

Lab 4: Connecting to the Cloud

NOTE: We will be working with cloud-based software so make sure you have a stable internet connection for your Jetson Nano before proceeding.

Objective: This lab will cover the setup for google cloud and some of the cloud-based services it has to offer.

Preface: Cloud-based services provide on-demand access to scalable computing resources. This allows businesses and individuals to leverage powerful computing resources without having to invest in expensive hardware or software infrastructure. Some examples of cloud-based services include:

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)
- Database as a Service (DaaS)
- Machine Learning as a Service (MLaaS).

Cloud-based services offer access to computing resources and software applications without the need for extensive hardware and software investments. Consider the use cases for cloud computing for possible applications towards the final project.

Materials Required:

- Jetson Nano Development Kit (basic setup complete)
- ethernet cable
- keyboard and mouse
- display with cables / secondary computer

Assignment Submission Instructions

You will need to turn in the following for full credit (10 points + 2) on today's lab:

- screenshot of GCP Console homepage (2 pts)
- screenshot of Pub/Sub Logs Explorer (2 pts)
- screenshot of your API implementation (2 pts)
- (OPTIONAL) Part IV: Upload your Python code, that includes creating table, schema and data insertion part. Include screenshots from the cloud that displays the inserted data. (2 pts)
- all questions answered (3 pts)
- all the items above turned in via github/canvas(1 pt)

Part I: Setting Up Google Cloud Platform

NOTE: Before proceeding, make sure to review the [Week 7 Slides](#) covered in lecture. You can also choose to follow this [guide](#).

Step 1: set up google cloud account

- create a google cloud account
- create a brand new project
- copy down the project ID
- add billing information
- verify billing account

Important Step:

Install Python3.8 before going through.

```
sudo apt install python3.8

sudo update-alternatives --install /usr/bin/python3 python3 /usr/bin/python3.6 1
sudo update-alternatives --install /usr/bin/python3 python3 /usr/bin/python3.8 2

sudo update-alternatives --config python3
```

After you type the last command, the terminal should show like below.

There are 2 choices for the alternative python3 (providing /usr/bin/python3).

Selection	Path	Priority	Status
* 0	/usr/bin/python3.6	1	auto mode
1	/usr/bin/python3.6	1	manual mode
2	/usr/bin/python3.8	2	manual mode

Step 2: google cloud cli and gcloud

- install gcloud CLI from versioned archives:
<https://cloud.google.com/sdk/docs/install#linux>
- install linux 64-bit (ARM) package
- unzip the tar.gz file to preferred directory
- run the following
 - `chmod -R 777 google-cloud-sdk/`
 - This will recursively give permission to all files in google-cloud-sdk

- `./google-cloud-sdk/install.sh`

Step 3: connect cloud account to nano

- open new terminal window
- Source gcloud
 - `echo 'export PATH=$HOME/lab4/google-cloud-sdk/bin:$PATH' >> ~/.bashrc`
 - `source ~/.bashrc`
- verify gcloud is up-to-date by running:
 - `gcloud components update`
- now connect your account using
 - `gcloud auth login`
- set project-id using
 - `gcloud config set project [Project_ID]`

Step 4: install alpha interactive (skip this part if it doesn't work)

- install interactive cloud shell using:
 - `gcloud components install alpha`
 - `gcloud alpha interactive`

Part II: Using the Pub/Sub API

Step 1: attach API to project

- select/create a project
- select cloud pub sub from navigation menu (search if you don't see it)
- enable the API

Step 2: topics and subscriptions

- open google cloud shell
- create your first topic using:
 - `gcloud pubsub topics create my-topic`
- add a subscription
 - `gcloud pubsub subscriptions create my-sub --topic my-topic --ack-deadline=60`

- list topics and subscriptions
 - gcloud pubsub topics list
 - gcloud pubsub subscriptions list

Step 3: send and pull messages

- publish messages to the topic using
 - gcloud pubsub topics publish my-topic --message hello
 - gcloud pubsub topics publish my-topic --message goodbye
- pull messages from the subscription
 - gcloud pubsub subscriptions pull --auto-ack --limit=2 my-sub

Step 4: acknowledging messages

- send and pull message through:
 - gcloud pubsub topics publish my-topic --message thanks
 - gcloud pubsub subscriptions pull my-sub
- above command shows ACK_ID
- acknowledge the message:
 - gcloud pubsub subscriptions ack my-sub --ack-ids [ACK_ID]

Step 5: view/manage topics & subscriptions from GUI

- navigate back to PubSub tab on GCP
 - <https://cloud.google.com/pubsub?hl=en>
 - Go to console
 - go to the Topics tab
 - each detail on your subscriptions is viewable
- use this page to manually check your messages

Step 6: Use the Logging Tool

- navigate to the Logging > *Logs Explorer* tab
- observe the cloud pub/sub logs
- Optional: view the information on *Logs Dashboard* tab

Q2.1: How many consecutive tasks were performed by your API?

Q2.2: What kind of metrics does the histogram display on GCP?

Part III: Exploring APIs & Services

NOTE: Project groups should work together to complete this part of the lab. For submission credit, screenshots and question answers should be submitted per lab group.

- Go to the GCP Console homepage once more
 - <https://console.cloud.google.com/>
- Look through some of APIs available
- Read through the list of free services available on Google cloud platform, you can make use of these services for your project. If you plan on using them, make sure you go through the [free tier usage](#) to **avoid any charges**.
- Talk among your project team members
 - Which API and/or services would be relevant towards your project?
 - How can you count this toward your project requirements?
- Optional: Look at the Logs Explorer to view the level of API activity.

Q3.1: What API did you end up choosing?

Q3.2: (Brief Survey Question) Did this lab contribute towards your knowledge of GCP and project requirements? What aspects of labs can we improve going forward?

(OPTIONAL) Part IV: Using Jetson with BigQuery for storing data

- Write a simple Python script, to create a table and insert some dummy data into the BigQuery table from your Jetson.
- NOTE: Streaming inserts are not available in the free tier, so you please use batch loading to insert data into the table.

```
raise exceptions.from_http_response(response)
google.api_core.exceptions.Forbidden: 403 POST https://bigquery.googleapis.com/bigquery/v2/projects/
ee131-408507/datasets/haiku/tables/sampletable/insertAll?prettyPrint=false: Access Denied: BigQuery
BigQuery: Streaming insert is not allowed in the free tier
```

- A good starting point:
https://cloud.google.com/bigquery/docs/samples/bigquery-create-table#bigquery_create_table-python
- Save your final Python code and include a screenshot of the inserted data from the GCP web interface
- Sample Screenshot:

The screenshot displays the Google Cloud BigQuery web interface. At the top, there's a 'Sandbox' banner with a 'Set up billing to upgrade to the full BigQuery experience' message. The interface is divided into three main sections: Explorer, Query Editor, and Query Results.

Explorer: Shows a project named 'ee131-408507' with a dataset 'haiku' containing a table 'sampletable'.

Query Editor: The query editor shows a query: `SELECT * FROM 'ee131-408507.haiku.sampletable' LIMIT 1000`. The query is titled 'Untitled' and has a 'RUN' button.

Query Results: The query has completed successfully. The results are displayed in a table with the following columns: Row, timestamp, sensor_type, and value.

Row	timestamp	sensor_type	value
1	2024-01-09T12:00:00	Temperature	23.5
2	2024-01-09T12:05:00	Humidity	60.3

Below the table, there's a 'Job history' section with a 'REFRESH' button.

References and Guides

- [Week 7 Slides - Theory and Setup for Google Cloud](#)
- [Getting Started | Google Cloud](#)
- [gcloud | Google Cloud CLI Documentation](#)

Comprehensive Video Tutorials

- [Install Google Cloud SDK & CLI for Mac Linux & Windows](#)
- [Google Cloud Command Line for Beginners or "How to gcloud"](#)

- [Google Cloud Platform Tutorial for Beginners - Full Course](#)