CSCI 3287 Design and Analysis of Data Systems

Homework # 7 -- Cassandra Lab

April 16, 2020

Overview

This Project is worth 100 points (out of 1000) toward your final grade. It is due on Sunday, April 26 at 11:59 p.m. Your assignment submission should be a document saved and submitted as a PDF file via the link found in the assignment section of "Week 14" in Moodle which is the same place where you found this file.

This assignment will give you hands-on practice in working with the Apache Cassandra "NoSQL" database software.

Objectives

- Students will deploy and run the Apache Cassandra NoSQL database engine
- Students will gain exposure to CQL – Cassandra Query Language
- Students will experience deployment of Apache Cassandra in GCP (the Google Cloud Platform)
- Students will launch and use the Cassandra CQL Shell in GCP

Sections

This assignment has been broken into FOUR sections so that instructions for each part can be posted when ready. This allows students to begin work on Parts One and Two before Part Three is posted.

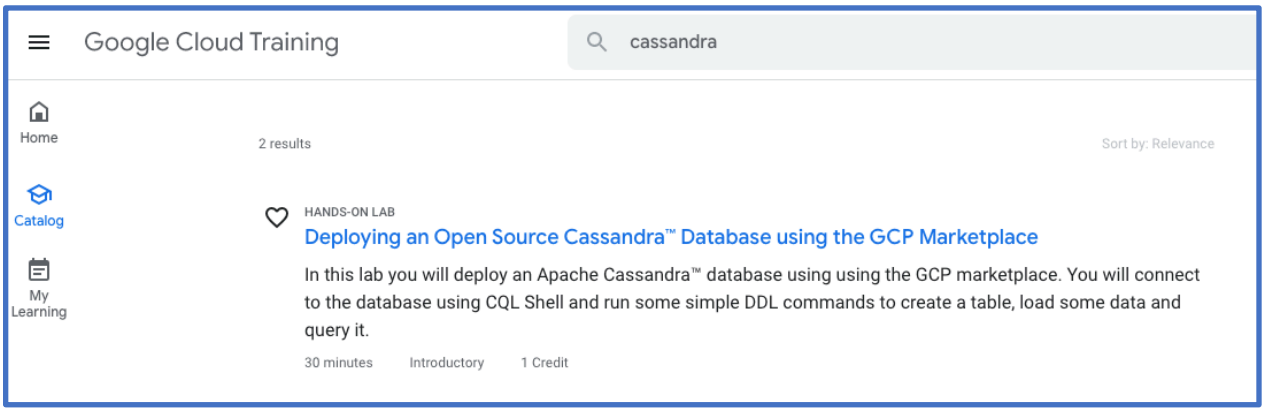
Part One	Students sign up with GCP (Google Cloud Platform) and obtain free credits
Part Two	Students use free QwikLabs credits to complete QwickLabs course "GSP704 - Deploying an Open Source Cassandra™ Database using the GCP Marketplace"
Part Three	Students use GCP credits to spin up a VM, install Cassandra, create a Keyspace, Create a Table, load it with data, and run CQL queries to access that data
Part Four	Students assemble results in a final document and submit via Moodle link

Part Two Instructions:

For Part Two of this homework assignment, you will use your free Qwiklabs credits to complete an online lab using the Cassandra database in the cloud.

1. To access the online lab, first, go to https://google.qwiklabs.com/catalog

2. Search for the "Cassandra" course GSP704, Deploying an Open Source Cassandra™ Database using the GCP Marketplace



3. Follow the directions and complete the lab. The directions will appear on your screen when you enter the lab. For your review, I have copied the directions into Appendix "A" below for your reference. You should read through the directions before starting.

4. Keep an eye on the time. The lab allows you 30 minutes. You should be able to complete the lab in 15 minutes or less.

5. Once you finish the lab, the terminal session in GCP remains open for you to play. Feel free to use the cqlsh terminal window to play with the CQL language to see what it can and can't do (compared to SQL.)

6. Answer the following questions for your homework submission:

QUESTIONS:

1. In step 4 of the lab, you spun up a VM running Cassandra. What is your deployment name?

2. In what GCP zone is it running?

3. How many CPUs in your VM?

4. How much memory did it allocate to your VM?

5. What is the IP address of your VM?

6. What command do you enter to connect to the Cassandra shell? What was your username and password?

7. What is the name of the keyspace you created?

8. What is the name of the table you created?

9. What is the replication factor for the keyspace you created?

   In the instructions it told you to exit the cqlsh. If ou have time remaining (out of your 30 minutes lab) go back to the SSH dropdown, open a new cqlsh terminal, log in again.

10. Run the query: "`Select * from space_flights.catalog;`" again

11. Modify the query: "`select count(*) from space_flights.catalog;`" How many rows are in the table?

12. Run the query: "`select spacecraft_name, journey_id from space_flights.catalog`"

13. Modify your query to select all the rows where the spacecraft_name is like "%mercury%". What happens? (Not all SQL commands will work in CQL).

    See https://docs.datastax.com/en/archived/cql/3.3/cql/cql_reference/cqlSelect.html

14. Modify your query to try to sort the output using a "ORDER BY". What happens?

Appendix “A”, qwiklabs instructions for the Cassandra Lab.

Deploying an Open Source Cassandra™ Database using the GCP Marketplace

30 minutes1 Credit

Rate Lab

GSP704

Google Cloud Self-Paced Labs

Overview

In this lab you will deploy an Apache Cassandra™ database using using the GCP marketplace. You will connect to the database using CQL Shell and run some simple DDL commands to create a table, load some data and query it.

Objectives

In this lab, you learn how to perform the following tasks:

- Deploy Apache Cassandra™ using the GCP marketplace
- Connect to Cassandra™ using CQL Shell
- Create keyspaces and tables using CQL
- Read and write data using CQL

Setup and Requirements

Qwiklabs setup

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 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 the Google Cloud Platform for the duration of the lab.

What you need

To complete this lab, you need:

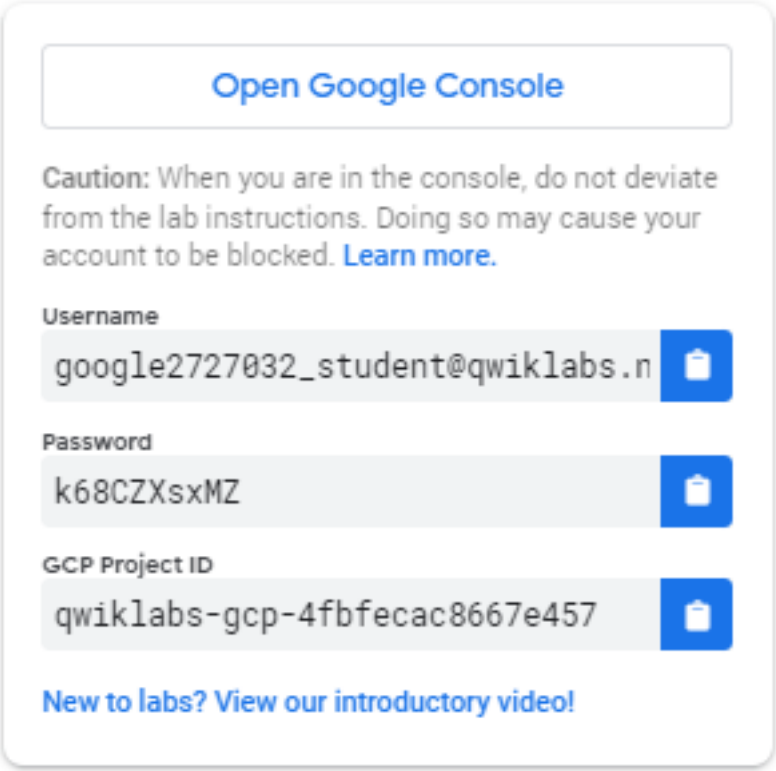
- Access to a standard internet browser (Chrome browser recommended).
- Time to complete the lab.
  Note: If you already have your own personal GCP account or project, do not use it for this lab.

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

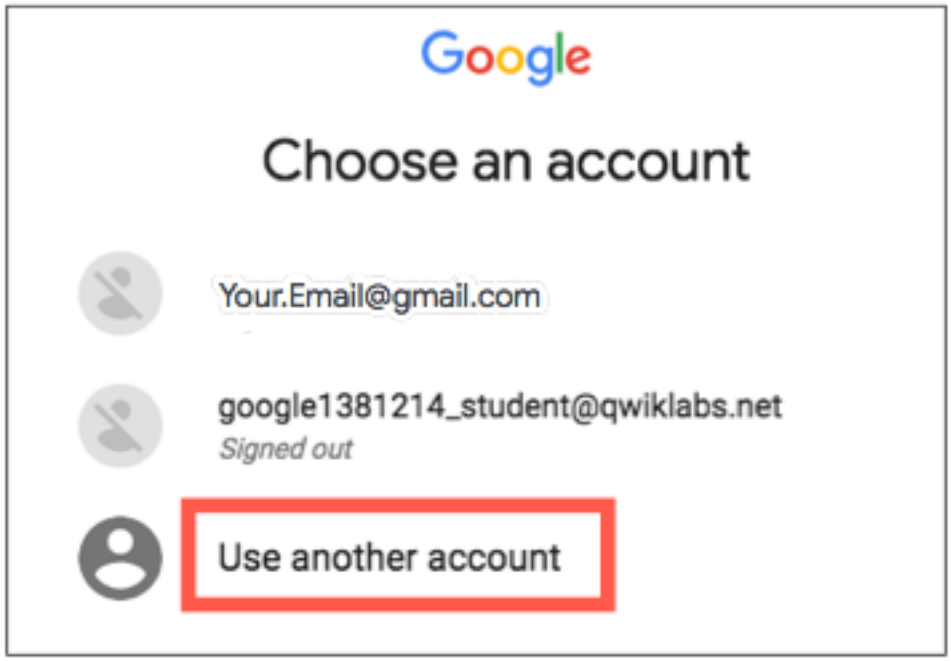
Google Cloud Platform Console

How to start your lab and sign in to the 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.



2. Copy the username, and then click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Choose an account** page.
   Tip: Open the tabs in separate windows, side-by-side.
3. On the Choose an account page, click **Use Another Account**.



4. The Sign in page opens. Paste the username that you copied from the Connection Details panel. Then copy and paste the password.

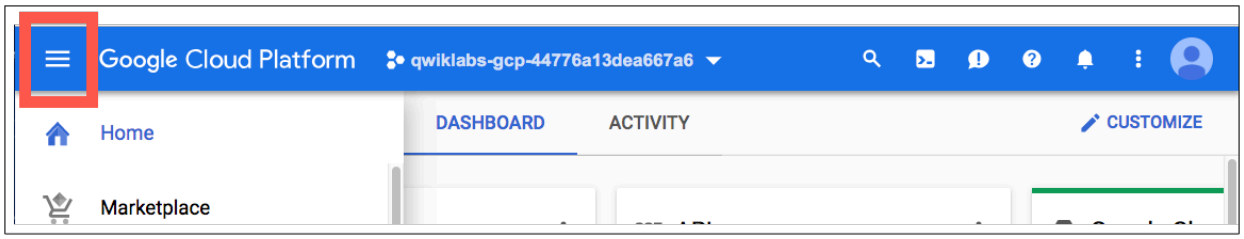
   Important: You must use the credentials from the Connection Details panel. Do not use your Qwiklabs credentials. If you have your own GCP account, do not use it for this lab (avoids incurring charges).

5. 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 GCP console opens in this tab.

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

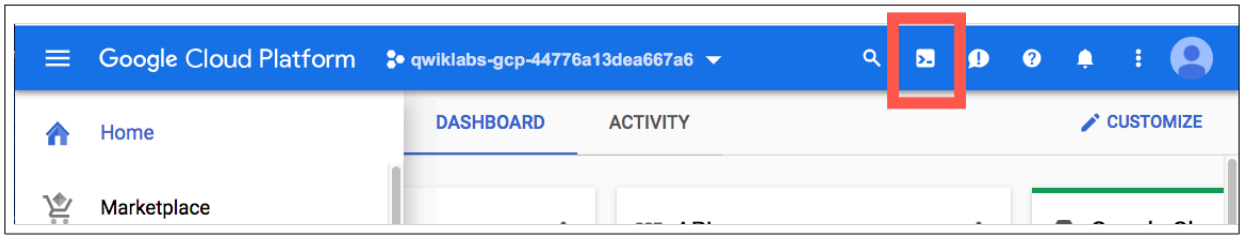


Activate Google Cloud Shell

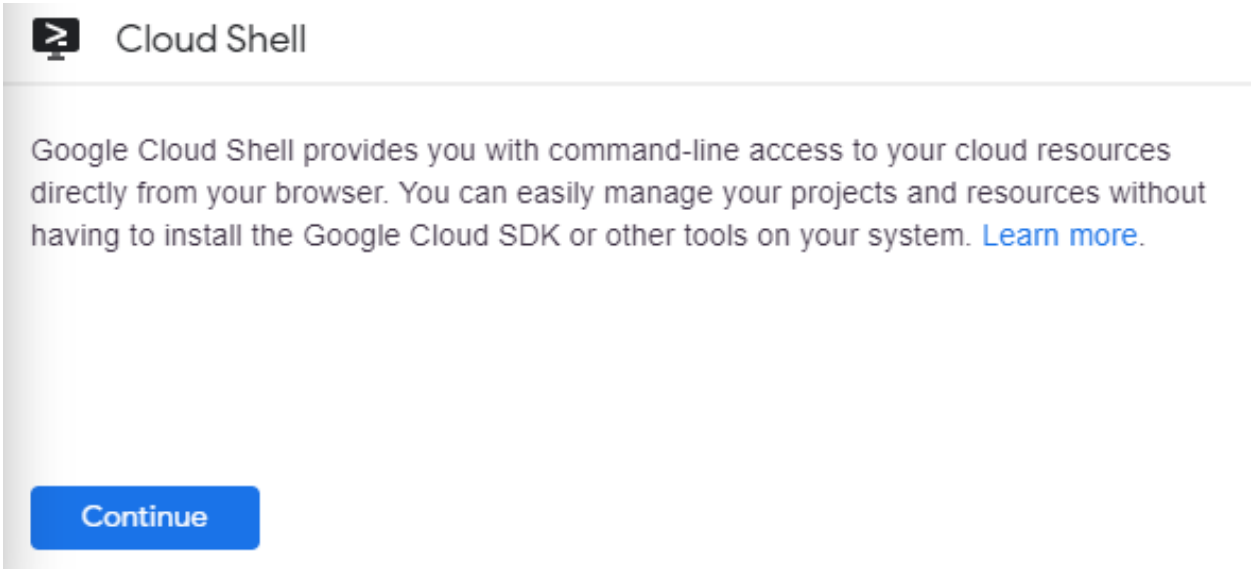
Google Cloud Shell is a virtual machine that is loaded with development tools. It offers a persistent 5GB home directory and runs on the Google Cloud. Google Cloud Shell provides command-line access to your GCP resources.

1. In GCP console, on the top right toolbar, click the Open Cloud Shell button.

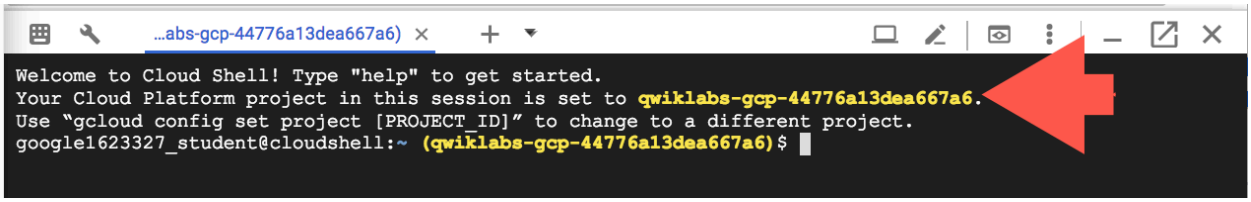
   NOTE: the button is labeled "Activate"



2. Click **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:



gcloud is the command-line tool for Google Cloud Platform. 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>
```

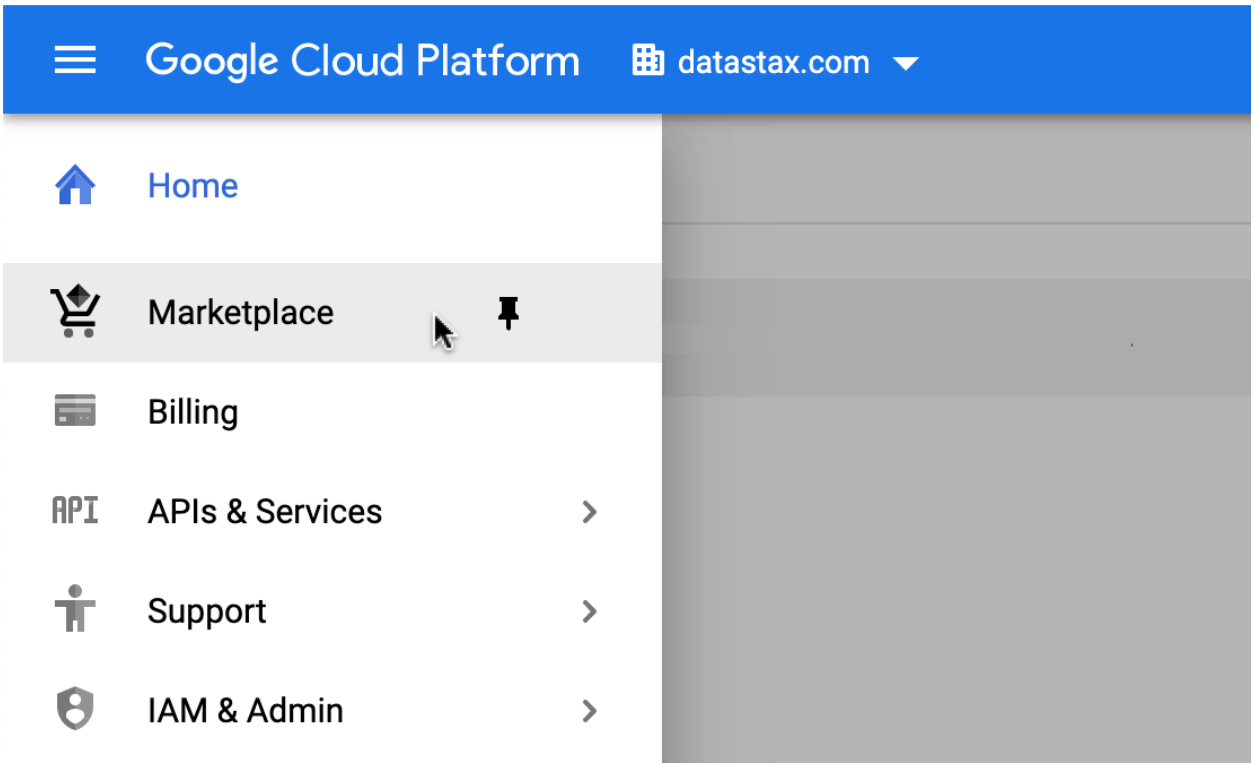
Example output:

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

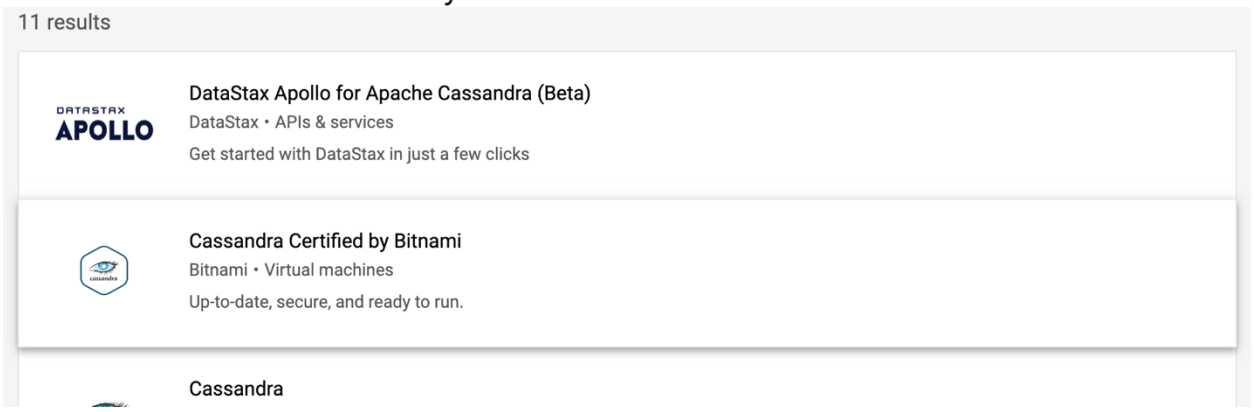
Full documentation of **gcloud** is available on Google Cloud gcloud Overview.

Deploy Cassandra™

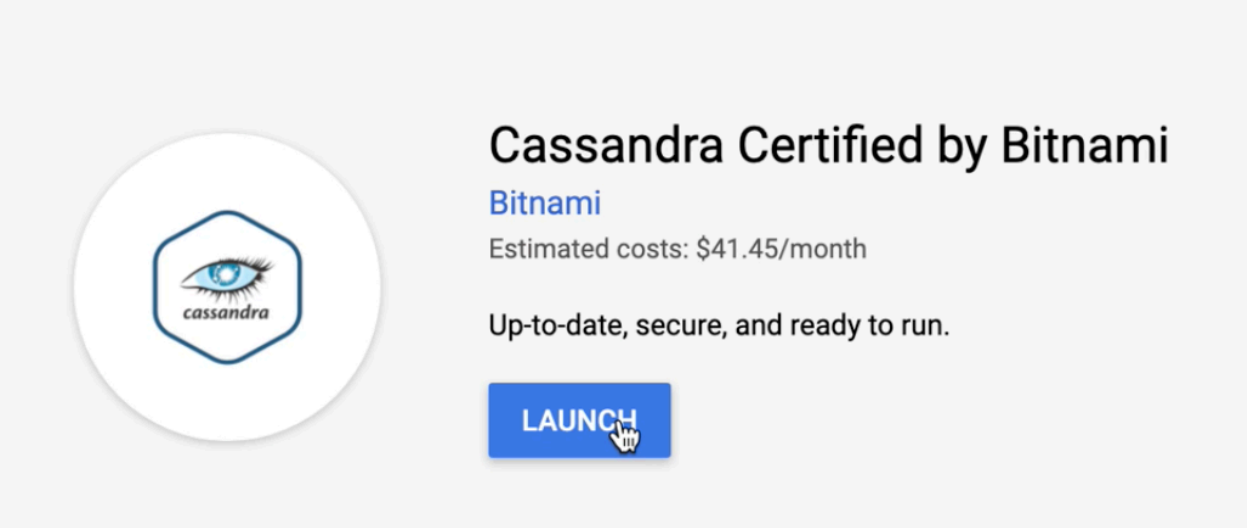
1. Browse to the GCP Marketplace in the left hand navigation menu.



2. Search for “apache cassandra” and click on the search result named “Cassandra Certified by Bitnami”.



3. Click the “LAUNCH” button.



4. Leave all the default values and click “Deploy”.

Deployment name

cassandra-1

Zone

us-east4-a

Machine type

2 vCPUs | 4 GB memory | Customize

Boot Disk

Boot disk type

Standard Persistent Disk

Boot disk size in GB

10

Networking

Network interfaces

default default (10.150.0.0/20)

+ Add network interface

You have reached the maximum number of one network interface

Deploy

When the database has finished deploying you will see the details in Deployment Manager.

Click *Check my progress* to verify the objective.

Deploy Cassandra Database using the GCP Marketplace

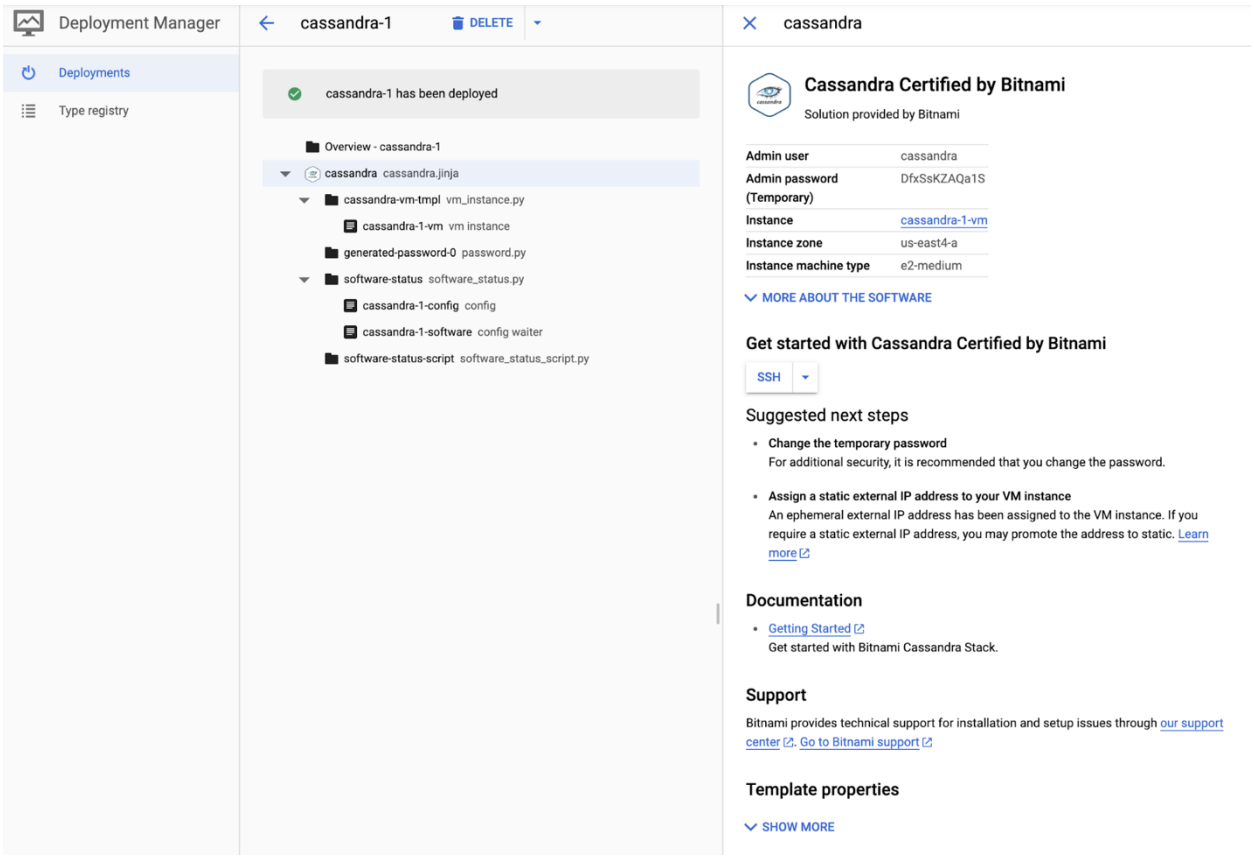
Check my progress

I never saw this…

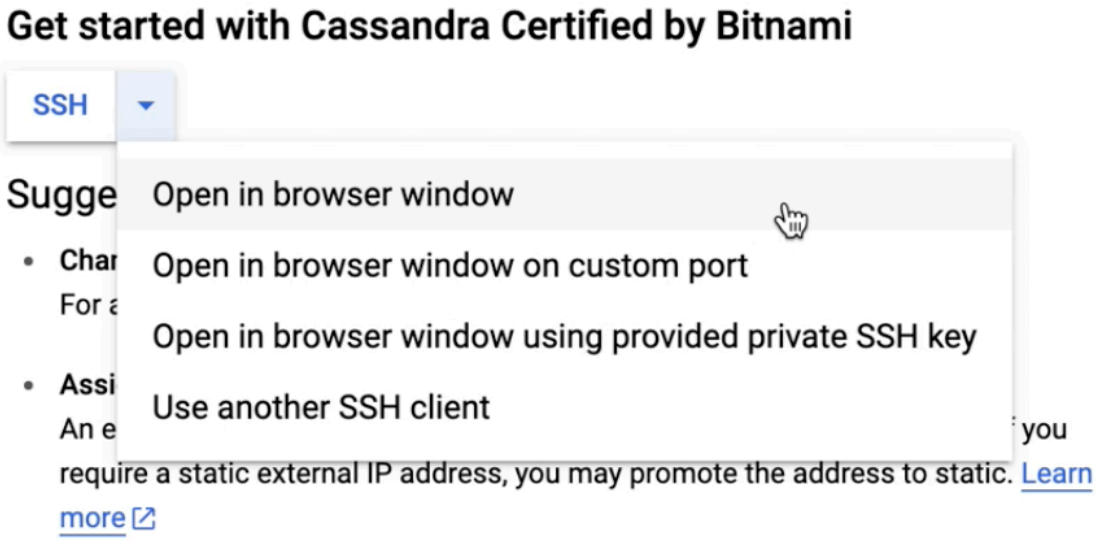
AAHHH – it's in the instructions, NOT in the window.

Connect to the database

1. Note the Admin user and Admin password on the right hand side.



2. To connect to the database, open up an SSH session by clicking the SSH dropdown menu and selecting “Open in browser window”.



3. Open up the CQL Shell by typing the following into the command line, replacing `<<user>>` and `<<pass>>` with the username and password you just made a note of.

```
cqlsh -u <<user>> -p <<pass>>
```

```
                                                ***
ifinlayson@cassandra-1-vm:~$ cqlsh -u cassandra -p DfxSsKZAQa1S
Connected to My Cluster at 127.0.0.1:9042.
[cqlsh 5.0.1 | Cassandra 3.11.5 | CQL spec 3.4.4 | Native protocol v4]
Use HELP for help.
cassandra@cqlsh>
```

Create a keyspace and table

1. Once you are logged in to the database, create a keyspace.

```
CREATE KEYSPACE space_flights WITH replication = {'class': 'SimpleStrategy',
'replication_factor': 1};
```

2. Create a table in the keyspace

```
CREATE TABLE space_flights.catalog (
    spacecraft_name text,
    journey_id timeuuid,
    start timestamp,
    end timestamp,
    active boolean,
    summary text,
    PRIMARY KEY ((spacecraft_name), journey_id)
    ) WITH CLUSTERING ORDER BY (journey_id desc);
```

You can view the keyspace and table you created using the following commands.

```
DESCRIBE KEYSPACE space_flights;


DESCRIBE TABLE space_flights.catalog;
```

Note that the output includes default values for a number of settings that you did not specify when you ran the CREATE statements.

```
cassandra@cqlsh> DESCRIBE KEYSPACE space_flights;

CREATE KEYSPACE space_flights WITH replication = {'class': 'SimpleStrategy', 'replication_factor': '1'}  AND durable_writes = true;

CREATE TABLE space_flights.catalog (
    spacecraft_name text,
    journey_id timeuuid,
    active boolean,
    end timestamp,
    start timestamp,
    summary text,
    PRIMARY KEY (spacecraft_name, journey_id)
) WITH CLUSTERING ORDER BY (journey_id DESC)
    AND bloom_filter_fp_chance = 0.01
    AND caching = {'keys': 'ALL', 'rows_per_partition': 'NONE'}
    AND comment = ''
    AND compaction = {'class': 'org.apache.cassandra.db.compaction.SizeTieredCompactionStrategy', 'max_threshold': '32', 'min_threshold': '4'}
    AND compression = {'chunk_length_in_kb': '64', 'class': 'org.apache.cassandra.io.compress.LZ4Compressor'}
    AND crc_check_chance = 1.0
    AND dclocal_read_repair_chance = 0.1
    AND default_time_to_live = 0
    AND gc_grace_seconds = 864000
    AND max_index_interval = 2048
    AND memtable_flush_period_in_ms = 0
    AND min_index_interval = 128
    AND read_repair_chance = 0.0
    AND speculative_retry = '99PERCENTILE';

cassandra@cqlsh>
```

Click *Check my progress* to verify the objective.

Create a keyspace and table

Check my progress

Insert data into the table

1. Insert the following data

```
INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('vostok1', 805b1a00-5673-11a8-8080-808080808080,
'1961-4-12T06:07:00+0000', '1961-4-12T07:55:00+0000', False, 'First manned
spaceflight. Completed one Earth orbit.');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('mercury-redstone3', 2396fc00-68cd-11a8-8080-
808080808080, '1961-5-5T14:34:00+0000', '1961-5-5T14:49:00+0000', False,
'First American manned suborbital spaceflight (altitude 187 kilometres, 116
miles).');
```

```
INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('mercury-redstone4', 2d2f1800-a53c-11a8-8080-
808080808080, '1961-7-21T12:20:00+0000', '1961-7-21T12:35:00+0000', False,
'Second American manned suborbital flight (altitude 118.26mi, 190km).');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('vostok2', 5c2ac800-b191-11a8-8080-808080808080,
'1961-8-6T05:00:00+0000', '1961-8-7T05:01:00+0000', False, 'Day-long flight.
Completed 17 Earth orbits. Brief manual control by pilot.');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('mercury-atlas6', 8c7b3200-4d82-11a9-8080-
808080808080, '1962-2-20T15:47:00+0000', '1962-2-20T20:42:00+0000', False,
'First American manned orbital flight. Completed three orbits.');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('mercury-atlas7', e9d69600-9685-11a9-8080-
808080808080, '1962-5-24T13:45:00+0000', '1962-5-24T18:41:00+0000', False,
'First manual retrofire. Earth photography and study of liquids in weightless
conditions.');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('vostok3', ff31b400-d46d-11a9-8080-808080808080,
'1962-8-11T08:30:00+0000', '1962-8-15T06:52:00+0000', False, 'First instance
of two manned spacecraft in orbit simultaneously.');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('vostok4', 403fcc00-d533-11a9-8080-808080808080,
'1962-8-12T08:02:00+0000', '1962-8-15T06:59:00+0000', False, 'First instance
of two manned spacecraft in orbit simultaneously.');

INSERT INTO space_flights.catalog (spacecraft_name, journey_id, start, end,
active, summary) VALUES ('mercury-atlas8', 977b6200-fe3b-11a9-8080-
808080808080, '1962-10-3T13:15:00+0000', '1962-10-3T22:28:00+0000', False,
'First flawless Mercury mission.');
```

Query the table

1. Select all of the records from the table

```
select * from space_flights.catalog;
```

```
 spacecraft_name | journey_id                           | active | end                             | start                           | summary
-----------------+--------------------------------------+--------+---------------------------------+---------------------------------+-------------------------------------------------------------------------------------------------------
    mercury-atlas7 | a9d69600-9685-11a9-8080-808080808080 |  False | 1962-05-24 18:41:00.000000+0000 | 1962-05-24 13:45:00.000000+0000 | First manual retrofire. Earth photography and study of liquids in weightless conditions.
mercury-redstone4 | 2d2f1800-a53c-11a8-8080-808080808080 |  False | 1961-07-21 12:35:00.000000+0000 | 1961-07-21 12:20:00.000000+0000 |                                  Second American manned suborbital flight (altitude 118.26mi, 190km).
   mercury-atlas6 | 8c7b3200-4d82-11a9-8080-808080808080 |  False | 1962-02-20 20:42:00.000000+0000 | 1962-02-20 15:47:00.000000+0000 |                                  First American manned orbital flight. Completed three orbits.
   mercury-atlas8 | 977b6200-fe3b-11a9-8080-808080808080 |  False | 1962-10-03 22:28:00.000000+0000 | 1962-10-03 13:15:00.000000+0000 |                                  First flawless Mercury mission.
          vostok3 | ff31b400-d46d-11a9-8080-808080808080 |  False | 1962-08-15 06:52:00.000000+0000 | 1962-08-11 08:30:00.000000+0000 |                  First instance of two manned spacecraft in orbit simultaneously.
mercury-redstone3 | 2396fc00-68cd-11a8-8080-808080808080 |  False | 1961-05-05 14:49:00.000000+0000 | 1961-05-05 14:34:00.000000+0000 |      First American manned suborbital spaceflight (altitude 187 kilometres, 116 miles).
          vostok2 | 5c2ac800-b191-11a8-8080-808080808080 |  False | 1961-08-07 05:01:00.000000+0000 | 1961-08-06 05:00:00.000000+0000 |                  Day-long flight. Completed 17 Earth orbits. Brief manual control by pilot.
          vostok1 | 805bla00-5673-11a8-8080-808080808080 |  False | 1961-04-12 07:55:00.000000+0000 | 1961-04-12 06:07:00.000000+0000 |                                  First manned spaceflight. Completed one Earth orbit.
          vostok4 | 403fcc00-d533-11a9-8080-808080808080 |  False | 1962-08-15 06:59:00.000000+0000 | 1962-08-12 08:02:00.000000+0000 |                  First instance of two manned spacecraft in orbit simultaneously.

(9 rows)
```

2. Select one of the records by its primary key

```
SELECT * FROM space_flights.catalog WHERE spacecraft_name = 'vostok2';
```

```
 spacecraft_name | journey_id                           | active | end                             | start                           | summary
-----------------+--------------------------------------+--------+---------------------------------+---------------------------------+-------------------------------------------------------------------------------------------------------
          vostok2 | 5c2ac800-b191-11a8-8080-808080808080 |  False | 1961-08-07 05:01:00.000000+0000 | 1961-08-06 05:00:00.000000+0000 | Day-long flight. Completed 17 Earth orbits. Brief manual control by pilot.

(1 rows)
```

3. Exit the CQL shell

```
cqlsh> exit
```

4. Close the SSH window.

Click *Check my progress* to verify the objective.

Insert data into the table

Check my progress