Google Cloud (Part 1)

Theory and Understanding

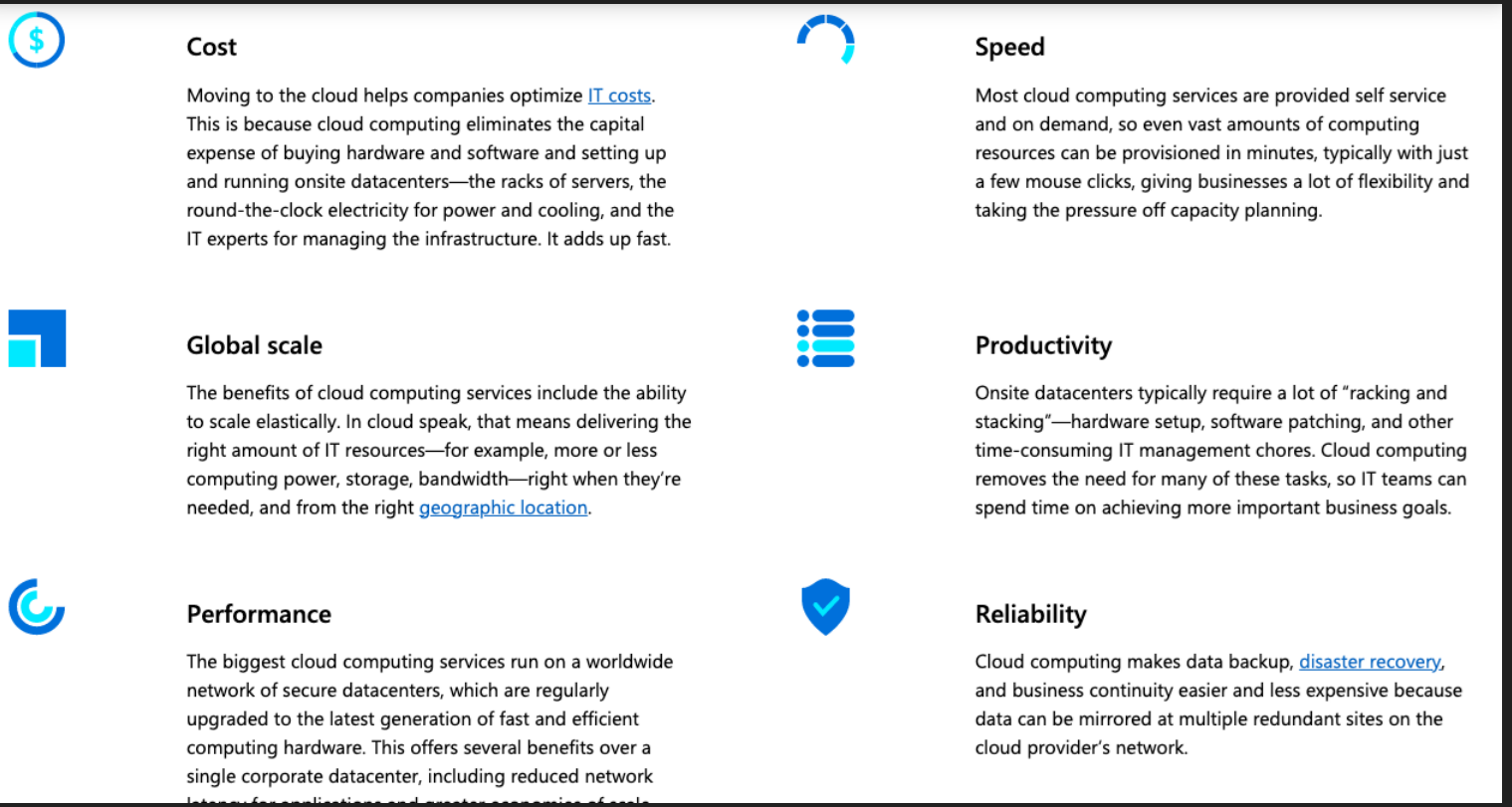
Overview

- What is Google Cloud?
- Compatibility
- License Type
- Project Utilization
- Things to Know

Cloud Computing

- delivery of services over Internet
- covers majority of resource heavy operations
- very scalable
- grouped into public, private, hybrid
- types of cloud services: IaaS, PaaS, SaaS, MLaaS, and serverless
  - Infrastructure as a Service
  - Platform as a Service
  - Software as a Service
  - Machine Learning as a Service

Benefits of Cloud Computing [1]



Cost

Moving to the cloud helps companies optimize IT costs. This is because cloud computing eliminates the capital expense of buying hardware and software and setting up and running onsite datacenters—the racks of servers, the round-the-clock electricity for power and cooling, and the IT experts for managing the infrastructure. It adds up fast.

Speed

Most cloud computing services are provided self service and on demand, so even vast amounts of computing resources can be provisioned in minutes, typically with just a few mouse clicks, giving businesses a lot of flexibility and taking the pressure off capacity planning.

Global scale

The benefits of cloud computing services include the ability to scale elastically. In cloud speak, that means delivering the right amount of IT resources—for example, more or less computing power, storage, bandwidth—right when they're needed, and from the right geographic location.

Productivity

Onsite datacenters typically require a lot of "racking and stacking"—hardware setup, software patching, and other time-consuming IT management chores. Cloud computing removes the need for many of these tasks, so IT teams can spend time on achieving more important business goals.

Performance

The biggest cloud computing services run on a worldwide network of secure datacenters, which are regularly upgraded to the latest generation of fast and efficient computing hardware. This offers several benefits over a single corporate datacenter, including reduced network

Reliability

Cloud computing makes data backup, disaster recovery, and business continuity easier and less expensive because data can be mirrored at multiple redundant sites on the cloud provider's network.

GCP and Its Resources

- Google Cloud Platform (GCP)
- suite of cloud computing resources
- company resources accessible to the public
- PaaS, IaaS and Serverless environments

A giant list of Google Cloud resources [2]

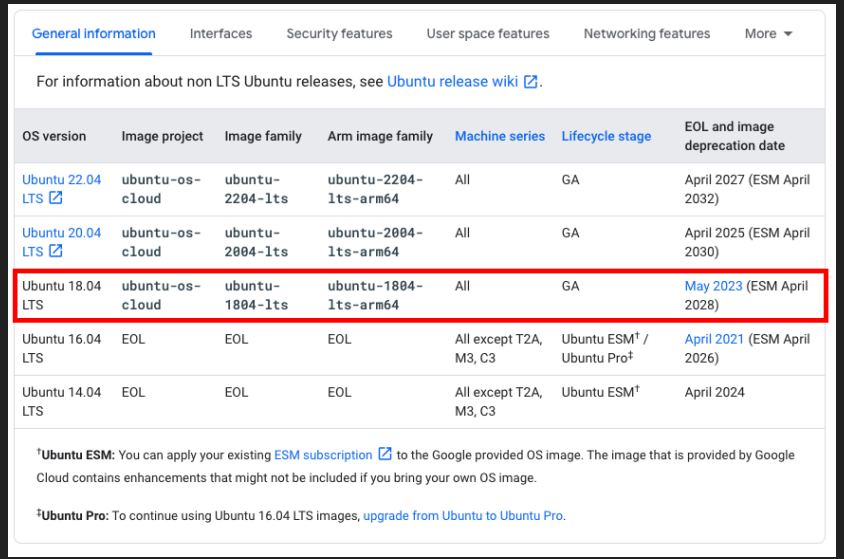
Future-Proof?

Q: Google has recently cited their GCP as being “future-proof”. What is your interpretation of this statement?

Development and Target OS

- primarily for Windows and Linux distributions
- builds and supports Container-Optimized OS images
  - CentOS, Debian, Fedora
  - SUSE Enterprise Server
  - Ubuntu is supported for 5 years post-release
- built for microsoft SQL server
  - relational database OS
  - very scalable for businesses
- Compute Engine provides support

Continued Ubuntu support extends to Jetson Nano's OS [3]



General information | Interfaces | Security features | User space features | Networking features | More

For information about non LTS Ubuntu releases, see Ubuntu release wiki.

OS version	Image project	Image family	Arm image family	Machine series	Lifecycle stage	EOL and image deprecation date
Ubuntu 22.04 LTS	ubuntu-os-cloud	ubuntu-2204-lts	ubuntu-2204-lts-arm64	All	GA	April 2027 (ESM April 2032)
Ubuntu 20.04 LTS	ubuntu-os-cloud	ubuntu-2004-lts	ubuntu-2004-lts-arm64	All	GA	April 2025 (ESM April 2030)
Ubuntu 18.04 LTS	ubuntu-os-cloud	ubuntu-1804-lts	ubuntu-1804-lts-arm64	All	GA	May 2023 (ESM April 2028)
Ubuntu 16.04 LTS	EOL	EOL	EOL	All except T2A, M3, C3	Ubuntu ESM† / Ubuntu Pro‡	April 2021 (ESM April 2026)
Ubuntu 14.04 LTS	EOL	EOL	EOL	All except T2A, M3, C3	Ubuntu ESM†	April 2024

†**Ubuntu ESM:** You can apply your existing ESM subscription to the Google provided OS image. The image that is provided by Google Cloud contains enhancements that might not be included if you bring your own OS image.

‡**Ubuntu Pro:** To continue using Ubuntu 16.04 LTS images, upgrade from Ubuntu to Ubuntu Pro.

License and Availability

- anyone is eligible to sign-up
- $300 free credit + $100 for business account (UCR)
- different pricing models for services [4]

Operation	Pricing	Details
Queries (on-demand)	$5 per TB	The first 1 TB per month is free.
Commitment model	**Hourly cost**	**Details**
Pay as you go	$0.04 / slot hour	No commitment. Billed per second with a 1 minute minimum
Operation	**Pricing**	**Details**
Active logical storage	$0.02 per GB	The first 10 GB is free each month.

Don’t Worry About Costs

- GCP has an unfathomable amount of remote physical servers, databases, computers
- costs are representative of large-scale businesses
- you will hardly put a dent in free-credit provided

Several factory-like structures around the world [5]

How can we apply this?

If you recall your project requirements:

A good Edge Computing project will include everything that an Edge Network should have:

- Decision-making on the device that is capturing the data
- Interaction between multiple devices
- Computing offload to a cloud computing server
- Intermediate device management (Fog layer)
- Workflows that start and end at the Edge (consumer and producer are at the Edge)

In order to satisfy these requirements, you will need to do at least the following for your project:

- Have at least one device sensing data and processing it in place
- Have at least two edge devices interacting with each other in some manner
- Have at least one fog computing device managing the interaction between devices and with the cloud
- Have at least one aspect of your computation happening on the cloud

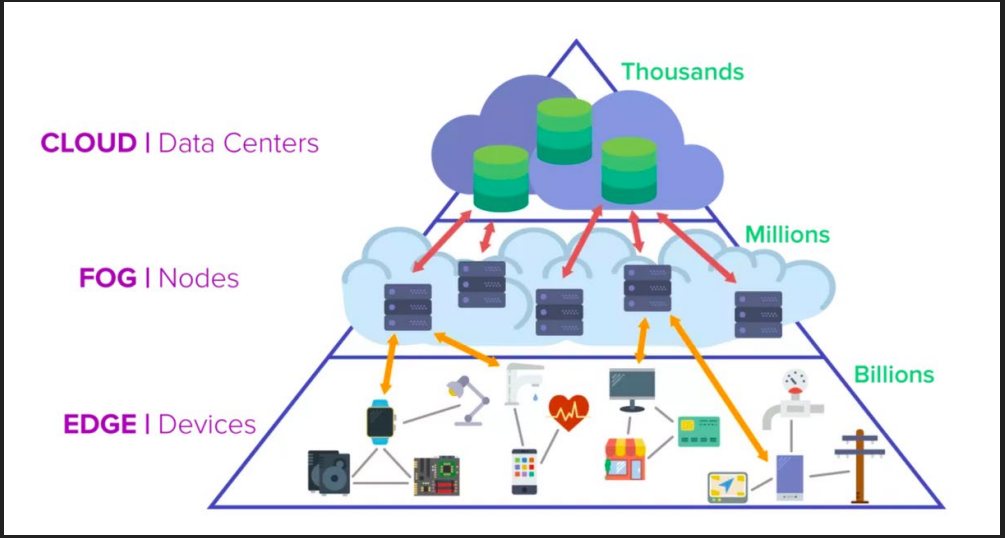
Better Understanding…

Q: Now that you have a better understanding of cloud computing and its functions, does your project meet these requirements?

Using GCP or Cloud Computing

- simply put the cloud is a resource, not a crutch
- project goals should be oriented around **edge devices**
- you **are not expected** to build reference architecture or write cloud applications

Remember this image? [6]



Things to Know

Most of these are present in Google provided client-libraries, but for your reference:

- Cloud SQL Admin API - https://cloud.google.com/sql/docs/mysql/admin-api
- Workload Manager API- https://cloud.google.com/workload-manager/docs/reference/rest
- Pub/Sub API - https://cloud.google.com/pubsub/docs/reference/rest
- Service/Networking API - https://cloud.google.com/service-infrastructure/docs/service-networking/getting-started

Sources Cited

[1] What Is Cloud Computing? | Microsoft Azure

[2] A giant list of Google Cloud resources

[3] Operating System Details

[4] BigQuery Pricing

[5] Google data centers

[6] Edge Computing Needs AI

Implementing Google Cloud (Part 2)

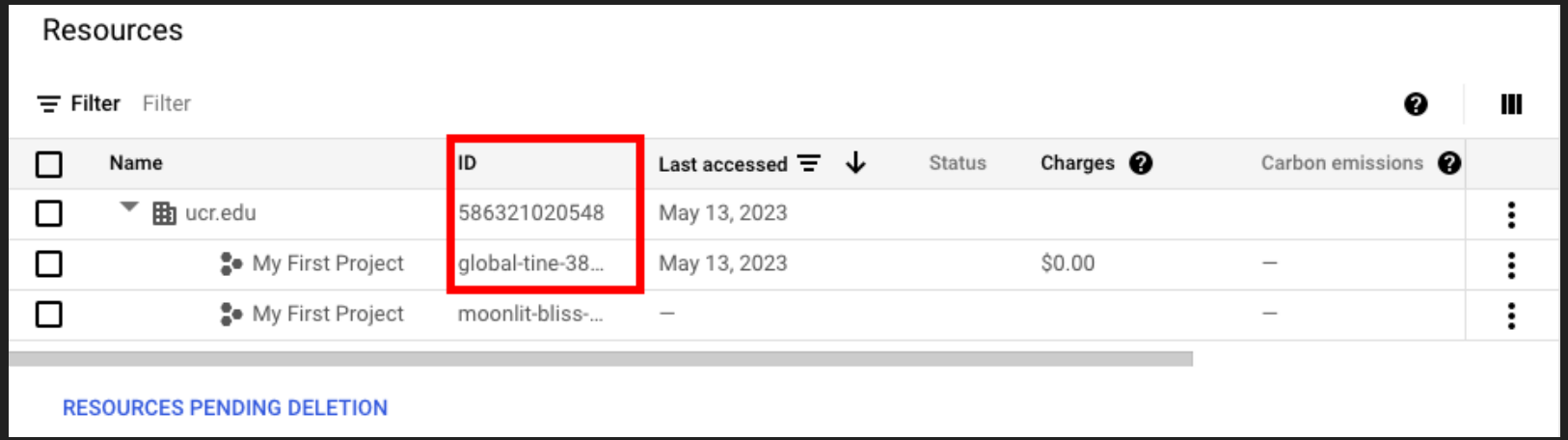
Covering Lab 4 and Beyond

What I will be covering

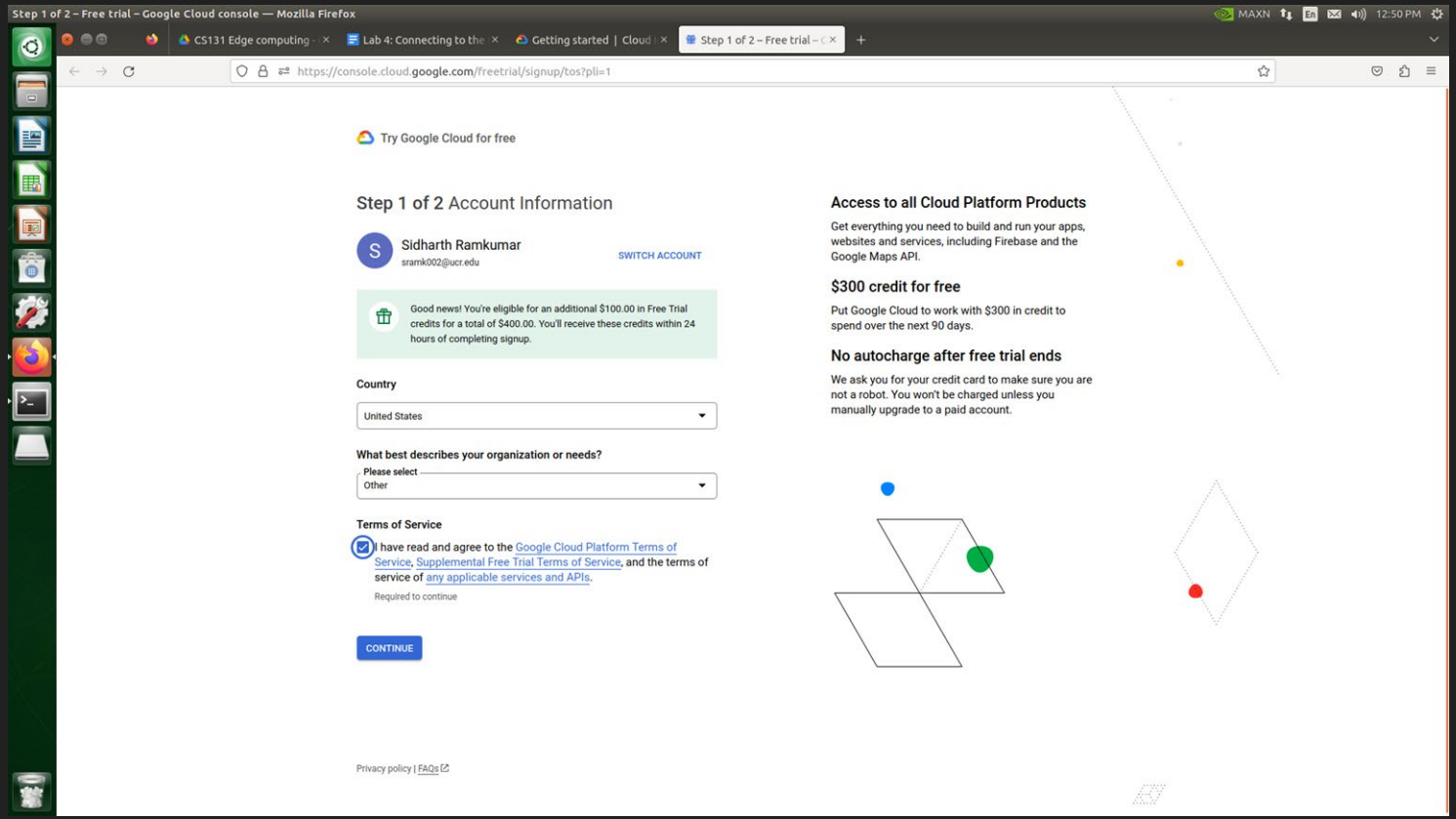
- Set up Google Cloud Account
- Install Google Cloud SDK & CLI
- Intro to Tools
- Pub/Sub Model Test
- Pulling Info from APIs

Let's Get Started!

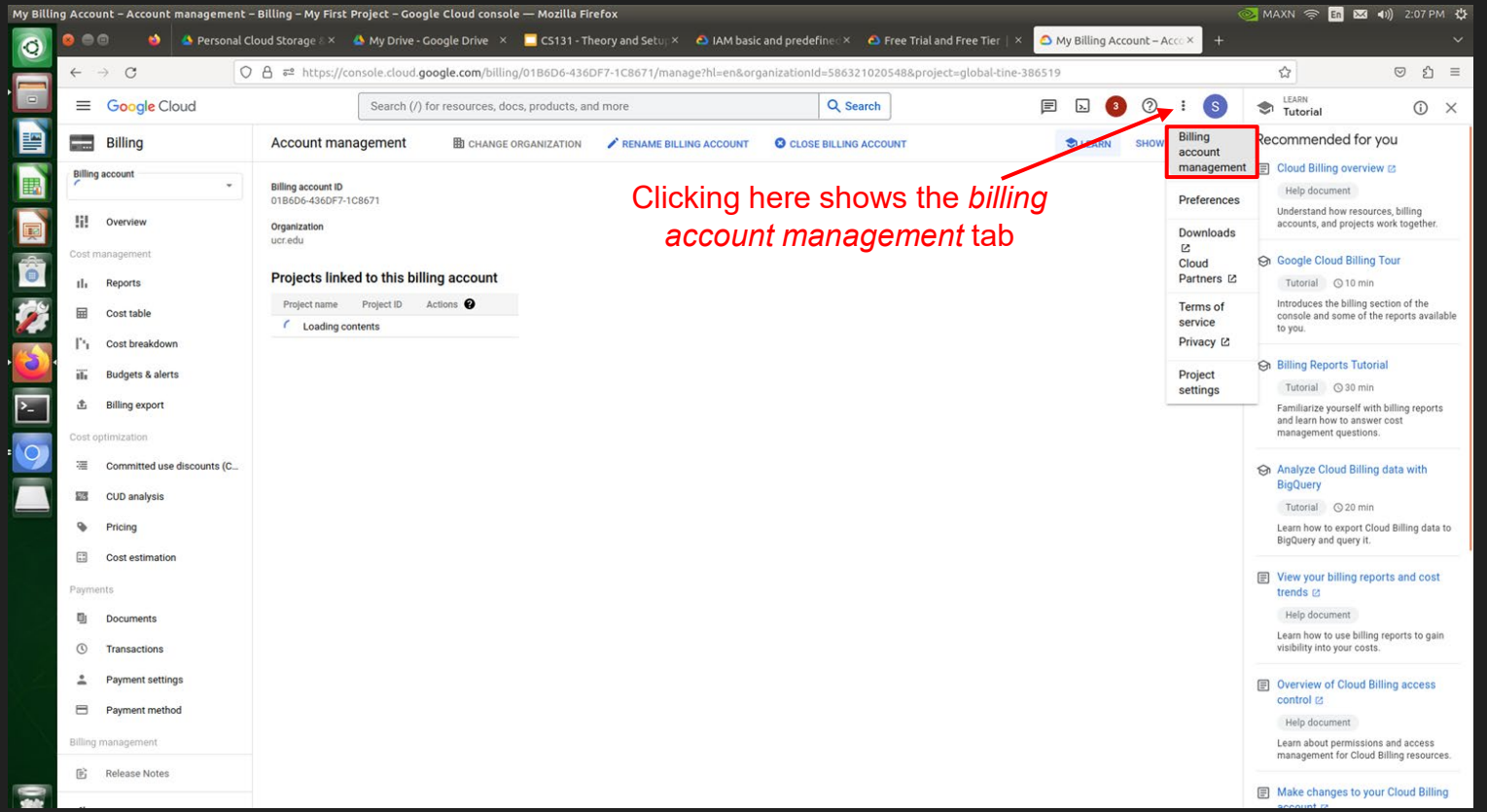
- First create a google cloud account
- Create your very first project through resource manager
- Keep track of the project ID:



Creating the Account

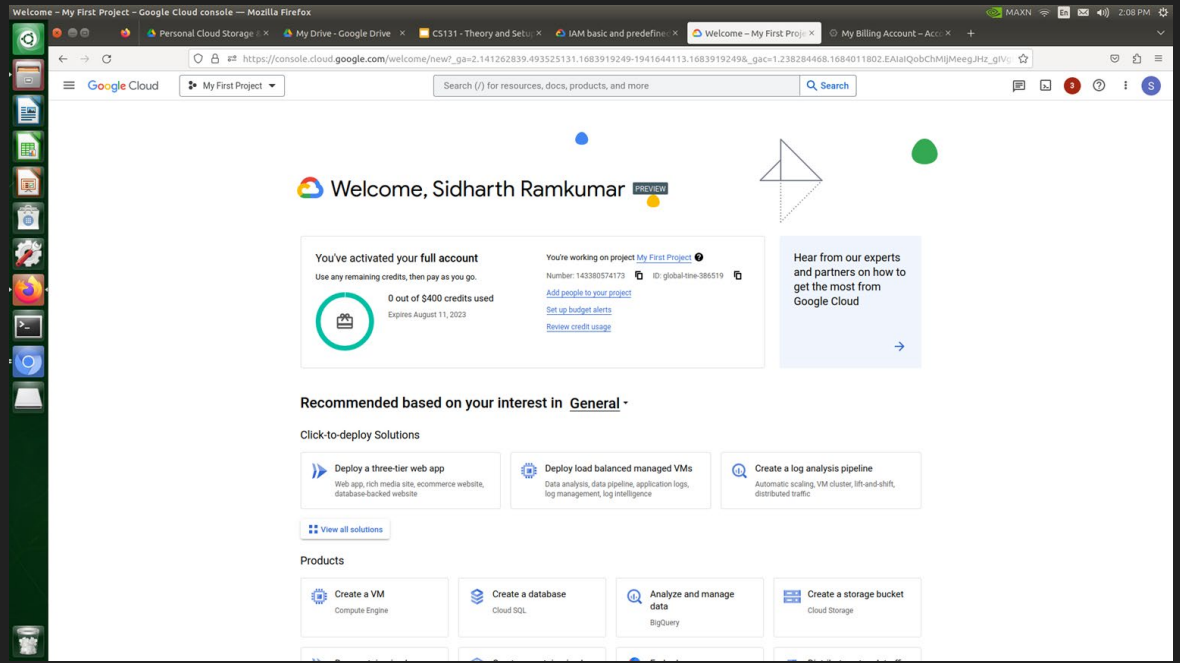


Billing Account



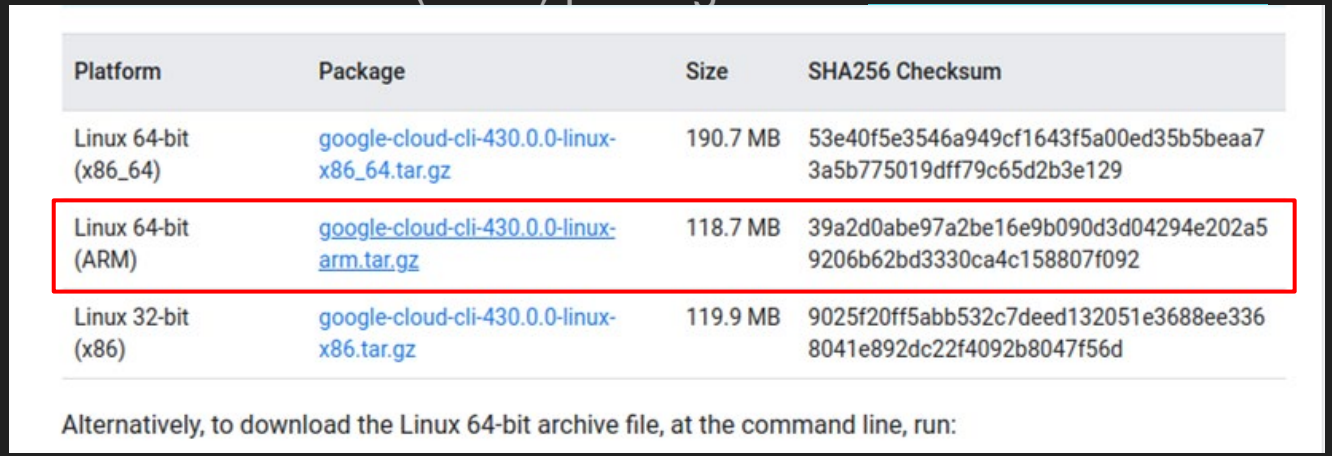
Accessing Console

- homepage for your Google Cloud Account
- cloud services and tools for your project



Install Google Cloud CLI

- We will install google-cloud-sdk
  - important to access GCP through command line
  - will be able run *gcloud* commands
  - interactivity between cloud and edge device
- Install Linux 64-bit (ARM) package from versioned archives



Platform	Package	Size	SHA256 Checksum
Linux 64-bit (x86_64)	google-cloud-cli-430.0.0-linux-x86_64.tar.gz	190.7 MB	53e40f5e3546a949cf1643f5a00ed35b5beaa73a5b775019dff79c65d2b3e129
Linux 64-bit (ARM)	google-cloud-cli-430.0.0-linux-arm.tar.gz	118.7 MB	39a2d0abe97a2be16e9b090d3d04294e202a59206b62bd3330ca4c158807f092
Linux 32-bit (x86)	google-cloud-cli-430.0.0-linux-x86.tar.gz	119.9 MB	9025f20ff5abb532c7deed132051e3688ee3368041e892dc22f4092b8047f56d

Alternatively, to download the Linux 64-bit archive file, at the command line, run:

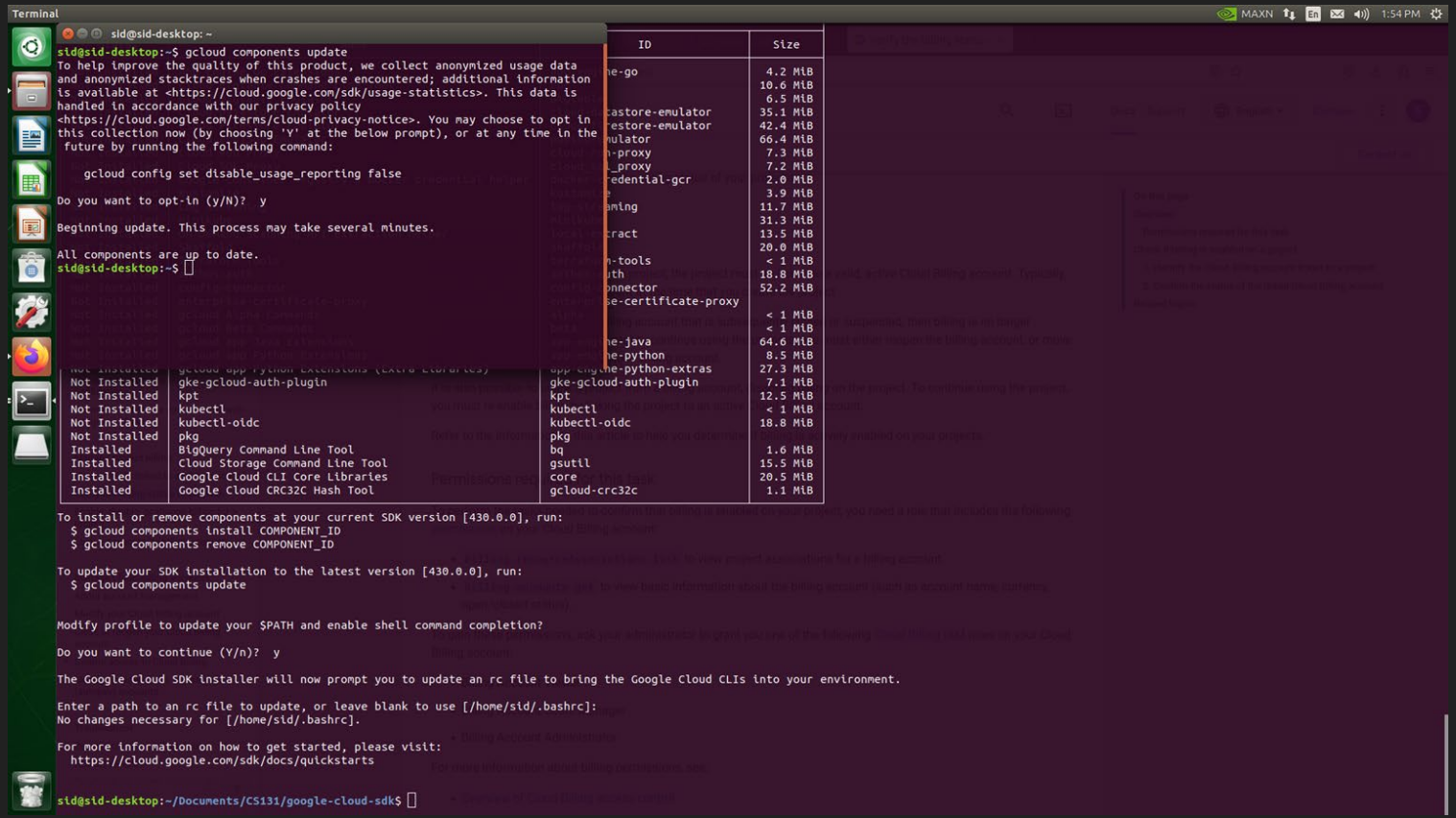
Run the Installation Scripts

- Unzip package into preferred directory
- Run commands for installation scripts
  - ./google-cloud-sdk/install.sh
  - alternatively you can turn on script-reader: ./google-cloud-sdk/install.sh --screen-reader=true
- Answer the questions when prompted
- Initialize gcloud CLI by using
  - ./google-cloud-sdk/bin/gcloud init

Connecting Cloud Account to Jetson

- Open a new terminal window
- Verify gcloud is up-to-date by running:
  - gcloud components update
- If you haven’t already, connect your account using:
  - gcloud auth login
  - sign-in through google accounts when prompted
  - notification via web browser if successful

Successful Installation and Update



What is gcloud?

- Primary command line interface for Google Cloud
- Do everything via command line
- Interacting with services - go from big to small - nested groups (“command groups”)
    - Correct to web console nesting

gcloud | (service) | (sub-service*) | (action) | (action target) | --(flags)

gcloud | compute | instances | create | instance-1 | --zone=uscentral1-a

credit to https://linuxacademy.com/ for the following slides [7]

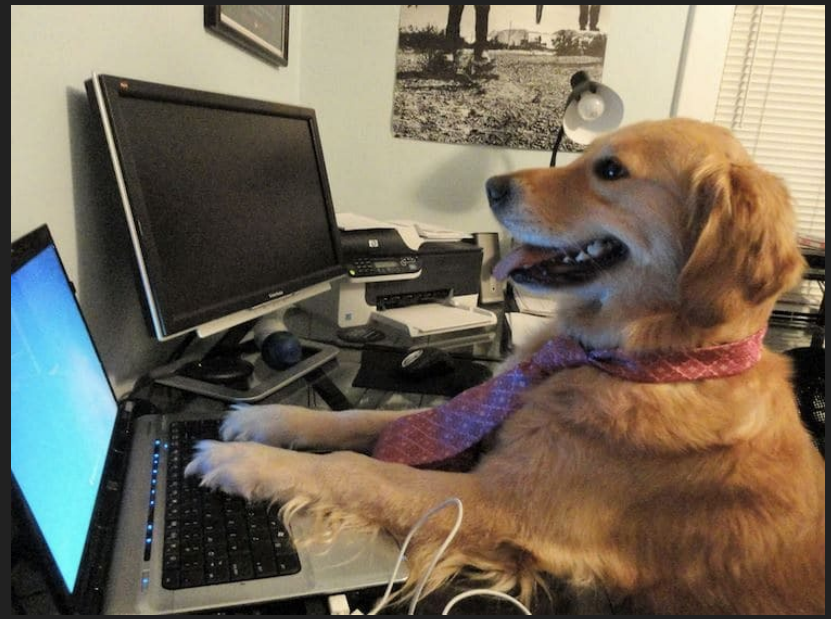
How to Look Up Commands

Getting help - “how do I do [x]?” [8]
type --help at any gcloud level

- gcloud compute --help
- gcloud compute instances --help
- gcloud compute instances create –help

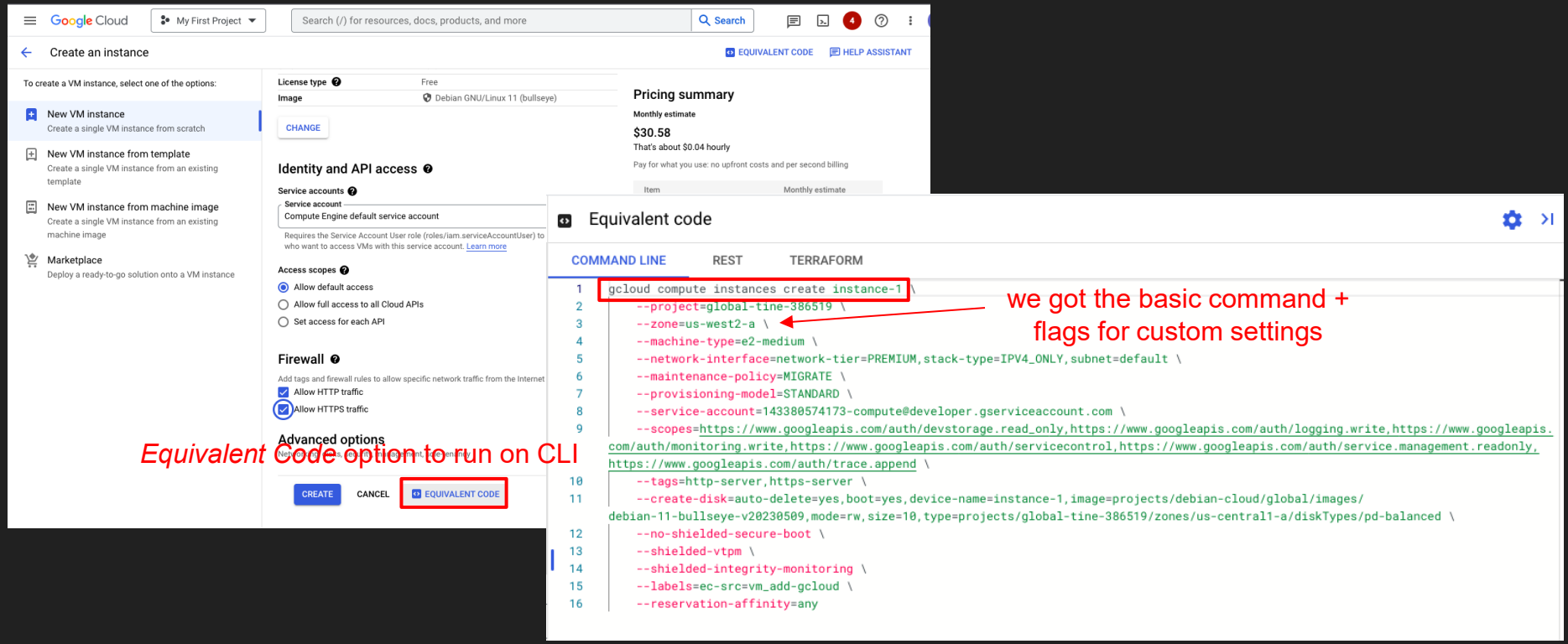
Google it (include “gcloud”)

- “How do I create a project with gcloud?”
  - gcloud create project
- “How do I enable specific API’s?”
  - gcloud enable api’s



Takeaway: You will never memorize everything - know how to reference answers.

Cross Referencing CLI Code



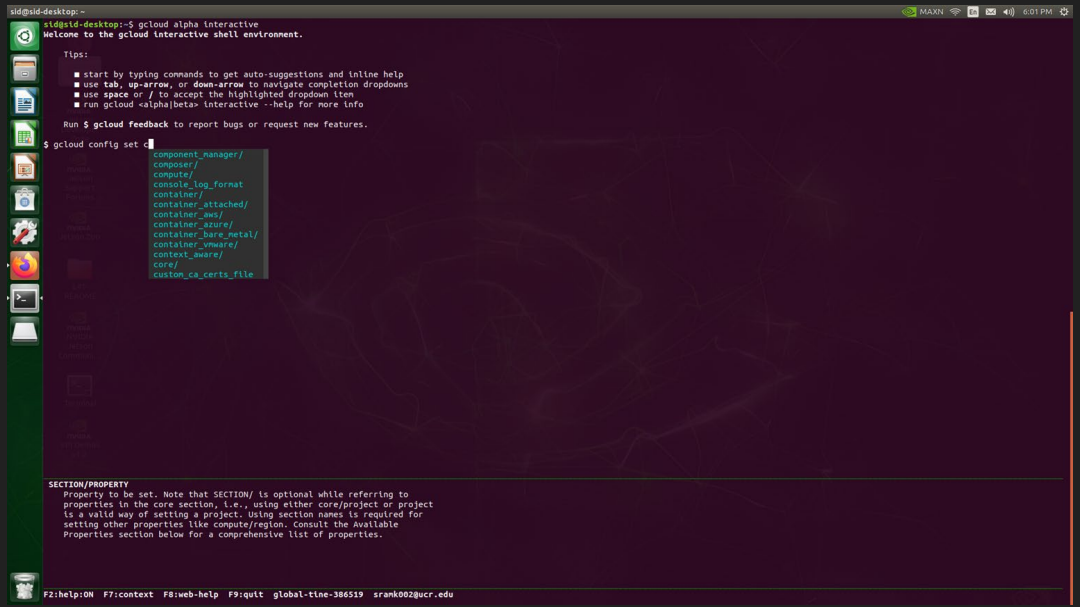
NOTE: I don't expect you to create VM instances. This is purely for explanatory purposes.

Configure Your Environment

- Set default project, zone, region, etc
  - gcloud config set project [project-id]
  - gcloud config set compute/zone us-west2-a
- “Where am I?”
  - gcloud config list

Install Alpha Interactive

- One of the most useful tools for gcloud CLI
- Interactive cloud shell - real time guidance
- To install, simply run:
  - gcloud components install alpha
- To launch shell:
  - gcloud alpha interactive



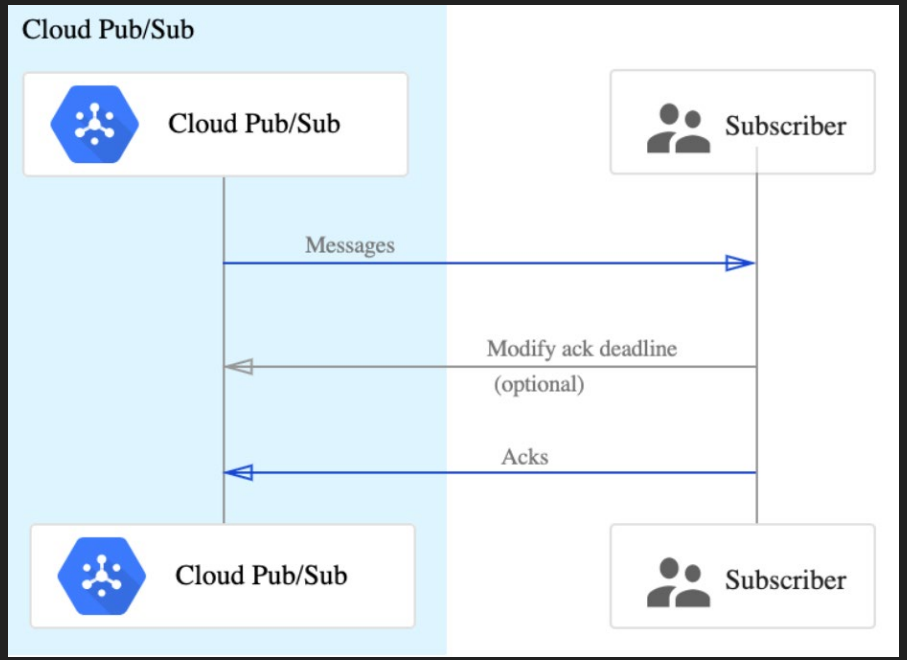
Using the Pub/Sub API

- Cloud Pub/Sub is scalable, durable, and fully managed messaging system
- Brings flexibility of MOMs to the cloud
- Many-to-many asynch messaging model
  - Secure and highly available communication
  - Used for independently written applications
  - Used for low-latency
- Many of Google's Products use this infrastructure
  - Ads, Search, Gmail, other GCP software
  - 500 millions msgs/s
  - 1 TB/s of data

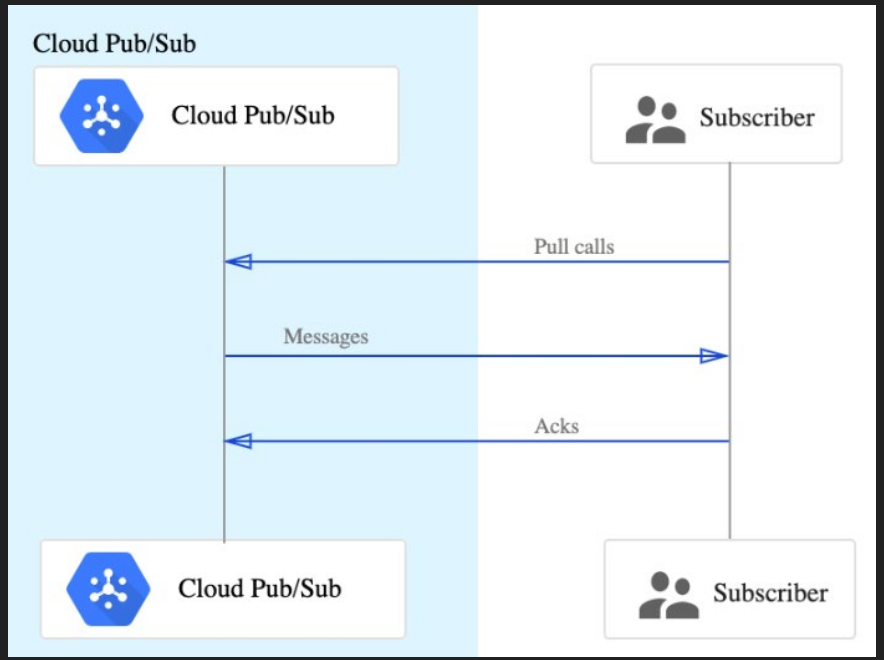
Following slides and examples borrowed from the Morioh GCP Course [9]

Two kinds of Subscriptions

Push Subscriptions



Pull Subscriptions



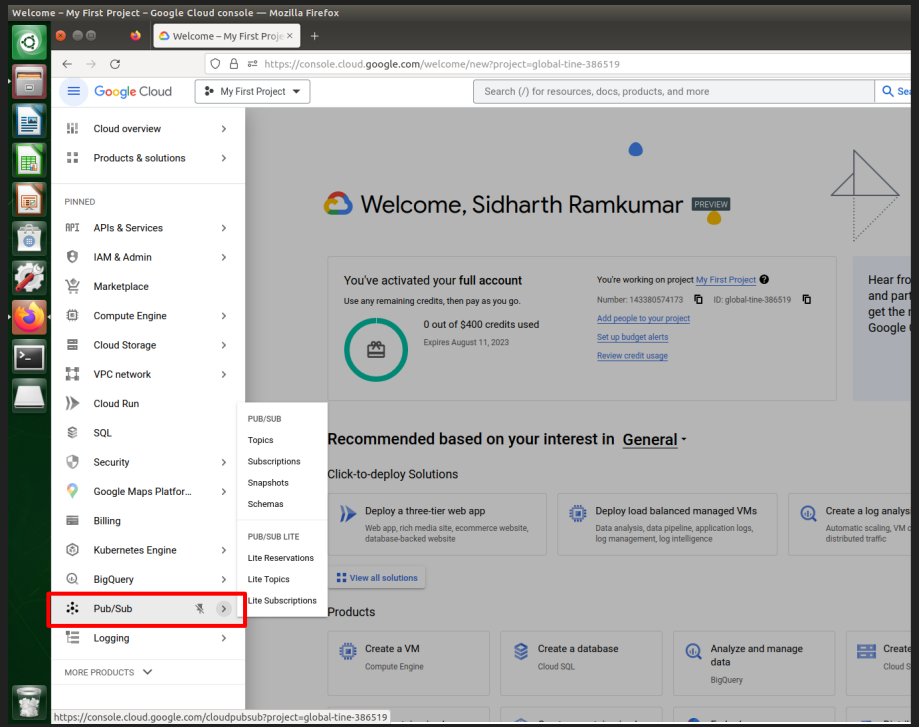
Choosing Push vs. Pull

The following table illustrates advantages of each subscription:

PUSH	PULL
Large volume of messages (a lot more than 1/second).	Multiple topics that must be processed by the same webhook.
Efficiency and throughput of message processing is critical.	App Engine Standard and Cloud Functions subscribers.
Public HTTPS endpoint, with non-self-signed SSL certificate, is not feasible to set up.	Environments where Google Cloud Platform dependencies (such as credentials and the client library) are not feasible to set up.

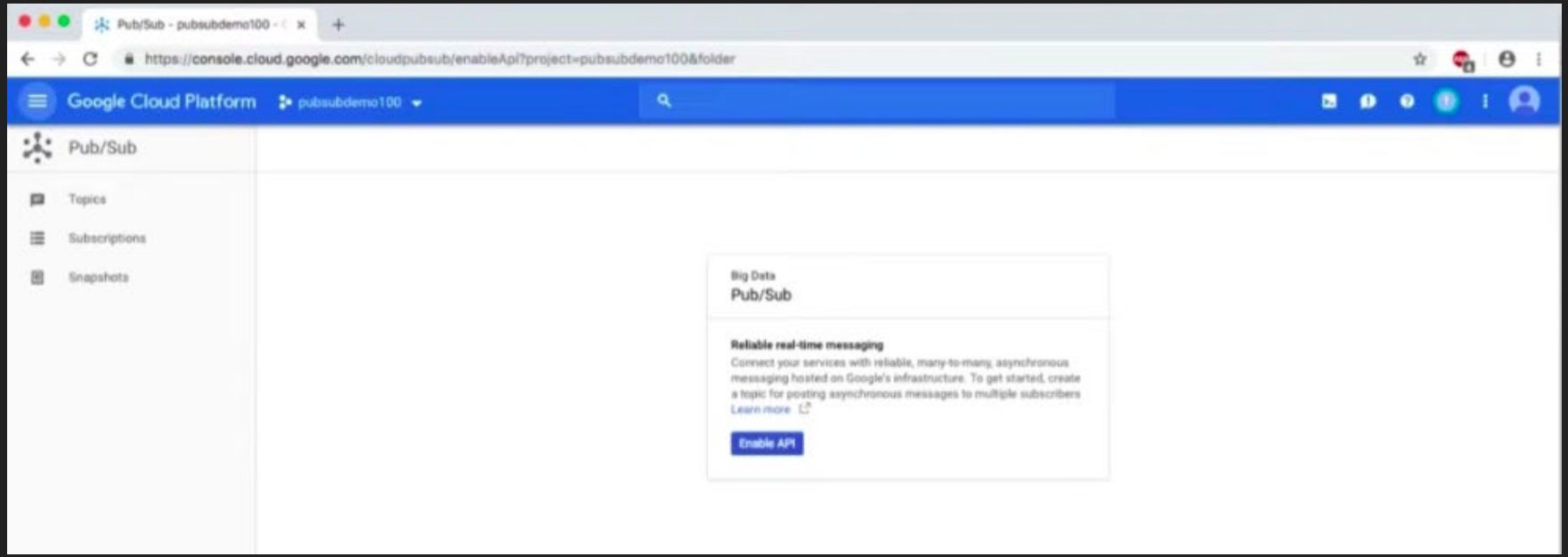
Navigating your GCP Console

- GCP console is a very handy tool
  - Options may seem overwhelming
  - Make sure to check pinned tabs
  - Regulated options through *interests*
- API options viewable through *APIs & Services* tab
- Simply click on the tool you would like to use
- Enable API if not already enabled by default



Enabling APIs for Google Cloud

- Simply clicking *Enable API* will allow you to use it in cloud's CLI



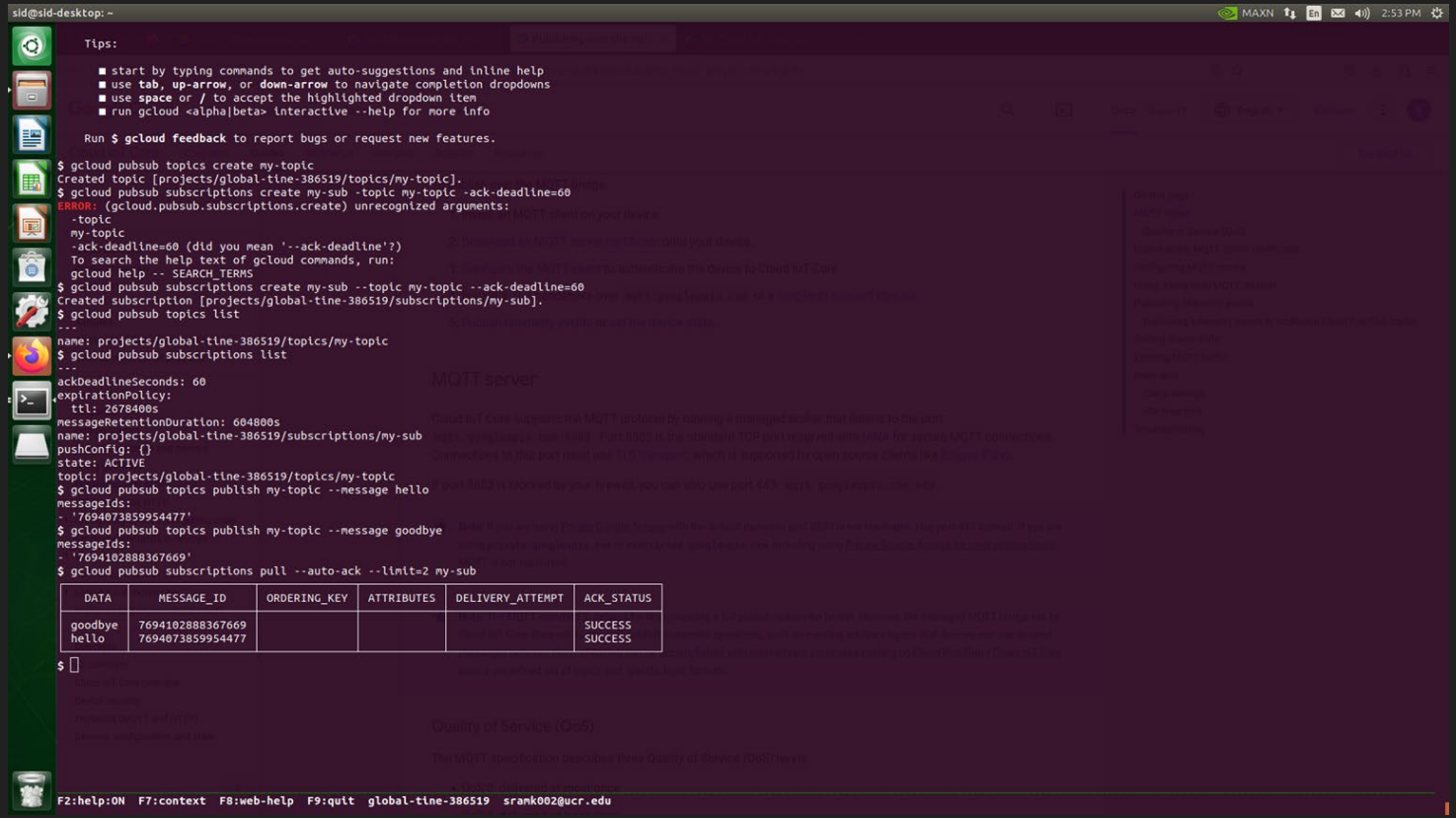
Creating Topics and Subscriptions

- 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

Send and Pull Messages

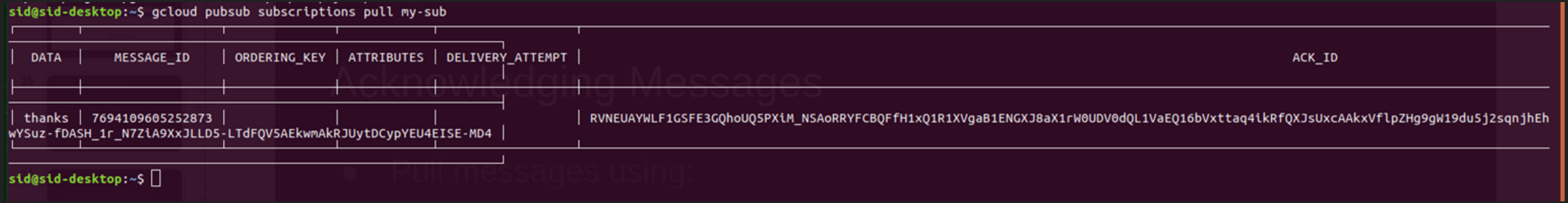
- Publish messages to the topic using
  - gcloud pubsub topics publish my-topic --message hello
  - gcloud pubsub topics publish my-topic --message goodbye
- Pull messages from the subscription
  - gcloud pubsub subscriptions pull --auto-ack --limit=2 my-sub

Pulling Subs through CLI



Acknowledging Messages

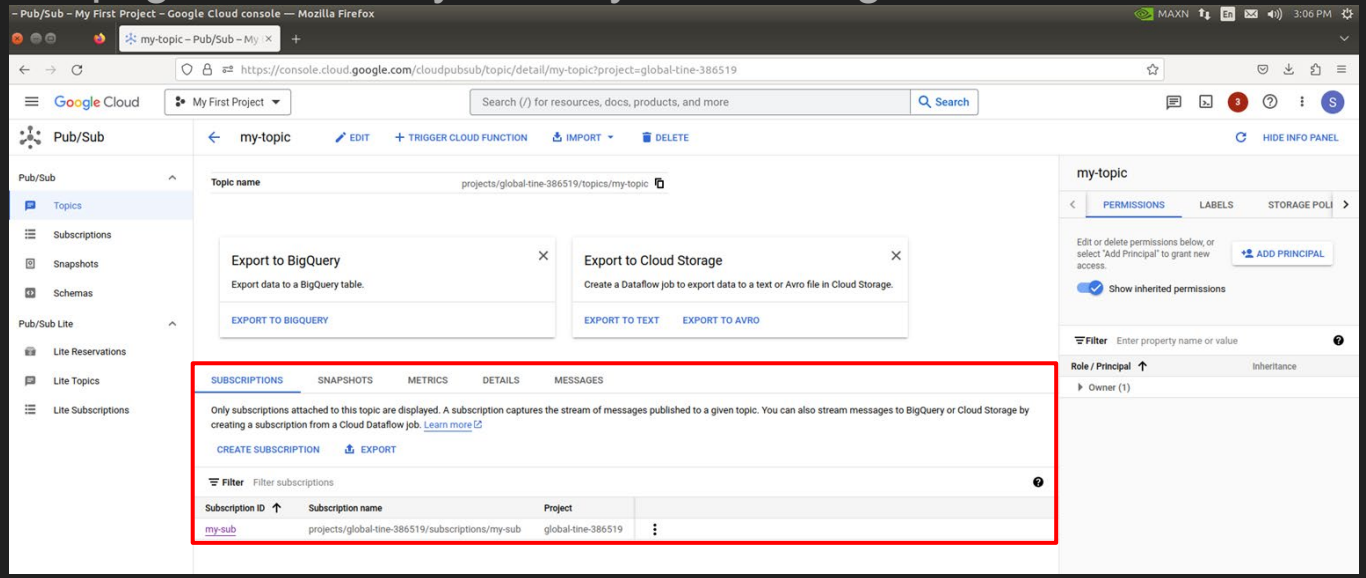
- Pull messages using:
  - gcloud pubsub topics publish my-topic --message thanks
  - gcloud pubsub subscriptions pull my-sub
- The above command provides your ACK_ID
- Acknowledge the message:
  - gcloud pubsub subscriptions ack my-sub --ack-ids [ACK_ID]



```
sid@sid-desktop:~$ gcloud pubsub subscriptions pull my-sub
| DATA   |   MESSAGE_ID     | ORDERING_KEY | ATTRIBUTES | DELIVERY_ATTEMPT |   ACK_ID
| thanks | 7694109605252873 |              |            |                  | RVNEUAYWLF1GSFE3GQhoUQ5PXiM_NSAoRRYFCBQFfH1xQ1R1XVgaB1ENGXJ8aX1rW0UDV0dQL1VaEQ16bVxttaq4ikRfQXJsUxcAAkxVflpZHg9gW19du5j2sqnjhEh
wYSuz-fDASH_1r_N7ZiA9XxJLLD5-LTdFQV5AEkwmAkRJUytDCypYEU4EISE-MD4 |
sid@sid-desktop:~$
```

View/Manage Topics & Subscriptions From GUI

- Navigate back to PubSub tab on GCP
  - Go to the Topics tab
  - Each detail on your subscriptions is viewable
- Use this page to manually check your messages

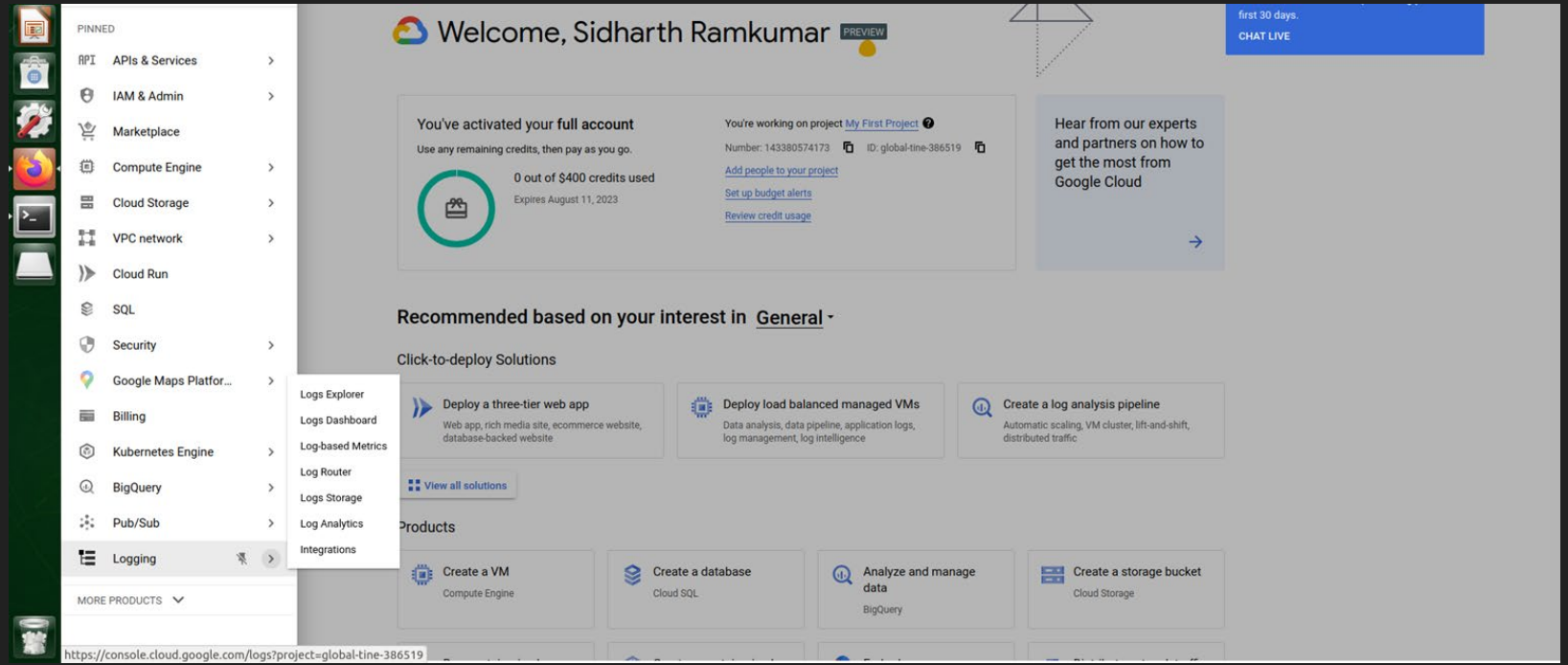


Monitoring API Activity

- The Cloud Pub/Sub API exports metrics via Stackdriver
  - Creates monitoring dashboards and alerts
  - Access metrics programmatically
- Metrics and resource types:
  - View usage metrics through *Metrics List*
  - Details for **pubsub_topic** and **pubsub_subscription** through *Monitored Resource Types*
  - APIs and services quotas dashboard
- All accessible through Console

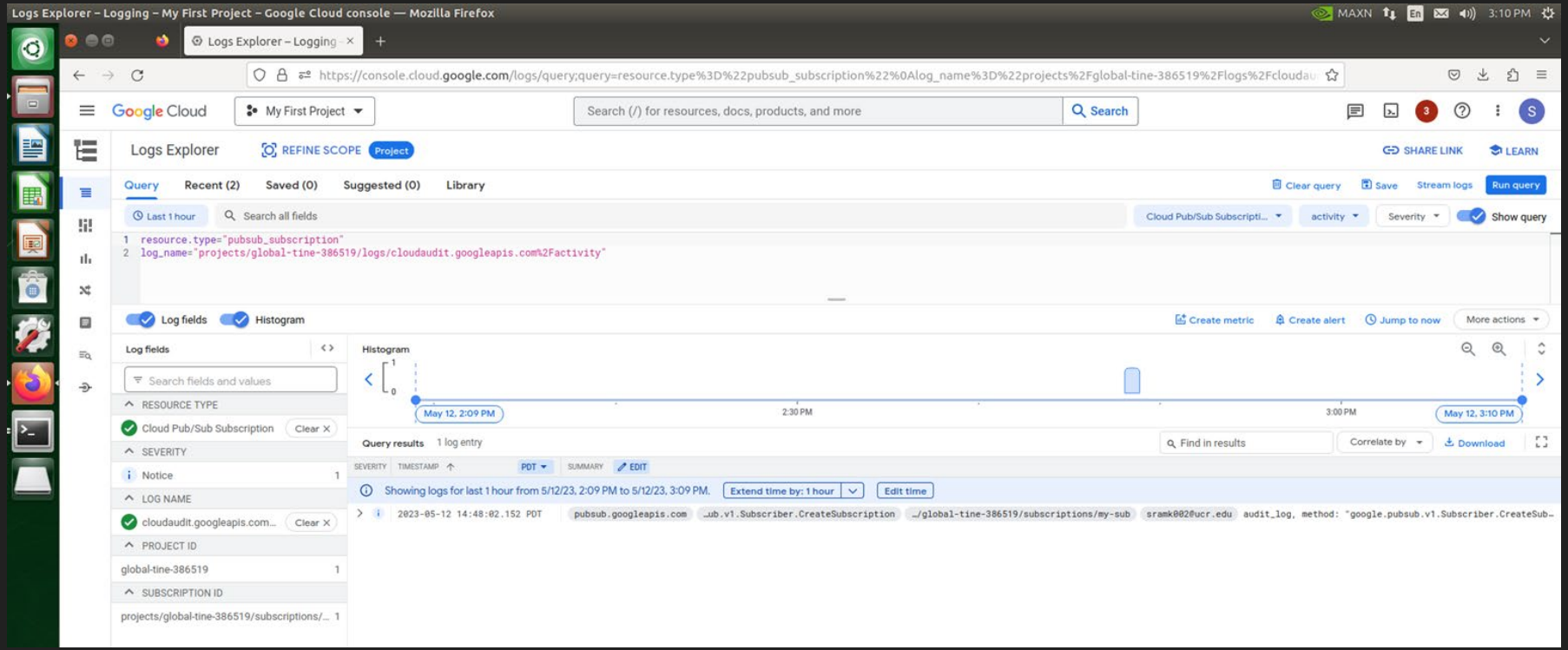
Use the Logging Tool

- Navigate to the Logging > *Logs Explorer* tab



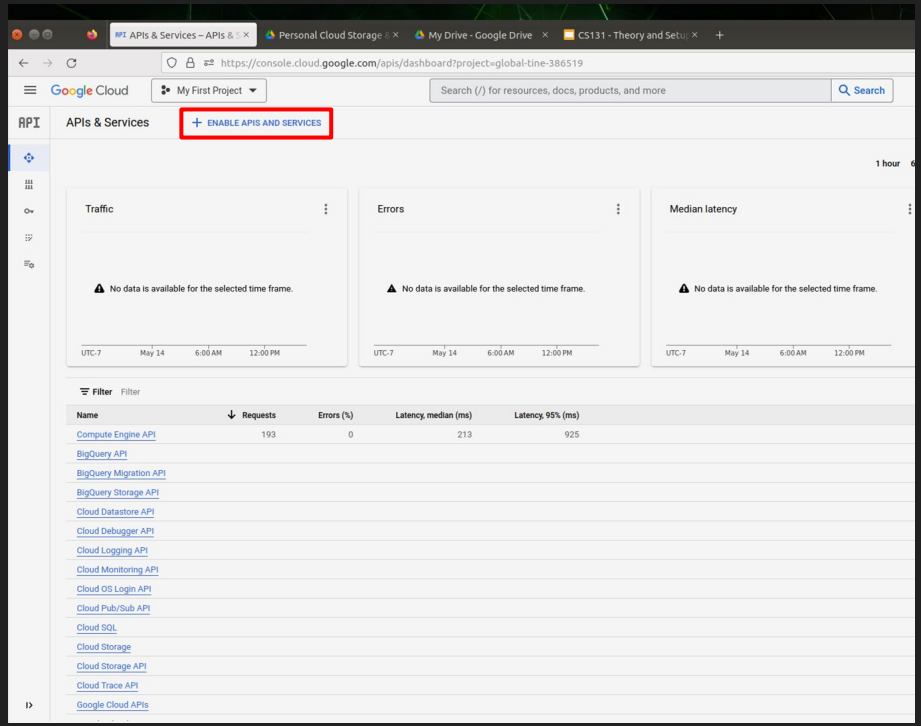
Observe Cloud Pub/Sub Logs

- Information via Stackdriver can be identified through these Logs



Now it’s your turn to explore!

- Go to the GCP Console homepage once more
- Look through some of APIs available
- Talk among your project team members
  - Which API would be relevant towards your project
  - How can count this toward your project requirements?



Exploring APIs & Services

- Now “Enable the API” using the steps from previous slides
- Call it in your Google CLI
- Screenshot the terminal and submit for credit
- **Optional:** Look at the Logs Explorer to view the level of API activity.

NOTE: Project groups should work together to complete Part 3 of the lab. For submission credit, screenshots and question answers should be submitted per lab group.

Sources Cited

[7] Google Cloud Command Line for Beginners or “How to gcloud”

[8] gcloud | Google Cloud CLI Documentation

[9] Google Cloud Platform Tutorial for Beginners - Full Course