Google Cloud Platform

This semester we are allowing all students to explore cloud computing as offered by the Google Cloud Platform. Using the instructions below one can establish a service using Google App Engine. Once established, you will be able to complete homework #3.

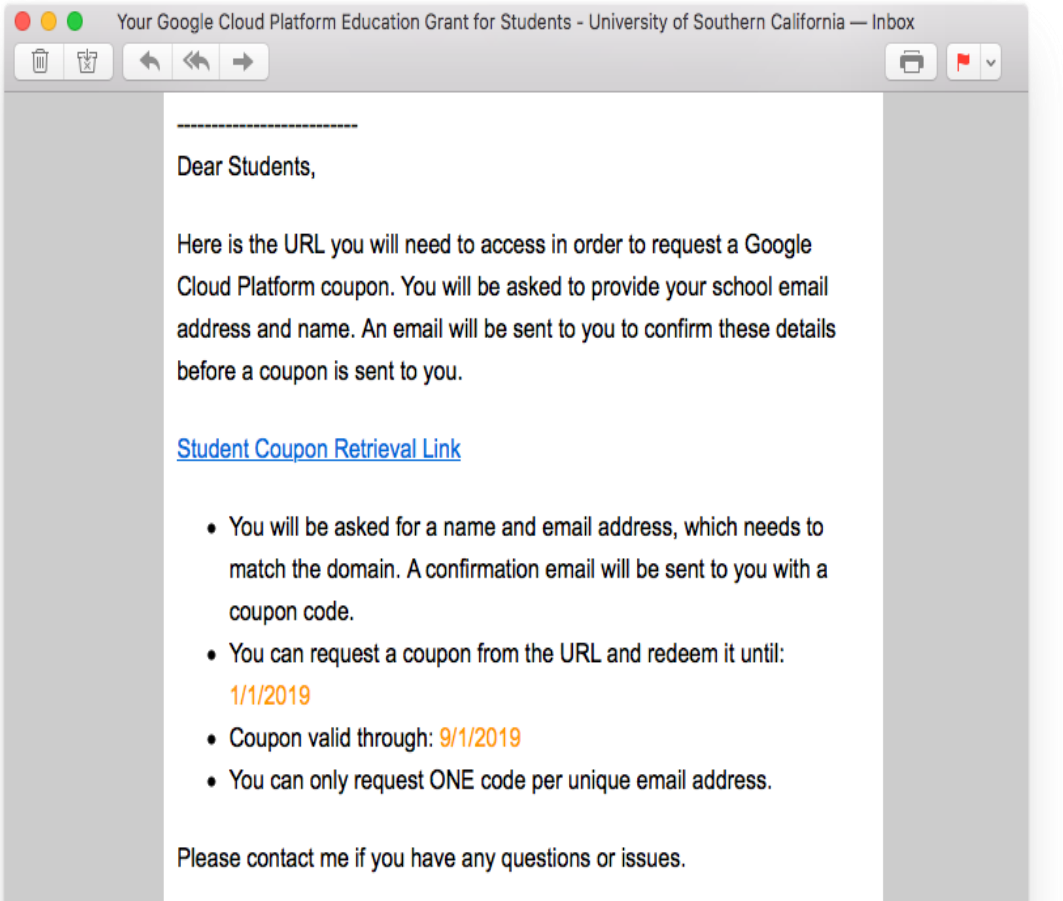
1. Sign up for Google Cloud Platform

If you do not have a credit card, Google provides you with a coupon code via the Google Cloud Platform Education Grants program (see **section 1.1**). If you do have a credit card, you can sign up for the Google Cloud Platform "Free Trial" (see **section 1.2**).

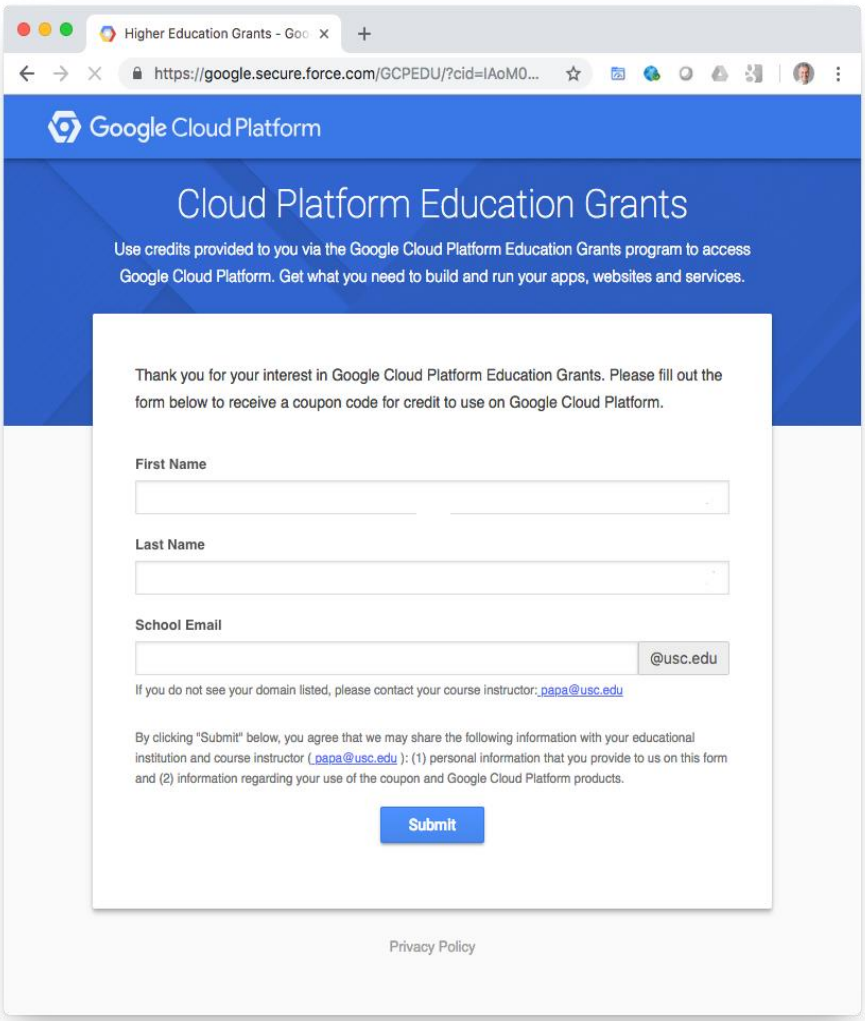
1.1 Get Google Cloud Platform Education Grants credit

On Piazza and by e-mail, you will receive a communication like the one displayed below.

The communication contains information on how to request a Google Cloud Platform coupon. **Click** on the text **Student Coupon Retrieval Link**.



You will be redirected to a web form as shown below:



Enter your **First Name**, **Last Name** and your **USC e-mail address**. @usc.edu will be pre-filled. **Click** on **Submit**. If you entered a valid USC e-mail address, an email will be sent to that USC email address to verify that you own such address. A sample email is shown below:

Dear Laurie,

Thank you for your interest in downloading a Google Cloud Platform Coupon Code. Please click on this link to verify your email address and a code will be sent to your email account.

Notice that anyone with the URL from USC can request a coupon, so please be careful and do not share the Student Coupon Retrieval Link or the link to verify your email.

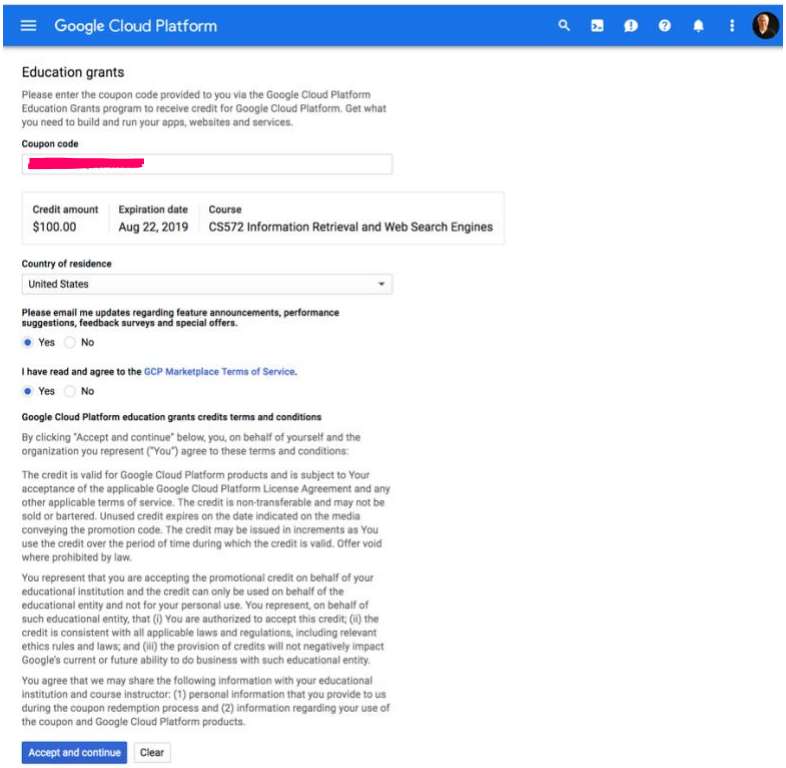
Once your USC email address is "verified", you will receive a second email with a Google Cloud Platform Coupon Code, as shown below.

Important step: Before clicking on the link labeled **[here]**, you should open your default browser, and **login** to a **Gmail** account. Every USC student has been provided with a Gmail account. (There is an icon at the top right corner that can be. Used to check which account you are logged into and that allows you to change accounts if you are logged into your usc.edu account.)

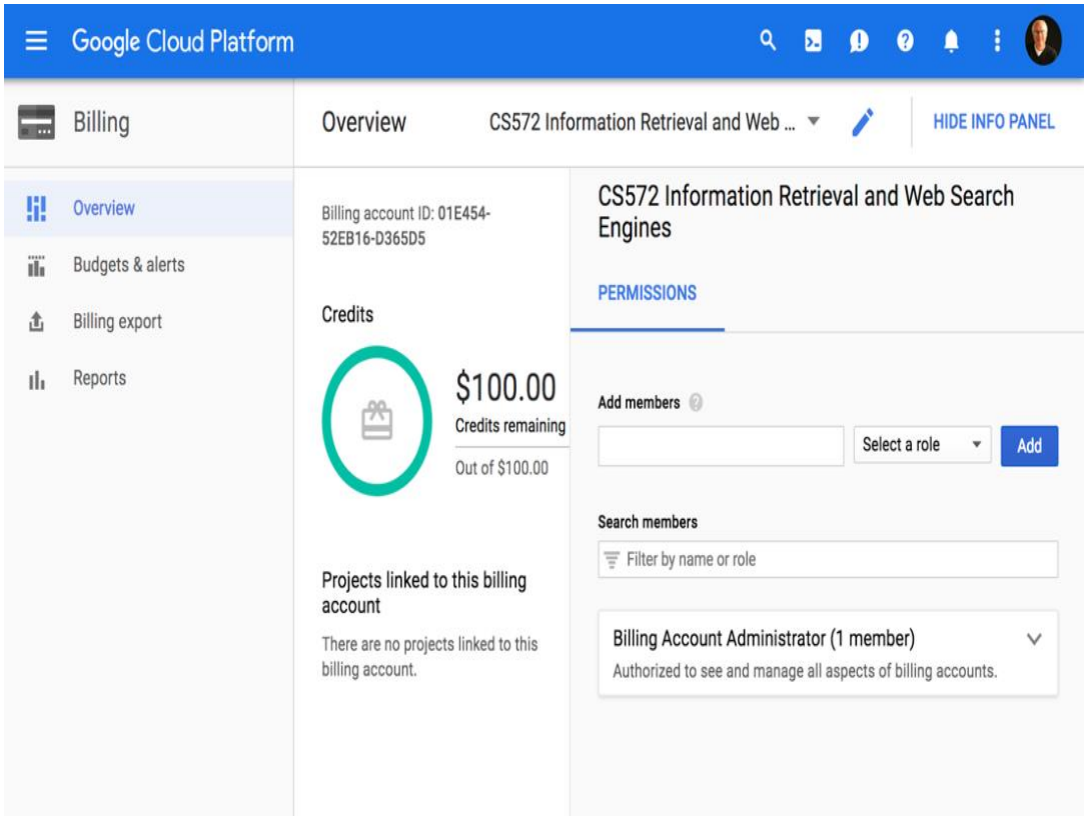
Once logged into Gmail, you can click on **[here]**, or you can go to this page:

https://console.cloud.google.com/education

to redeem your coupon. The web form below will be displayed.



You need to paste your coupon into the field labeled **Coupon code**. Select **Yes** or **No** to receive announcements. Make sure that the active profile in the top right is the one associated with your Gmail account. **Click** on **Accept and continue**. You will now be taken to the Google Cloud Platform' s **Billing** section, and the amount of your credit will be displayed, as shown below.



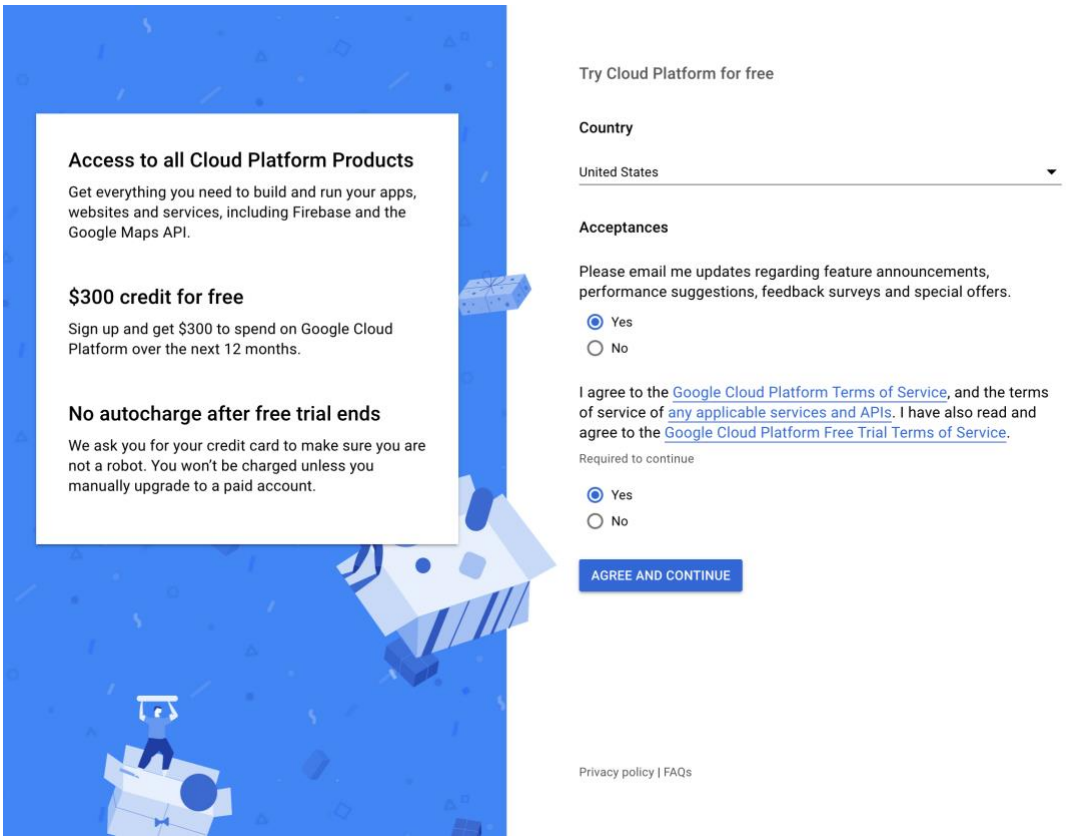
1.2 Sign up for Google Cloud Platform Free Trial

To sign up for the Free Trial, with a $300 credit, you need a credit or debit card. Unfortunately, an American Express or other pre-paid Gift card will not work with Google Cloud.

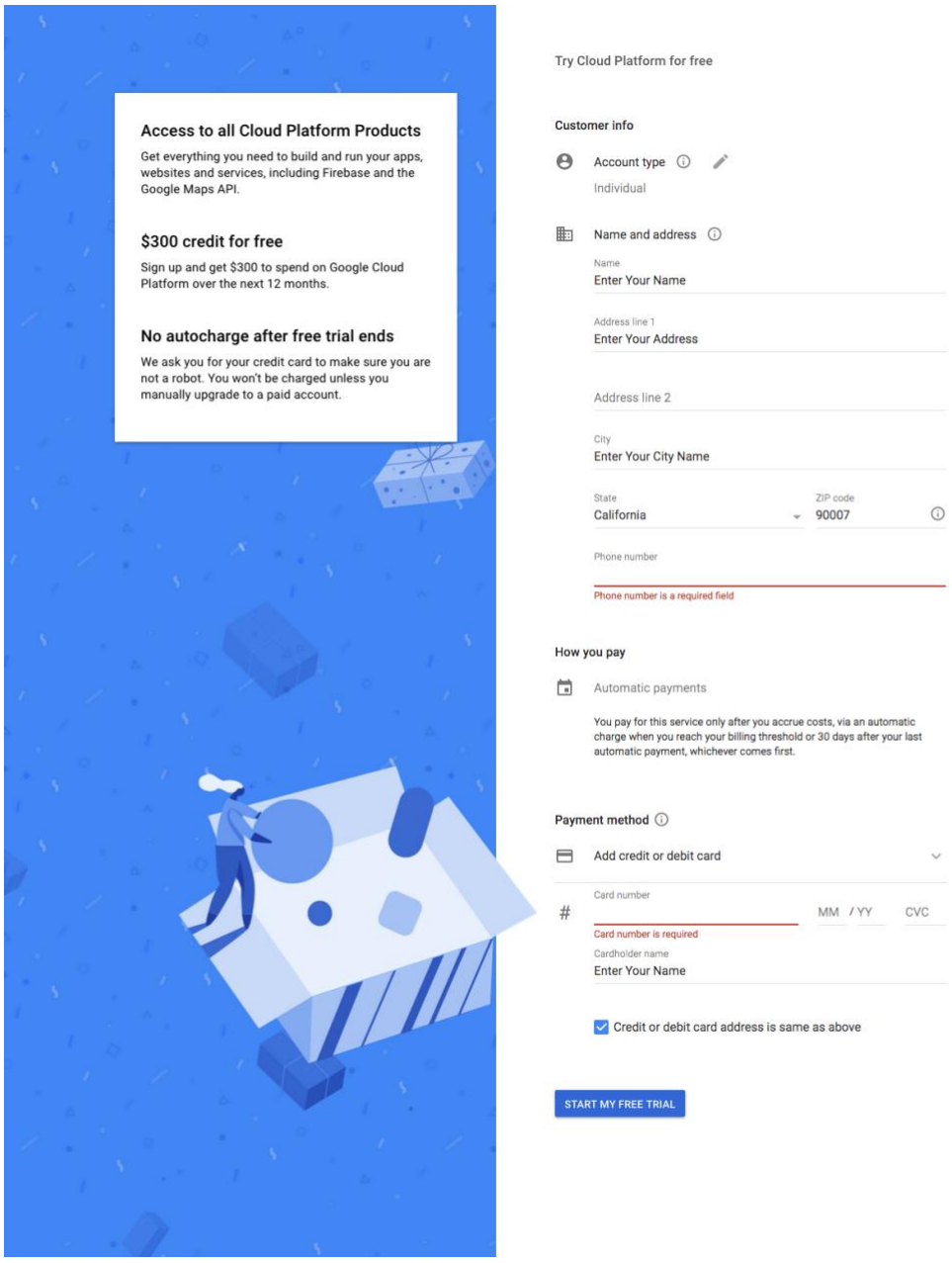
To sign up go to:

https://console.cloud.google.com/freetrial?pli=1&page=0

On the webpage entitled “Try Cloud Platform for free”, select that you “agree to use the services” and click on **Agree and continue**.



Step 1



Step 2

Figure 1: Google Cloud SignUp Screen

Select **Account Type Individual**. Follow the instructions to enter your account data as in **Figure 1**. You should **not** be using your @usc.edu e-mail account for your primary contact e-mail address, but instead use your @gmail.com address and finish by clicking **Start my free trial**. Again, you will have to provide a credit or debit card.

After you are signed up, you will see the message “Creating project. This may take a few moments.” You will then be redirected to the **Dashboard** of the **Google Developer Console**.

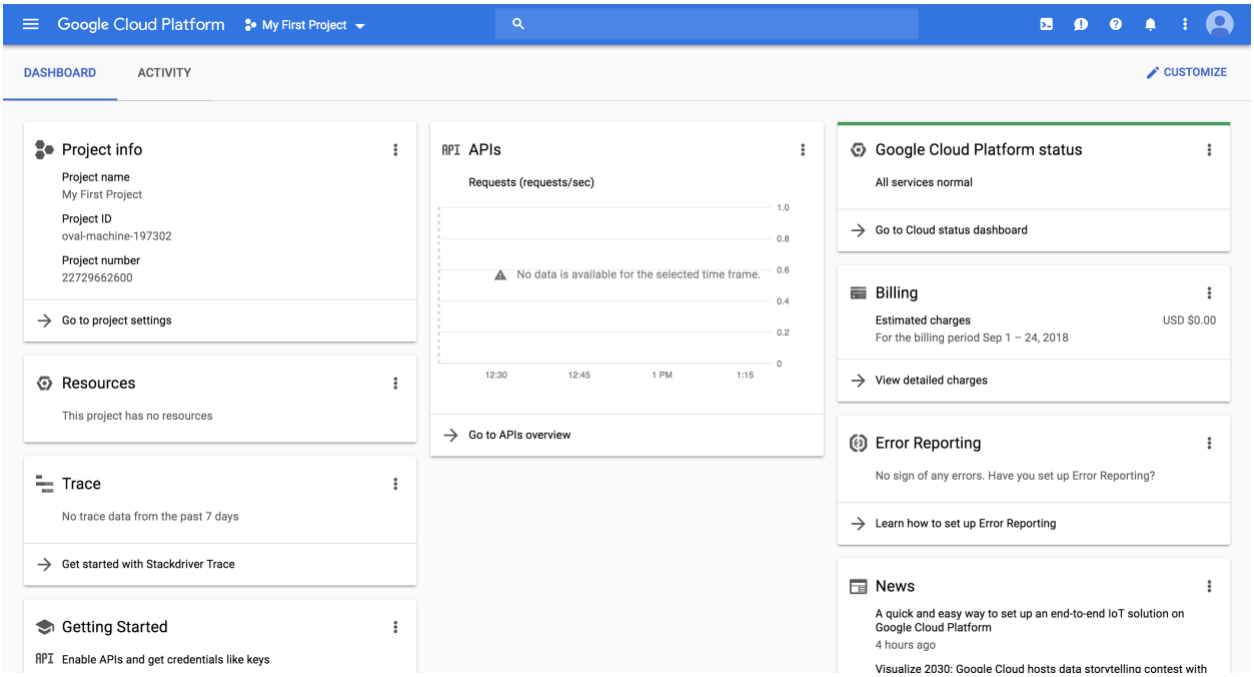
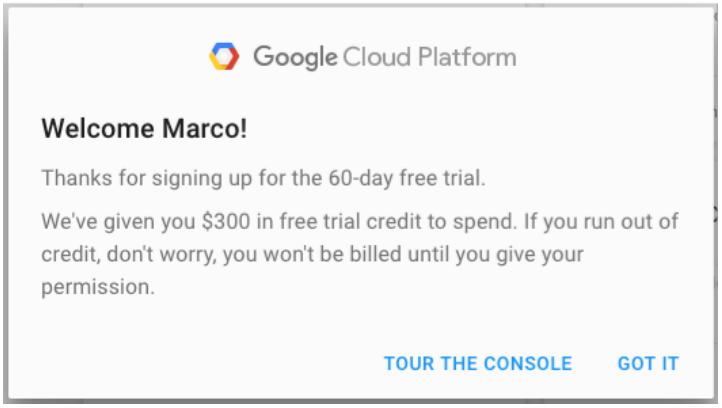


Figure 2: Dashboard of the Google Developer Console

A message will pop up indicating you signed up for the 60-day free trial, and have been given a $300 free trial credit.



If you previously developed any projects using Google APIs, you will find them listed. You are now ready to proceed with the specifics of your homework/project.

Notes on Google Cloud Pricing

If you go to

https://cloud.google.com/free/docs/always-free-usage-limits

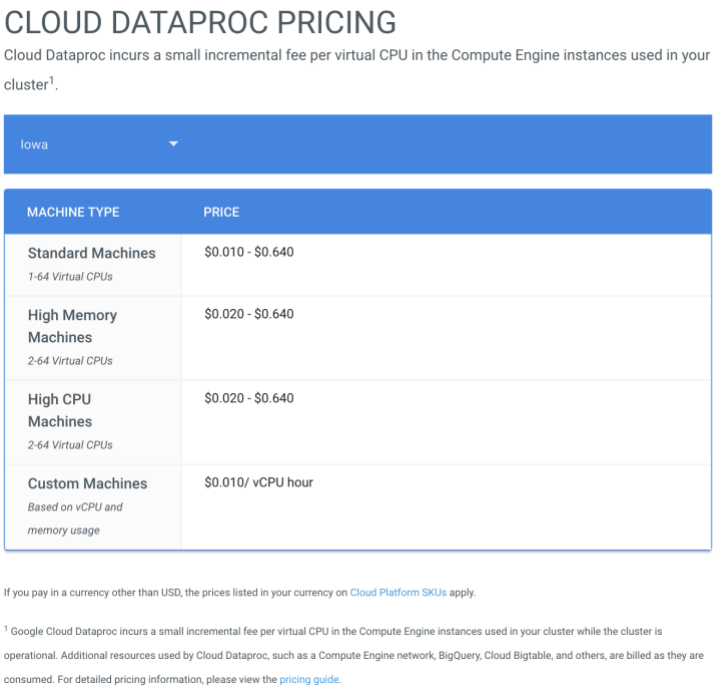
you will see that there are certain usage items that are always free. For example, under the Google App Engine 28 instance hours/day and 5GB Cloud Storage are just two of several items. The Google Cloud Datastore offers 1GB storage and 50,000 reads, 20,000 writes and 20,000 deletes for free. There are many other aspects of the Google Cloud that include free elements. Unfortunately, the DataProc is not one of them. As a result, the $300 free credit will kick in immediately.

The Google Cloud Dataproc is more fully described at

https://cloud.google.com/dataproc/

Adopting Google Cloud Platform pricing principles, Cloud Dataproc has a low cost and an easy to understand **price structure, based on actual use, measured by the minute**.

Here is the structure:



CLOUD DATAPROC PRICING

Cloud Dataproc incurs a small incremental fee per virtual CPU in the Compute Engine instances used in your cluster[1].

Iowa

MACHINE TYPE	PRICE
Standard Machines *1-64 Virtual CPUs*	$0.010 - $0.640
High Memory Machines *2-64 Virtual CPUs*	$0.020 - $0.640
High CPU Machines *2-64 Virtual CPUs*	$0.020 - $0.640
Custom Machines *Based on vCPU and memory usage*	$0.010/ vCPU hour

If you pay in a currency other than USD, the prices listed in your currency on Cloud Platform SKUs apply.

[1] Google Cloud Dataproc incurs a small incremental fee per virtual CPU in the Compute Engine instances used in your cluster while the cluster is operational. Additional resources used by Cloud Dataproc, such as a Compute Engine network, BigQuery, Cloud Bigtable, and others, are billed as they are consumed. For detailed pricing information, please view the pricing guide.

Notice that Compute Engine, BigQuery, BigTable and “others” are billed.

Setting up Your Initial Machine

On the Dashboard, click on "Project" at the top of the window and either create a new project or select an existing one. For new projects choose a name. It may take a while to complete, but eventually you will be redirected to the Google cloud Dashboard.

Google has a large set of APIs, that will appear if you click on the menu immediately to the left of Google Cloud Platform. You will get a list that looks like **Figure 2** below. Included in the BIG DATA category are: BigQuery, Pub/Sub, Dataproc, Dataflow, Machine Learning and Genomics. For this exercise we will use Dataproc. Using Dataproc we can quickly create a cluster of compute instances running Hadoop. The alternative to Dataproc would be to individually setup each compute node, install Hadoop on it, set up HDFS, set up master node, etc. Dataproc automates this grueling process for us. Follow the instructions below to create a Hadoop cluster using Dataproc.

Creating a Hadoop Cluster on Google Cloud Platform

1. Create a Google Dataproc Cluster. Select **Dataproc** from the navigation list on the left

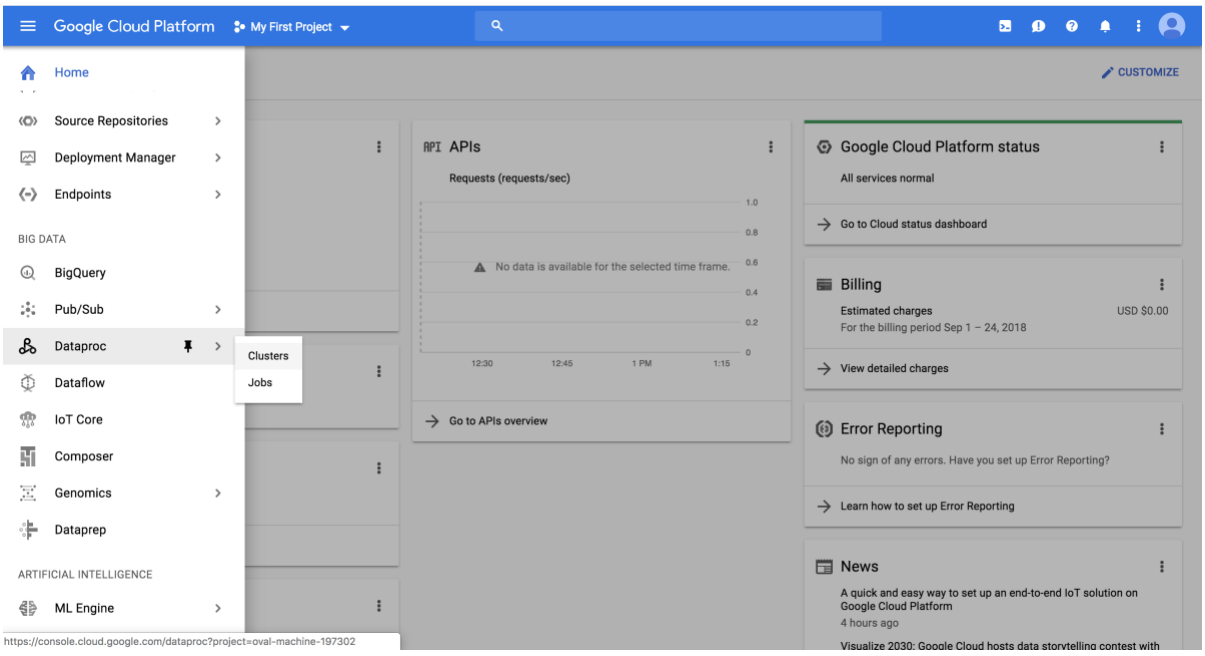


Figure 3: Google Cloud Platform APIs

2. If this is the first time you're using Dataproc then you'll encounter the error in the below screenshot (**Figure 4**). This means that your Google cloud account doesn't have the required API enabled. To enable the API copy the link in the error description and go to it. You will land on a page similar to the one in **Figure 5.** Click the **Enable** button at the top of the page to enable the Dataproc API **OR** you will get a pop-up box to

enable API (**see figure 6**). Click on Enable API and it will take some time to enable the Dataproc API (**Figure 6.1**)

Figure 4: Error caused when trying to create a cluster for the first time

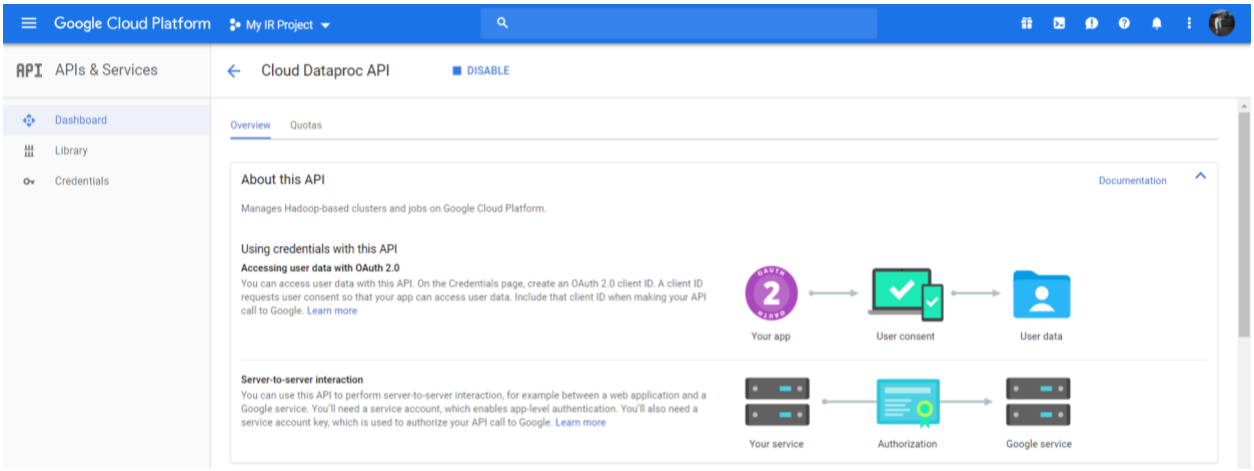


Figure 5: Enabling the Dataproc API

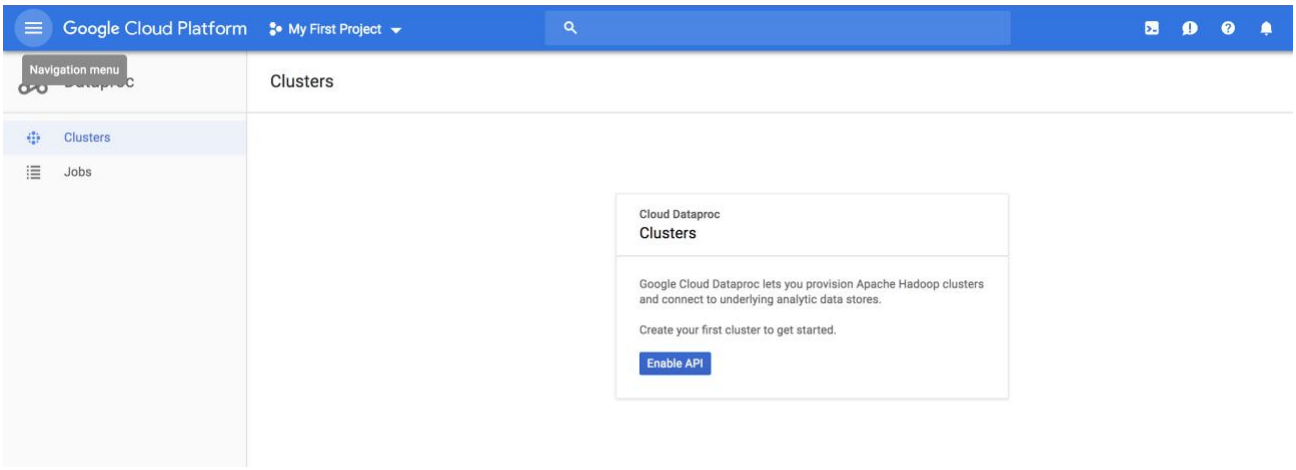


Figure 6: Click on Enable API

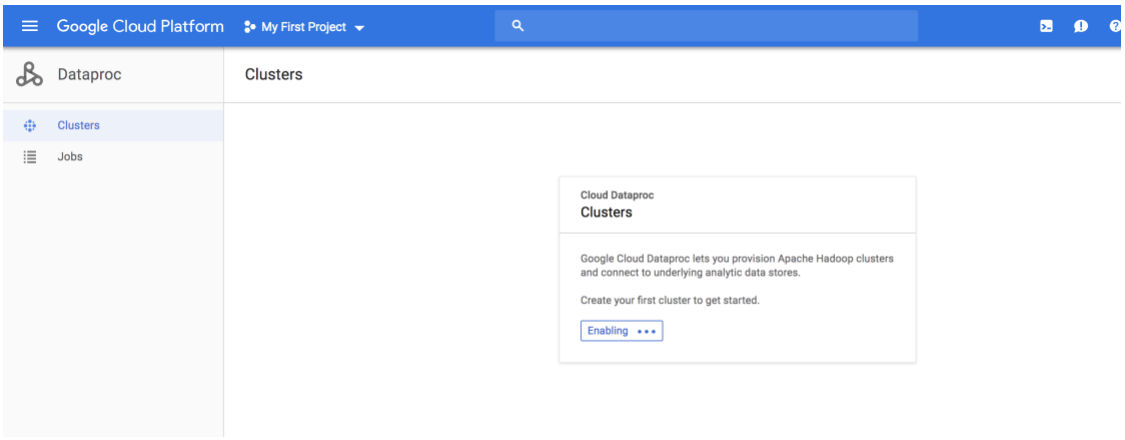


Figure 6.1: Enabling the Dataproc API

3. Once you've enabled the API you'll now see a dialog box with a **Create Cluster** button (**see figure 7**)

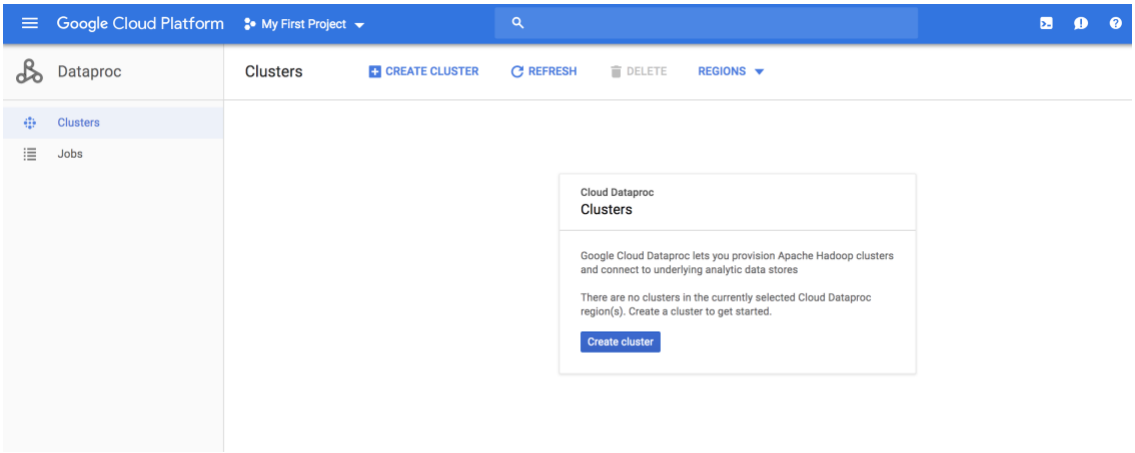


Figure 7: This is what you see once the API is enabled

4. Clicking on "**Create Cluster**" will take you to the cluster configuration section (**Figure 8**). Give any unique name to your cluster and select a **us-west** zone. You need to create a master and 3 worker nodes. Select the default configuration processors **(n1-standard-4 4vCPU 15 GB memory)** for each member and reduce the storage to **32 GB** HDD storage. Leave everything else default and click on "**Create**". If you get an error (**Figure 9**) saying that you've exceeded your quota, reduce the number of worker nodes or choose a Machine Type(for master and worker) with fewer **vCPUs**. In rare cases you may get the error in **Figure 4** again. If so, simply follow the instructions in step 2 again. If all goes well your cluster will be created in a few minutes.

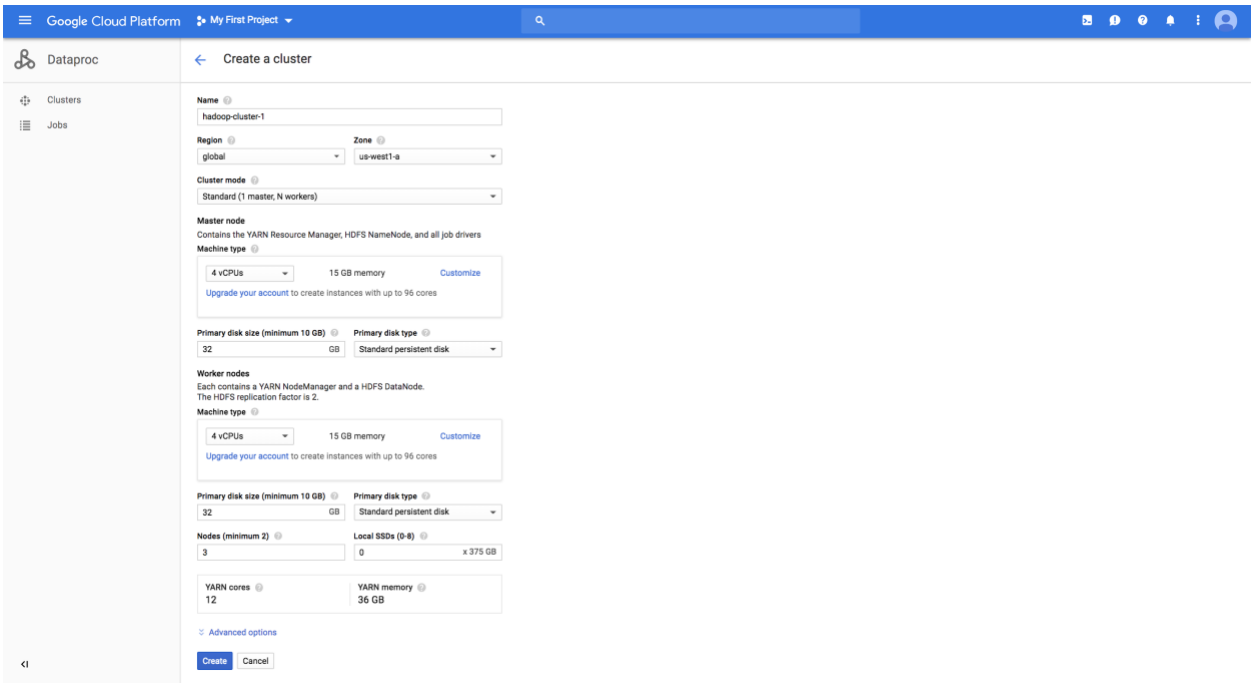


Figure 8: Screen for setting up a cluster

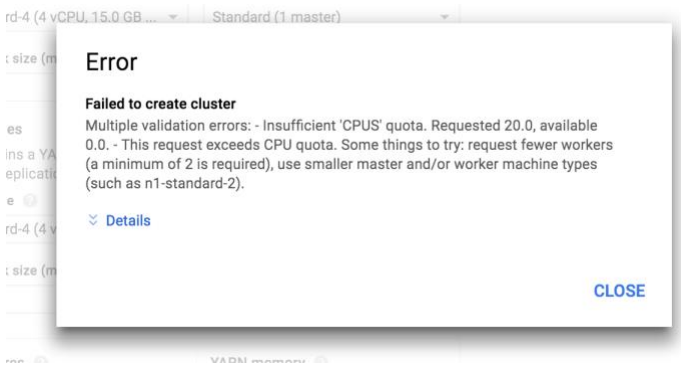


Figure 9: Insufficient CPU Quota error

5. Now that the cluster is setup we'll have to configure it a little before we can run jobs on it. Select the cluster you just created from the list of clusters under the cloud Dataproc section on your console. Go to the **VM Instances** tab and click on the **SSH** button next to the instance with the **Master** Role. If you don't see the SSH button click the **Refresh** button on the top of the page.

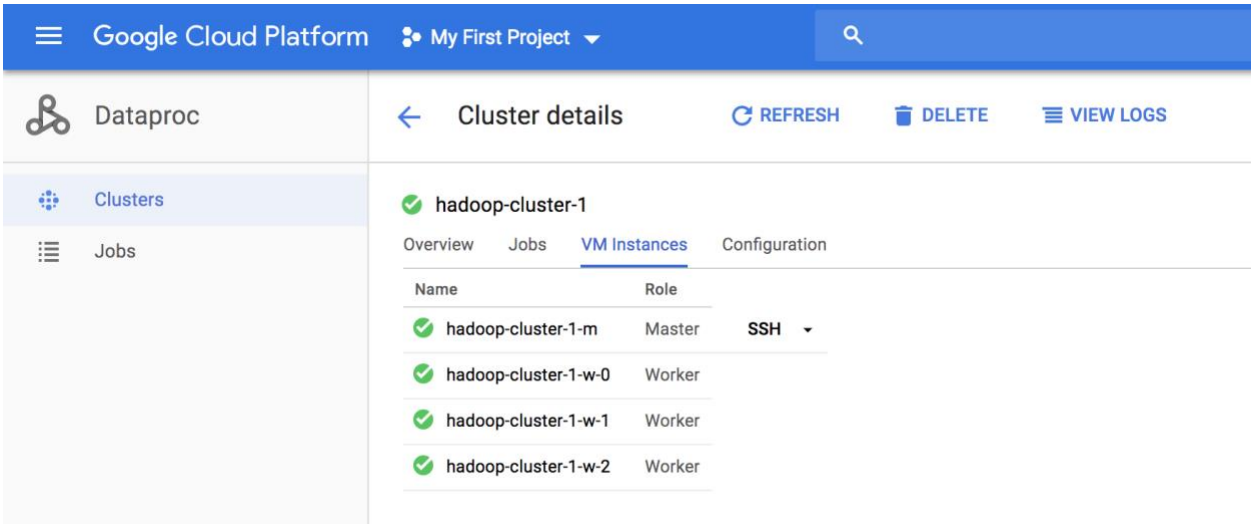


Figure 10: SSH into the master node.

6. Clicking on the **SSH** button will take you to a Command line Interface(CLI) like an xTerm or Terminal. All the commands in the following steps are to be entered in the CLI.

   There is no home directory on HDFS for the current user so set up the user directory on HDFS. So, we'll have to set this up before proceeding further. (To find out your user name run `whoami`)

   - `hadoop fs -mkdir -p /user/<your username here>`

7. Set up environment variables for JAVA and HADOOP_CLASSPATH. Please note that this step has to be done each time you open a new SSH terminal.

   - JAVA_HOME is already set-up. Do not change this.
   - `export PATH=${JAVA_HOME}/bin:${PATH}`
   - `export HADOOP_CLASSPATH=${JAVA_HOME}/lib/tools.jar`

   To ensure that the environment variables are set, run the command `env`. You should see the path associated with JAVA_HOME in the PATH variable and a new variable called HADOOP_CLASSPATH
   as highlighted in the image below.

8. Run hadoop fs -ls
9. If there is no error this implies that your cluster was successfully set up. If you do encounter an error it's most likely due to a missing environment variable or user home directory not being set up right. Retrace steps 1 to 6 to fix this.

NOTE:

- Please **disable** the billing for the cluster when you are not using it. Leaving it running will cost extra credits. The cluster is billed based on how many hours it is running and not how much data it is processing. So, if you leave the billing enabled overnight on an idle cluster you will still incur significant charges.
- Click the ☰ on the top left corner in the Google console and go to the **Billing** section. Click the ⋮ button next to the project you created initially and select *disable billing*. Please do this whenever you are not working on the cluster.

Enabling and Disabling Billing accounts

We need to disable billing for the project (where the cluster was created) when we are not running the job to save some credits. Follow the steps below to disable and enable the billing for your project:

Disable Billing:

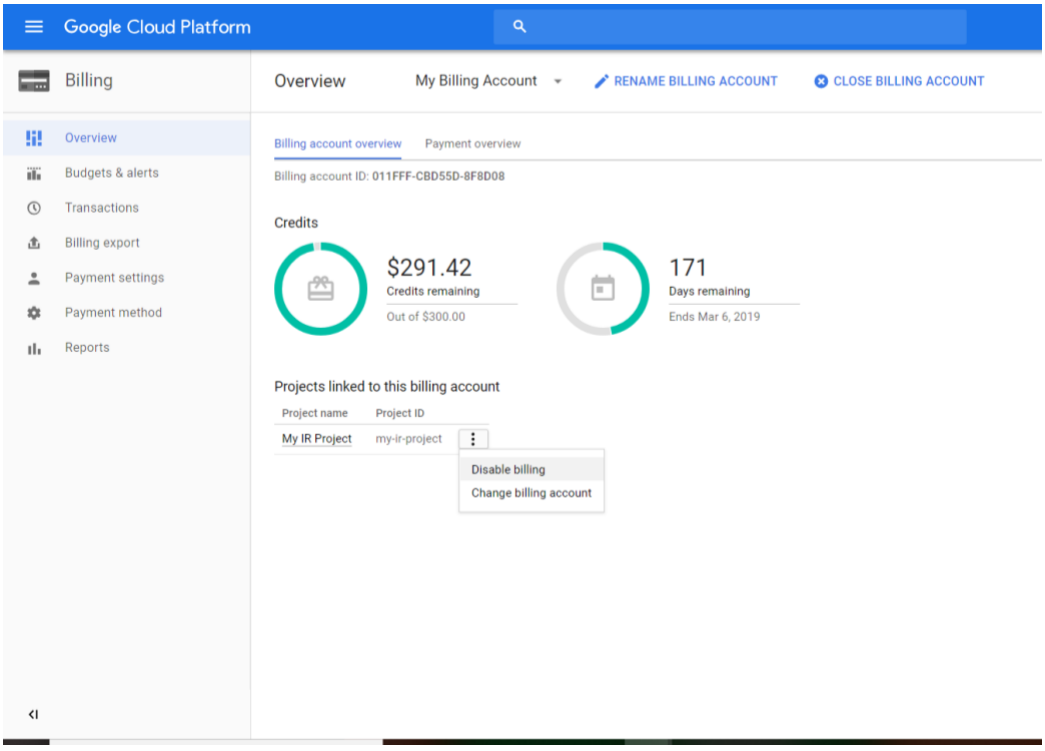
1. Click the navigation button on the top left ☰.
2. Navigate to the billing section.
3. Click on Disable billing for the project you created.(See screenshot below)
4. 

Figure 11: Disabling the billing for the cluster.

Enable Billing:

Option 1: When you navigate to the billing section you will be prompted to select the billing account. Select "Your Project Name". This billing account is created when you redeem the Google credits.

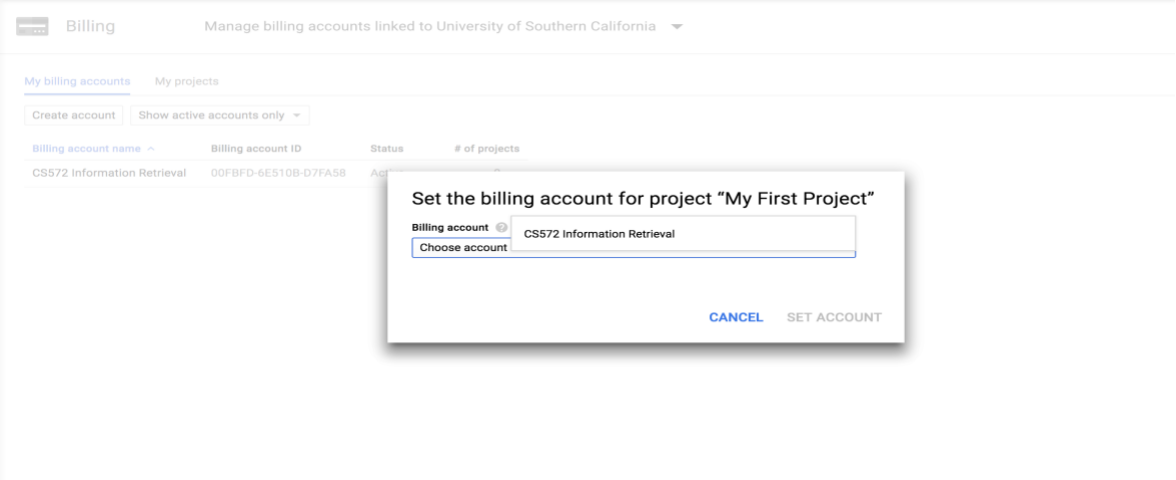


Figure 12: Select the account "Your Account Name"

Option 2: Navigate to the Dataproc section. You will see a screen similar to the figure below. Click on Enable billing.

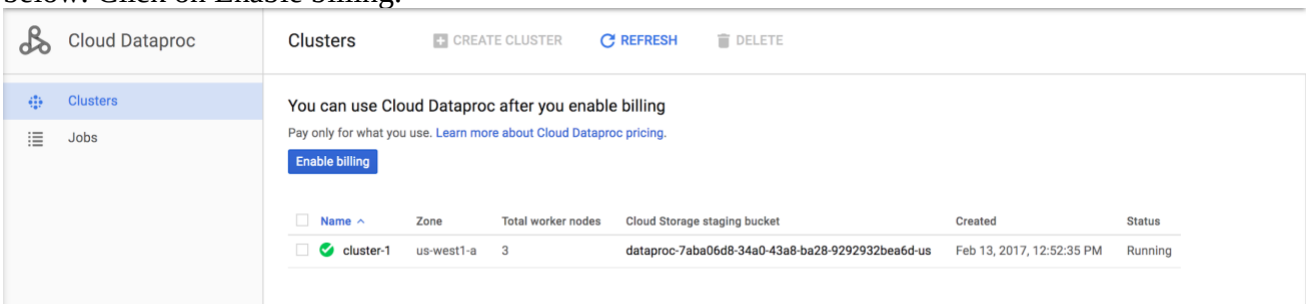


Figure 13: Enable billing

NOTE : Every time you disable and enable billing for a cluster, the Virtual Machines in the cluster don't start by themselves. We need to manually start the VMs. In the VM Instances section of the Cluster you might see all the VM's of the cluster disabled. To enable the VM Instances, navigate to the Compute Engine section. Select all the instances corresponding to the cluster you created and click on the START button. Once activated navigate back to the Dataproc section to resume working on the cluster.

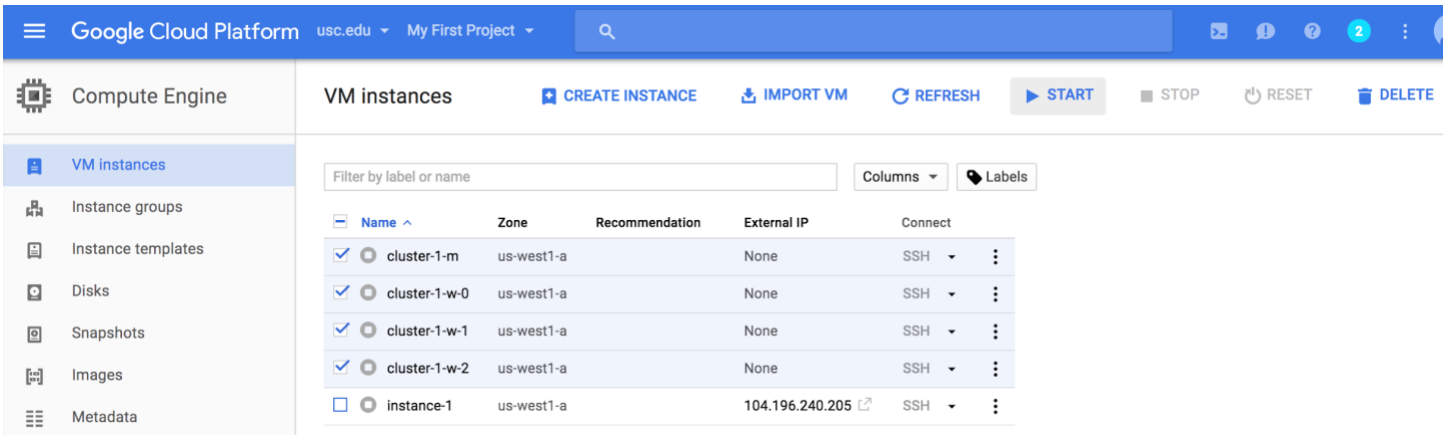


Figure 14: Select all virtual machines associated with the cluster.

Credits Spent:

To check how much you've been charged for your cluster, navigate to the Billing section and click on the project name in the Overview section (see Figure 15 & 16). We suggest you check this section at least once every 24 hours.

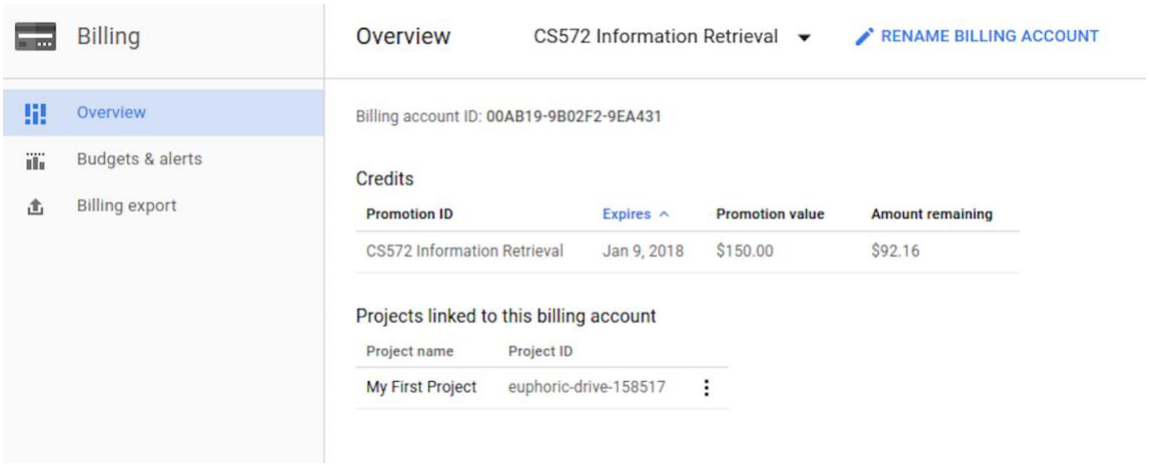


Figure 15: Billing Overview section.

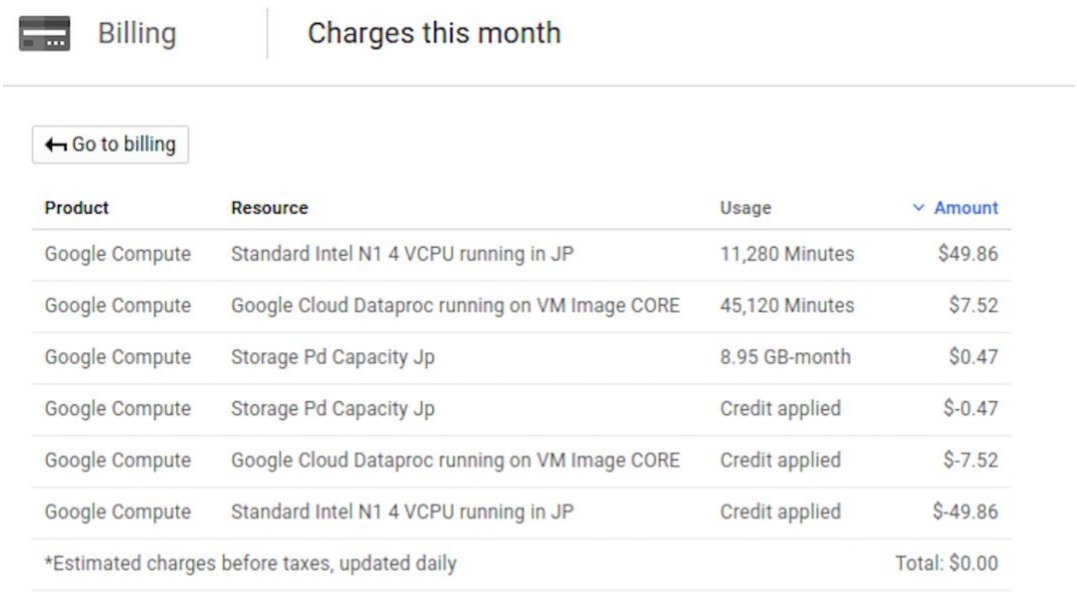


Figure 16: Cluster usage cost