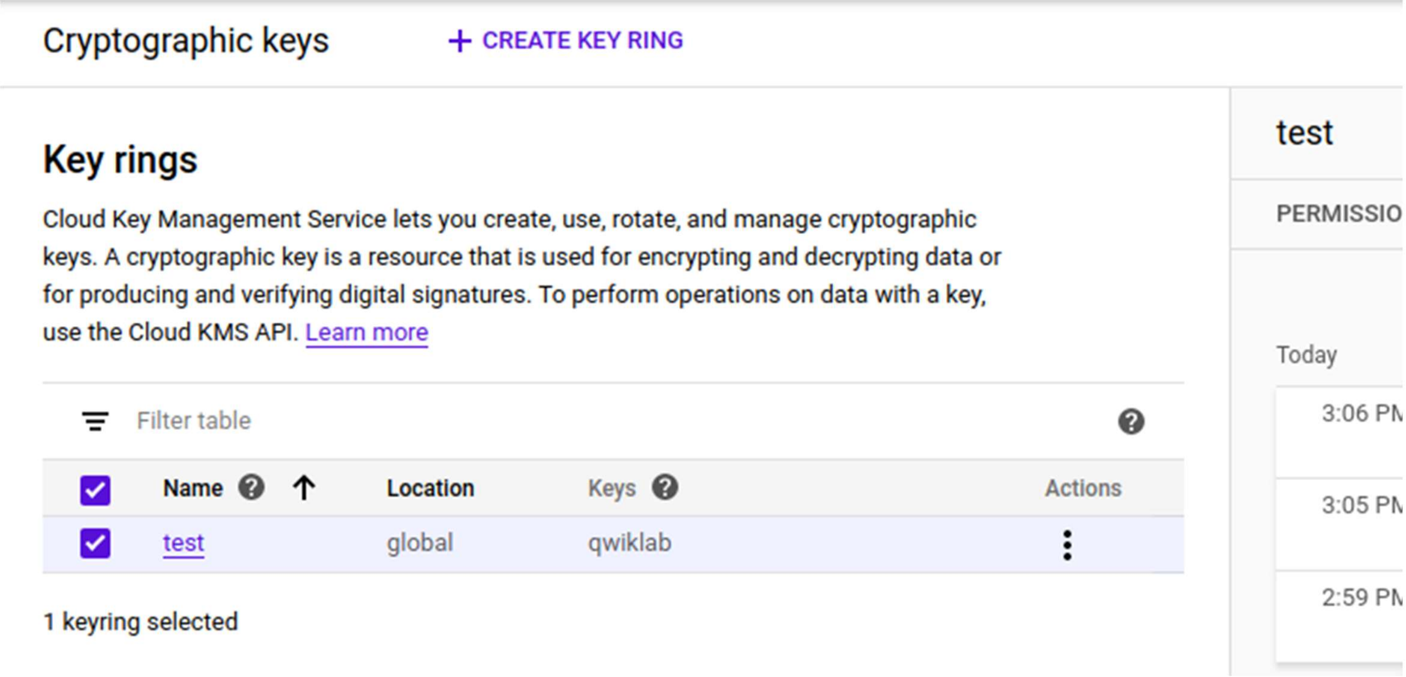
□	Name	Size	Type	Storage class
□	1..encrypted	2.42 KB	application/octet-stream	Multi-Regional
□	10..encrypted	5.85 KB	application/octet-stream	Multi-Regional
□	11..encrypted	2.05 KB	application/octet-stream	Multi-Regional
□	12..encrypted	2.15 KB	application/octet-stream	Multi-Regional
□	14..encrypted	1.45 KB	application/octet-stream	Multi-Regional
□	15..encrypted	6.04 KB	application/octet-stream	Multi-Regional
□	17..encrypted	1.92 KB	application/octet-stream	Multi-Regional
□	19..encrypted	1.45 KB	application/octet-stream	Multi-Regional
□	20..encrypted	1.74 KB	application/octet-stream	Multi-Regional

Note: Cloud Storage supports Server Side Encryption, which supports key rotation of your data and is the recommended way to encrypt data in Cloud Storage. The above example is for demonstration purposes only.

View Cloud Audit Logs

Google Cloud Audit Logging consists of two log streams, Admin Activity and Data Access, which are generated by Google Cloud services to help you answer the question "who did what, where, and when?" within your Google Cloud projects.

To view the activity for any resource in KMS, return to the Cryptographic keys page (**Navigation menu** > **Security** > **Cryptographic keys**), check the box next to your key ring, then click on the **Activity** tab in the right menu. This will take you to the Cloud Activity UI, where you should see the creation and all modifications made to the KeyRing.



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☑	Name ↑	Location	Keys	Actions
☑	test	global	qwiklab	⋮

1 keyring selected

Note: you can click "SHOW INFO PANEL" in the top-right corner if nothing comes up. You've now encrypted and uploaded data using KMS and Cloud Storage!

What was covered

- Using IAM to manage KMS permissions.
- Using KMS to encrypt data.
- Using Cloud Storage to store encrypted data.
- Using Cloud Audit Logging to view all activity for CryptoKeys and KeyRings.

Test your knowledge

Test your knowledge about Google cloud Platform by taking this quiz.

Cloud KMS is integrated with Cloud IAM and Cloud Audit Logging so that you can manage permissions on individual keys and monitor how these are used.

True

Congratulations!

Finish Your Quest

This self-paced lab is part of the Security & Identity Fundamentals Quest. A Quest is a series of related labs that form a learning path. Completing this Quest earns you the badge above, to recognize your achievement. You can make your badge (or badges) public and link to them in your online resume or social media account. Enroll in a Quest and get immediate completion credit if you've taken this lab. See other available Qwiklabs Quests.

Take Your Next Lab

Continue your Quest with Setting up a Private Kubernetes Cluster or try one of these:

- Securing Google Cloud with CFT Scorecard
- User Authentication: Identity-Aware Proxy

Next Steps / Learn More

- Learn more about rotating encryption keys
- Read about envelope encryption
- Read about Server Side Encryption
- Post questions and find answers on Stackoverflow under google-cloud-kms

Manual Last Updated March 9, 2021

Lab Last Tested September 04, 2020