Lab Cloud Composer

Setting (google cloud shell, Kubernetes Engine API,cloud composer)

- ✓ Activate Google Cloud Shell
  - * gcloud auth list
  - * gcloud config list project
- ✓ Check project permissions
- ✓ **Ensure that the Kubernetes Engine API is successfully enabled**
  - **Kubernetes Engine API** > **Manage** > **Disable API > Enable**
- ✓ **Ensure that the Cloud Composer API is successfully enabled**
  - **Cloud Composer API > Enable**
- ✓ **Cloud Storage** > **Browser** >**Create bucket**.(output for the Hadoop job)
- ✓ **Navigation menu** > **Composer > selecet composer1 and set properties for environment**
  - **click create** (10-20 minutes)

Property	Value
Name	highcpu
Location	us-central1
Zone	us-central1-a
Machine type	n1-highcpu-4

Airflow and core concepts

While waiting for your Composer environment to get created, review some terms that are used with Airflow.
Airflow is a platform to programmatically author, schedule and monitor workflows.
Use Airflow to author workflows as directed acyclic graphs (DAGs) of tasks. The airflow scheduler executes your tasks on an array of workers while following the specified dependencies.
Core concepts
DAG
A Directed Acyclic Graph is a collection of all the tasks you want to run, organized in a way that reflects their relationships and dependencies.
Operator
The description of a single task, it is usually atomic. For example, the *BashOperator* is used to execute bash command.
Task
A parameterised instance of an Operator; a node in the DAG.
Task Instance
A specific run of a task; characterized as: a DAG, a Task, and a point in time. It has an indicative state: *running*, *success*, *failed*, *skipped*, ...

Defining the workflow

Now let's discuss the workflow you'll be using. Cloud Composer workflows are comprised of DAGs (Directed Acyclic Graphs). DAGs are defined in standard Python files that are placed in Airflow's DAG_FOLDER. Airflow will execute the code in each file to dynamically build the DAG objects. You can have as many DAGs as you want, each describing an arbitrary number of tasks. In general, each one should correspond to a single logical workflow.

Below is the hadoop_tutorial.py workflow code, also referred to as the DAG:

```
"""Example Airflow DAG that creates a Cloud Dataproc cluster,
runs the Hadoop
wordcount example, and deletes the cluster.
This DAG relies on three Airflow variables
https://airflow.apache.org/concepts.html#variables
* gcp_project - Google Cloud Project to use for the Cloud
Dataproc cluster.
* gce_zone - Google Compute Engine zone where Cloud
Dataproc cluster should be
  created.
* gcs_bucket - Google Cloud Storage bucket to used as output
for the Hadoop jobs from Dataproc.
  See https://cloud.google.com/storage/docs/creating-buckets
for creating a
  bucket.
"""
```

```
import datetime
import os
from airflow import models
from airflow.contrib.operators import dataproc_operator
from airflow.utils import trigger_rule
# Output file for Cloud Dataproc job.
output_file = os.path.join(
    models.Variable.get('gcs_bucket'), 'wordcount',
    datetime.datetime.now().strftime('%Y%m%d-%H%M%S')) +
os.sep
# Path to Hadoop wordcount example available on every
Dataproc cluster.
WORDCOUNT_JAR = (
    'file:///usr/lib/hadoop-mapreduce/hadoop-mapreduce-
examples.jar'
)
```

```
# Arguments to pass to Cloud Dataproc job.
wordcount_args = ['wordcount',
'gs://pub/shakespeare/rose.txt', output_file]
yesterday = datetime.datetime.combine(
    datetime.datetime.today() - datetime.timedelta(1),
    datetime.datetime.min.time())
default_dag_args = {
    # Setting start date as yesterday starts the DAG immediately
when it is
    # detected in the Cloud Storage bucket.
    'start_date': yesterday,
    # To email on failure or retry set 'email' arg to your email and
enable
    # emailing here.
    'email_on_failure': False,
    'email_on_retry': False,
    # If a task fails, retry it once after waiting at least 5 minutes
    'retries': 1,
    'retry_delay': datetime.timedelta(minutes=5),
    'project_id': models.Variable.get('gcp_project')
}
```

```
with models.DAG(
        'composer_sample_quickstart',
        # Continue to run DAG once per day
        schedule_interval=datetime.timedelta(days=1),
        default_args=default_dag_args) as dag:
    # Create a Cloud Dataproc cluster.
    create_dataproc_cluster =
dataproc_operator.DataprocClusterCreateOperator(
        task_id='create_dataproc_cluster',
        # Give the cluster a unique name by appending the date
scheduled.
        # See https://airflow.apache.org/code.html#default-
variables
        cluster_name='composer-hadoop-tutorial-cluster-{{
ds_nodash }}',
        num_workers=2,
        region='us-central1',
        zone=models.Variable.get('gce_zone'),
        image_version='2.0',
        master_machine_type='n1-standard-2',
        worker_machine_type='n1-standard-2')
```

```
# Run the Hadoop wordcount example installed on the Cloud
Dataproc cluster
   # master node.
   run_dataproc_hadoop =
dataproc_operator.DataProcHadoopOperator(
      task_id='run_dataproc_hadoop',
      region='us-central1',
      main_jar=WORDCOUNT_JAR,
      cluster_name='composer-hadoop-tutorial-cluster-{{
ds_nodash }}',
      arguments=wordcount_args)
   # Delete Cloud Dataproc cluster.
   delete_dataproc_cluster =
dataproc_operator.DataprocClusterDeleteOperator(
      task_id='delete_dataproc_cluster',
      region='us-central1',
      cluster_name='composer-hadoop-tutorial-cluster-{{
ds_nodash }}',
      # Setting trigger_rule to ALL_DONE causes the cluster to
be deleted
      # even if the Dataproc job fails.
      trigger_rule=trigger_rule.TriggerRule.ALL_DONE)
   # Define DAG dependencies.
   create_dataproc_cluster >> run_dataproc_hadoop >>
delete_dataproc_cluster
```

DAG

To orchestrate the three workflow tasks, the DAG imports the following operators:

1. **DataprocClusterCreateOperator**: Creates a Cloud Dataproc cluster.
2. **DataProcHadoopOperator**: Submits a Hadoop wordcount job and writes results to a Cloud Storage bucket.
3. **DataprocClusterDeleteOperator**: Deletes the cluster to avoid incurring ongoing Compute Engine charges.

The tasks run sequentially, which you can see in this section of the file:

```
# Define DAG dependencies.
create_dataproc_cluster >> run_dataproc_hadoop >> delete_dataproc_cluster
```

The name of the DAG is quickstart, and the DAG runs once each day.

```
with models.DAG(
        'composer_sample_quickstart',
        # Continue to run DAG once per day
        schedule_interval=datetime.timedelta(days=1),
        default_args=default_dag_args) as dag:
```

Because the start_date that is passed in to default_dag_args is set to yesterday, Cloud Composer schedules the workflow to start immediately after the DAG uploads.

Viewing environment information
Go back to **Composer** to check the status of your environment.

Once your environment has been created, click the name of the environment (**highcpu**) to see its details.

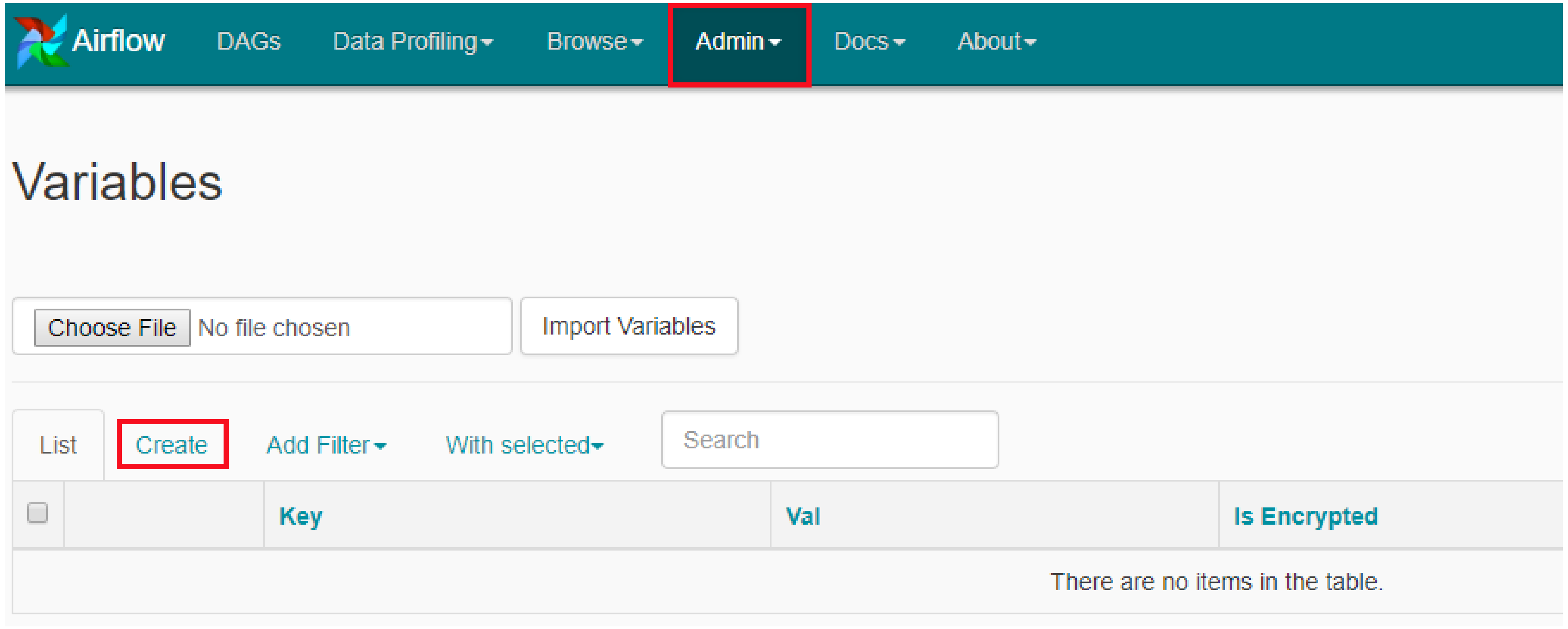
On the Environment details you'll see information such as the Airflow web interface URL, Kubernetes Engine cluster ID, and a link to the DAGs folder, which is stored in your bucket.

Airflow UI (environment variables)

1.Go back to the **Environments** page
2.In the **Airflow webserver** column for the environment, click **Airflow**.
3.Click on your lab credentials.
4.The Airflow web interface opens in a new browser window.

Setting Airflow variables

Airflow variables are an Airflow-specific concept that is distinct from environment variables.
1.Select **Admin** > **Variables** from the Airflow menu bar, then **Create**.



Variables

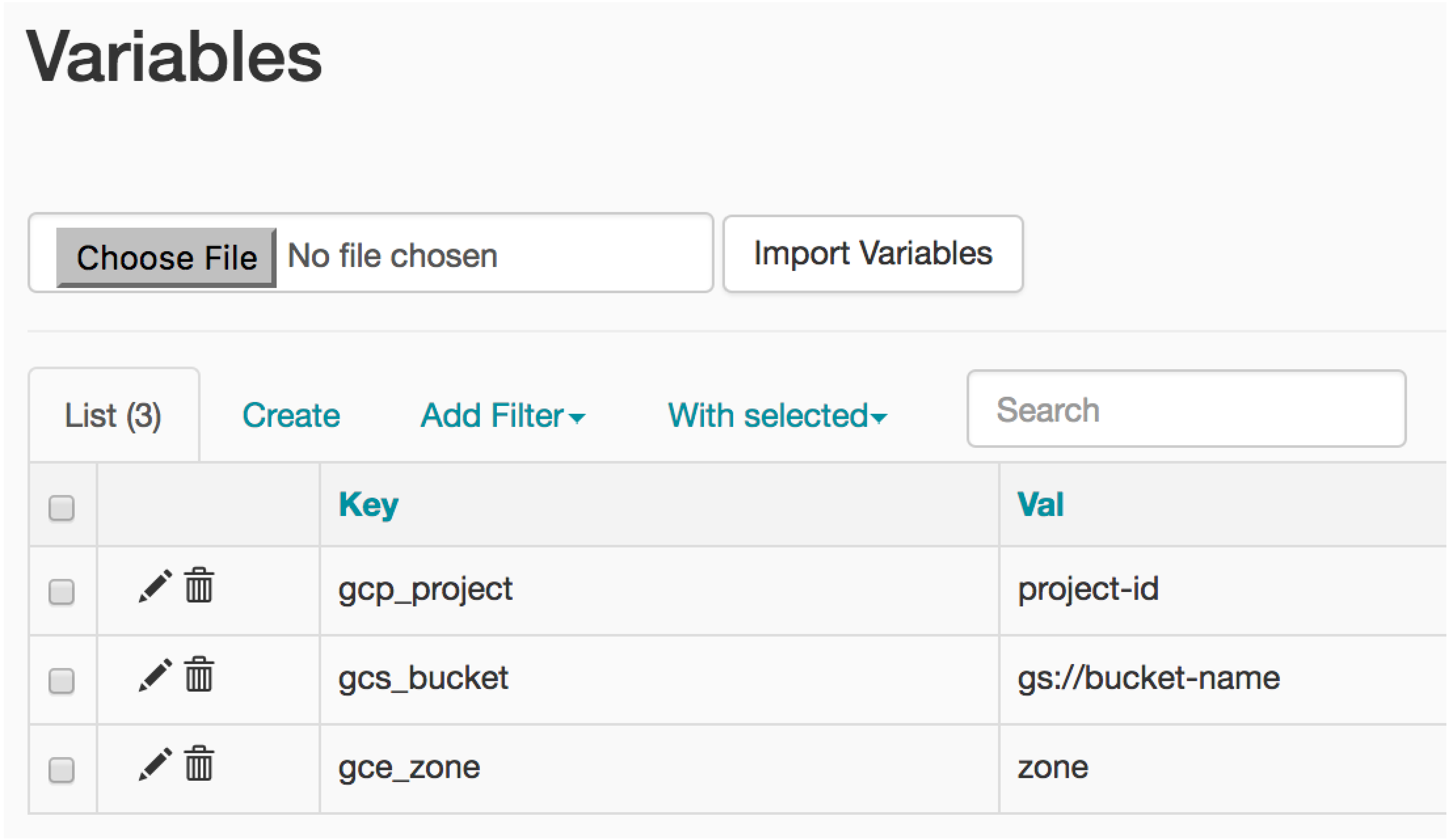
No file chosen

		Key	Val	Is Encrypted
There are no items in the table.				

Create the following Airflow variables, gcp_project, gcs_bucket, and gce_zone:

KEY	VALUE	Details
gcp_project	<your project-id>	The Google Cloud Platform project you're using for this quickstart.
gcs_bucket	gs://<my-bucket>	Replace <my-bucket> with the name of the Cloud Storage bucket you made earlier. This bucket stores the output from the Hadoop jobs from Dataproc.
gce_zone	us-central1-a	This is the Compute Engine zone where your Cloud Dataproc cluster will be created. To chose a different zone, see Available regions & zones.

Click **Save and Add Another** after adding first two variable and click **Save** for the third variable. Your Variables table should look like this when you're finished:



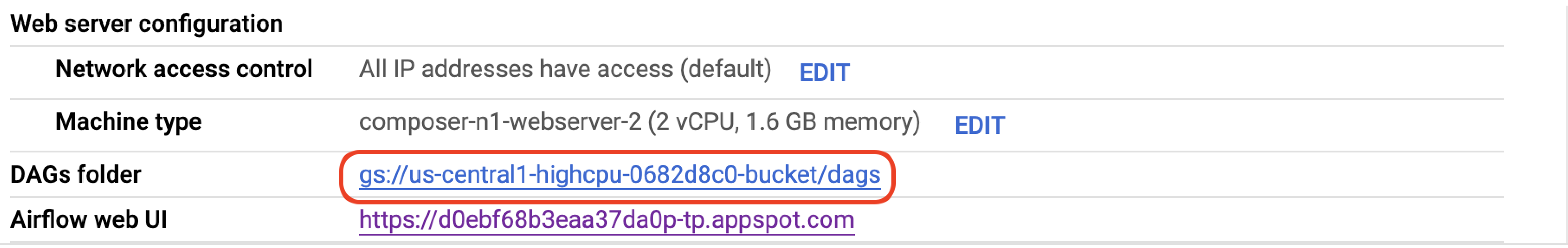
Variables

Key	Val
gcp_project	project-id
gcs_bucket	gs://bucket-name
gce_zone	zone

Uploading the DAG to Cloud Storage

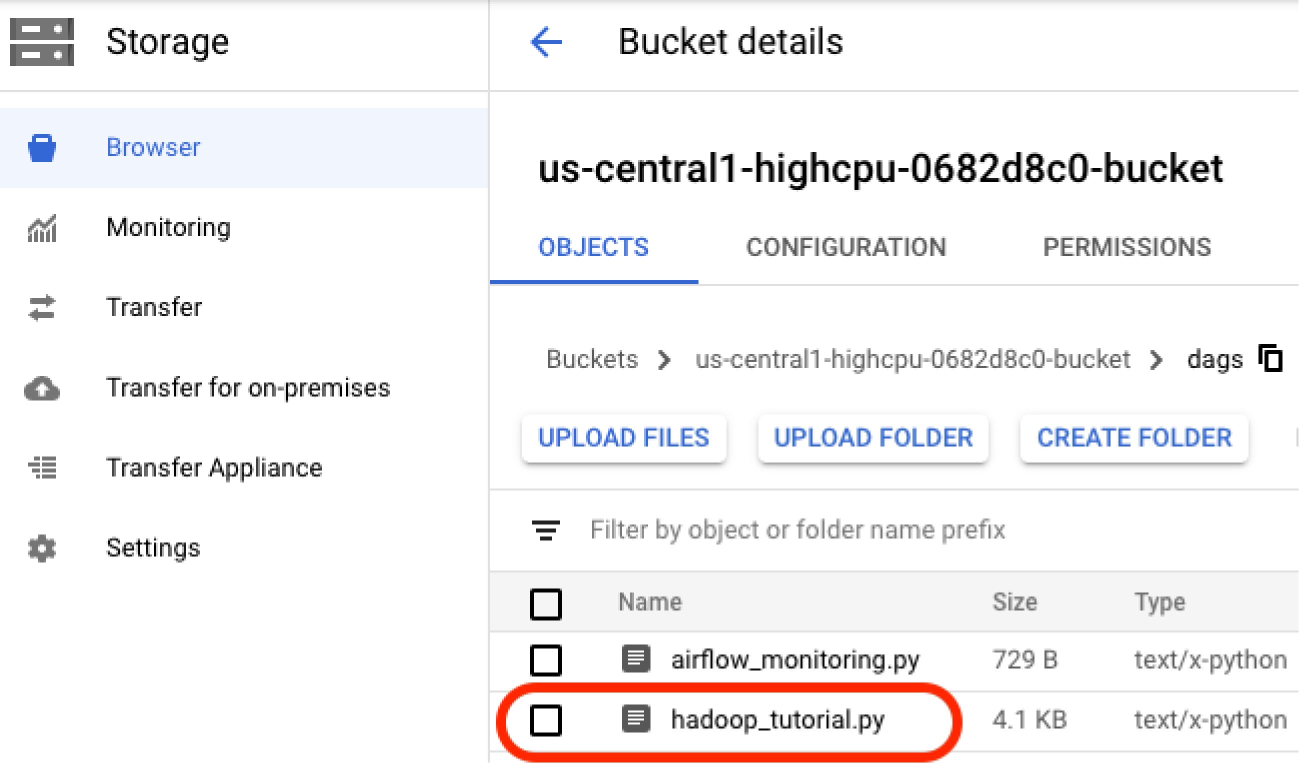
In Cloud Shell, upload a copy of the hadoop_tutorial.py file to the Cloud Storage bucket that was automatically created when you created the environment.
Replace <DAGs_folder_path> in the following command:
gsutil cp gs://cloud-training/datawarehousing/lab_assets/hadoop_tutorial.py <DAGs_folder_path>

with the path to the DAGs folder. You can get the path by going to **Composer**. Click on the environment you created earlier and then click on the **Environment Configuration** tab to see the details of the environment. Find DAGs folder and copy the path.
gsutil cp gs://cloud-training/datawarehousing/lab_assets/hadoop_tutorial.py gs://us-central1-highcpu-0682d8c0-bucket/dag



Web server configuration

Network access control	All IP addresses have access (default)	EDIT
Machine type	composer-n1-webserver-2 (2 vCPU, 1.6 GB memory)	EDIT
DAGs folder	gs://us-central1-highcpu-0682d8c0-bucket/dags	
Airflow web UI	https://d0ebf68b3eaa37da0p-tp.appspot.com	



us-central1-highcpu-0682d8c0-bucket

OBJECTS
CONFIGURATION
PERMISSIONS
Buckets > us-central1-highcpu-0682d8c0-bucket > dags
UPLOAD FILES
UPLOAD FOLDER
CREATE FOLDER
Filter by object or folder name prefix

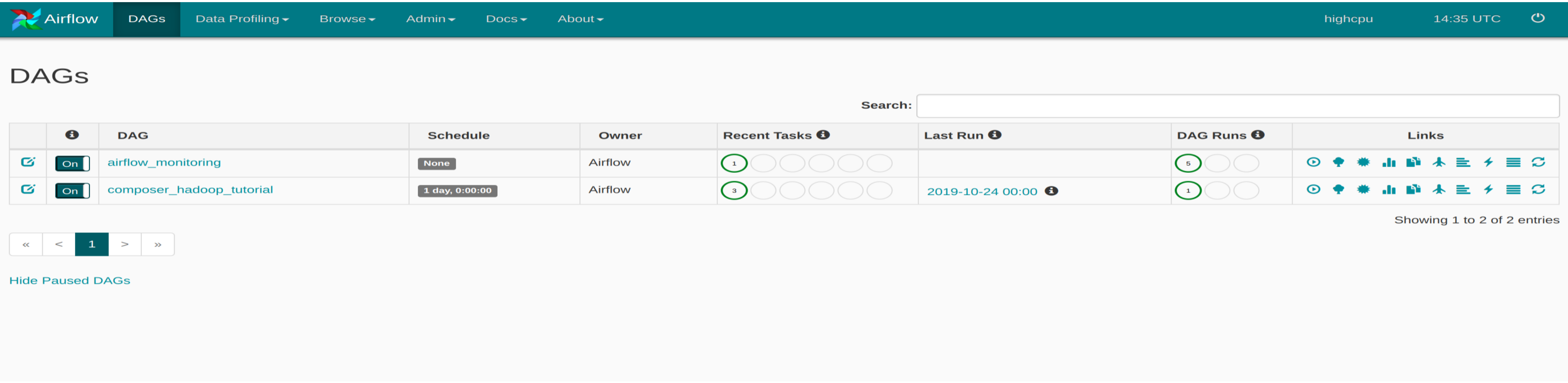
Name	Size	Type
airflow_monitoring.py	729 B	text/x-python
hadoop_tutorial.py	4.1 KB	text/x-python

When a DAG file is added to the DAGs folder, Cloud Composer adds the DAG to Airflow and schedules it automatically. DAG changes occur within 3-5 minutes.

You can see the task status of the composer_hadoop_tutorial DAG in the Airflow web interface.

Exploring DAG runs

When you upload your DAG file to the dags folder in Cloud Storage, Cloud Composer parses the file. If no errors are found, the name of the workflow appears in the DAG listing, and the workflow is queued to run immediately. Make sure that you're on the DAGs tab in the Airflow web interface. It takes several minutes for this process to complete. Refresh your browser to make sure you're looking at the latest information.



DAGs

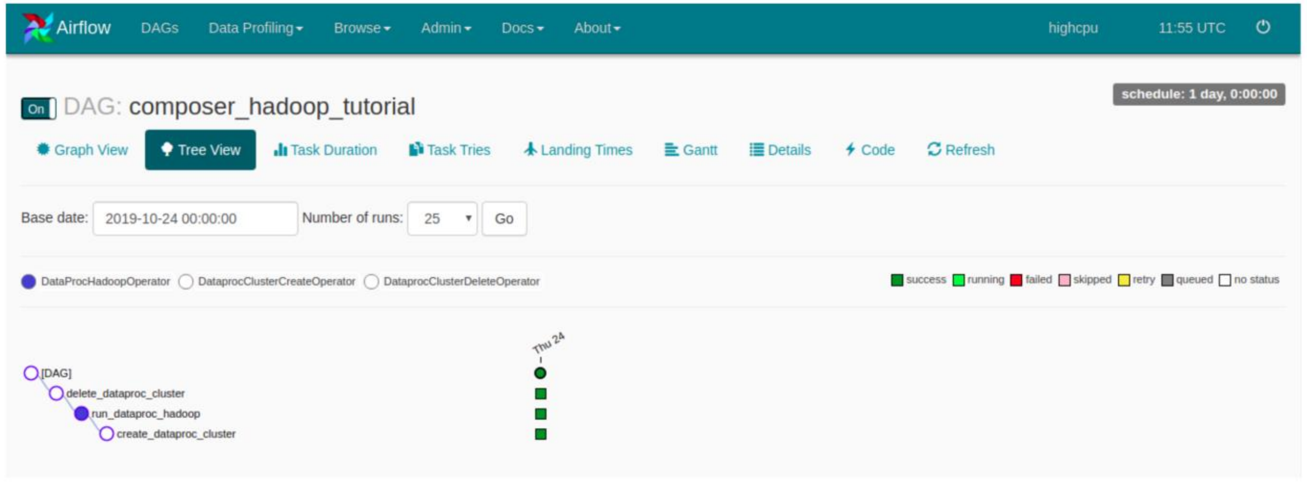
Search:

		DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
	On	airflow_monitoring	None	Airflow	1		5	
	On	composer_hadoop_tutorial	1 day, 0:00:00	Airflow	3	2019-10-24 00:00	1	

Showing 1 to 2 of 2 entries

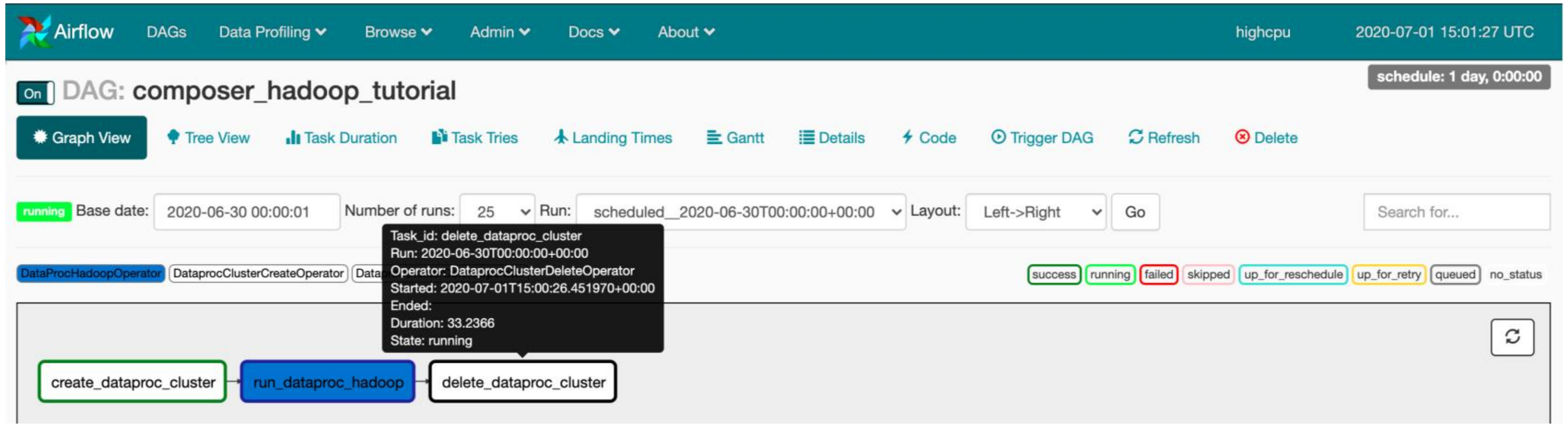
Hide Paused DAGs

1.In Airflow, click **composer_hadoop_tutorial** to open the DAG details page. This page includes several representations of the workflow tasks and dependencies.



Base date: 2019-10-24 00:00:00 Number of runs: 25 Go

2.In the toolbar, click **Graph View**. Mouseover the graphic for each task to see its status. Note that the border around each task also indicates the status (green border = running; red = failed, etc.).



Base date: 2020-06-30 00:00:01 Number of runs: 25 Run: scheduled__2020-06-30T00:00:00+00:00 Layout: Left->Right Go

```
Task_id: delete_dataproc_cluster
Run: 2020-06-30T00:00:00+00:00
Operator: DataprocClusterDeleteOperator
Started: 2020-07-01T15:00:26.451970+00:00
Ended:
Duration: 33.2366
State: running
```

3.Click the "Refresh" link to make sure you're looking at the most recent information. The borders of the processes change colors as the state of the process changes
Note: If your Dataproc cluster already exists, you can run the workflow again to reach the success state by clicking create_dataproc_cluster graphic and then click **Clear** to reset the three tasks and click **OK** to confirm.
4.Once the status for **create_dataproc_cluster** has changed to "running", go to **Navigation menu** > **Dataproc**, then click on:
•**Clusters** to monitor cluster creation and deletion. The cluster created by the workflow is ephemeral: it only exists for the duration of the workflow and is deleted as part of the last workflow task.
•**Jobs** to monitor the Apache Hadoop wordcount job. Click the Job ID to see job log output.
5.Once Dataproc gets to a state of "Running", return to Airflow and click **Refresh** to see that the cluster is complete.
When the run_dataproc_hadoop process is complete, go to **Navigation menu** > **Cloud Storage** > **Browser** and click on the name of your bucket to see the results of the wordcount in the wordcount folder.
6.Once all the steps are complete in the DAG, each step has a dark green border. Additionally the Dataproc cluster that was created is now deleted.

```
gsutil cp gs://cloud-
training/datawarehousing/lab_assets/hadoop_tutorial.py
gs://us-central1-highcpu-14592db6-bucket/dags
```