

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.



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](#).



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 latency for applications and greater economies of scale.



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.



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.



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]

[illegible]

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

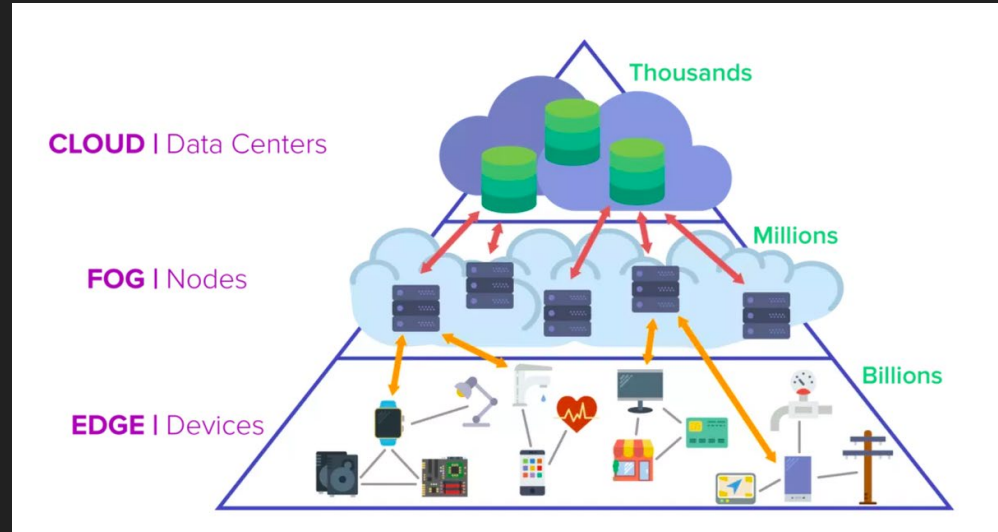
Better Understanding...

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:

Resources							
Filter							
<input type="checkbox"/>	Name	ID	Last accessed	Status	Charges	Carbon emissions	
<input type="checkbox"/>	▼ ucr.edu	586321020548	May 13, 2023				⋮
<input type="checkbox"/>	My First Project	global-tine-38...	May 13, 2023		\$0.00	—	⋮
<input type="checkbox"/>	My First Project	moonlit-bliss-...	—			—	⋮

RESOURCES PENDING DELETION

Creating the Account


Step 1 of 2 - Free trial - Google Cloud console - Mozilla Firefox


CS131 Edge computing - x Lab 4: Connecting to the x Getting started | Cloud | x Step 1 of 2 - Free trial - x

https://console.cloud.google.com/freetrial/signup/tos?pli=1

Try Google Cloud for free

Step 1 of 2 Account Information

 **Sidharth Ramkumar**
sramk002@ucr.edu [SWITCH ACCOUNT](#)

 Good news! You're eligible for an additional \$100.00 in Free Trial credits for a total of \$400.00. You'll receive these credits within 24 hours of completing signup.

Country

What best describes your organization or needs?

Terms of Service
☒ I have read and agree to the [Google Cloud Platform Terms of Service](#), [Supplemental Free Trial Terms of Service](#), and the terms of service of [any applicable services and APIs](#).
Required to continue

[CONTINUE](#)

[Privacy policy](#) | [FAQs](#)

Access to all Cloud Platform Products

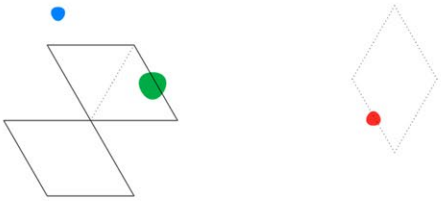
Get everything you need to build and run your apps, websites and services, including Firebase and the Google Maps API.

\$300 credit for free

Put Google Cloud to work with \$300 in credit to spend over the next 90 days.

No autocharge after free trial ends

We ask you for your credit card to make sure you are not a robot. You won't be charged unless you manually upgrade to a paid account.



Billing Account

The screenshot shows the Google Cloud Billing Account management interface. The top navigation bar includes tabs for 'Billing account management', 'CHANGE ORGANIZATION', 'RENAME BILLING ACCOUNT', and 'CLOSE BILLING ACCOUNT'. A red arrow points to the 'Billing account management' tab, which is highlighted with a red box. Below the navigation bar, the main content area displays the 'Billing account management' page. The page includes a sidebar on the left with links to 'Billing account', 'Overview', 'Reports', 'Cost table', 'Cost breakdown', 'Budgets & alerts', 'Billing export', 'Cost optimization', 'Payments', and 'Billing management'. The main content area shows the 'Billing account ID' (01B6D6-436DF7-1C8671), the 'Organization' (ucr.edu), and a table of 'Projects linked to this billing account'. The table has columns for 'Project name', 'Project ID', and 'Actions'. The 'Loading contents' message is displayed below the table. A red text overlay with an arrow pointing to the 'Billing account management' tab reads: 'Clicking here shows the *billing account management* tab'.

My Billing Account - Account management - Billing - My First Project - Google Cloud console - Mozilla Firefox

Personal Cloud Storage x My Drive - Google Drive x CS131 - Theory and Setu x IAM basic and predefine x Free Trial and Free Tier x My Billing Account - Acco x

Search (/) for resources, docs, products, and more

Google Cloud

Billing

Account management

CHANGE ORGANIZATION RENAME BILLING ACCOUNT CLOSE BILLING ACCOUNT

Billing account management

Billing account

Overview

Cost management

Reports

Cost table

Cost breakdown

Budgets & alerts

Billing export

Cost optimization

Committed use discounts (C...

CUD analysis

Pricing

Cost estimation

Payments

Documents

Transactions

Payment settings

Payment method

Billing management

Release Notes

Billing account ID: 01B6D6-436DF7-1C8671

Organization: ucr.edu

Projects linked to this billing account

Project name	Project ID	Actions
Loading contents		

Clicking here shows the *billing account management* tab

Recommended for you

Cloud Billing overview

Help document

Understand how resources, billing accounts, and projects work together.

Google Cloud Billing Tour

Tutorial 10 min

Introduces the billing section of the console and some of the reports available to you.

Billing Reports Tutorial

Tutorial 30 min

Familiarize yourself with billing reports and learn how to answer cost management questions.

Analyze Cloud Billing data with BigQuery

Tutorial 20 min

Learn how to export Cloud Billing data to BigQuery and query it.

View your billing reports and cost trends

Help document

Learn how to use billing reports to gain visibility into your costs.

Overview of Cloud Billing access control

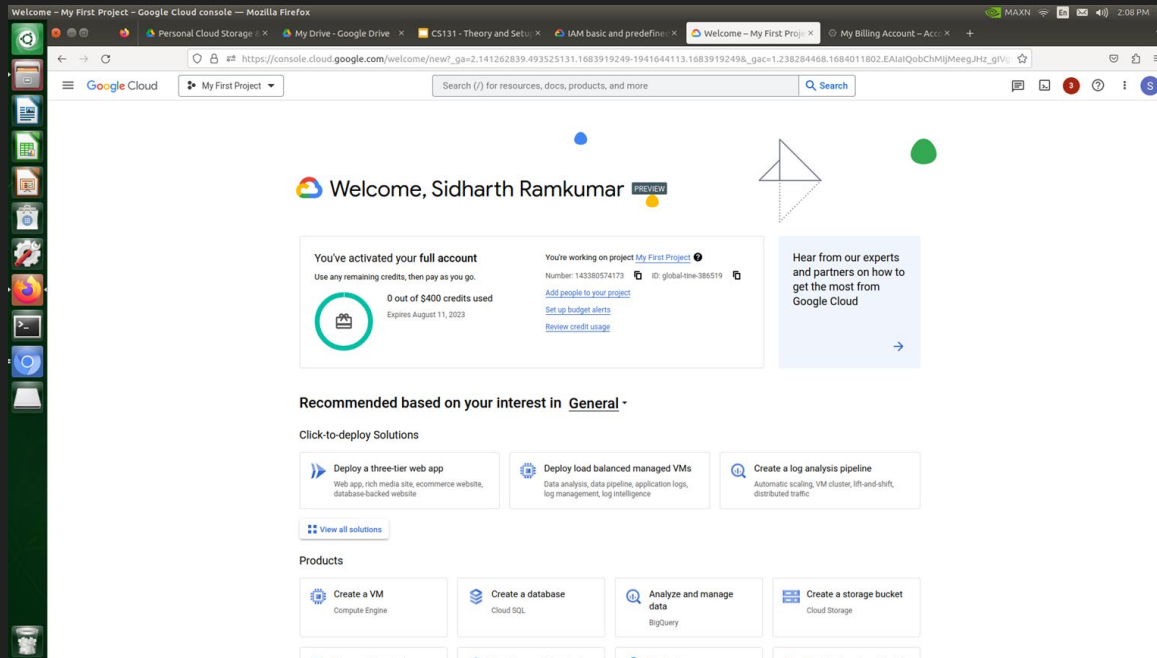
Help document

Learn about permissions and access management for Cloud Billing resources.

Make changes to your Cloud 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

The screenshot shows a terminal window with the following content:

```
Terminal
sid@sid-desktop: ~
sid$ gcloud components update
To help improve the quality of this product, we collect anonymized usage data
and anonymized stacktraces when crashes are encountered; additional information
is available at <https://cloud.google.com/sdk/usage-statistics>. This data is
handled in accordance with our privacy policy
<https://cloud.google.com/terms/cloud-privacy-notice>. You may choose to opt in
this collection now (by choosing 'Y' at the below prompt), or at any time in the
future by running the following command:

    gcloud config set disable_usage_reporting false

Do you want to opt-in (y/N)? y

Beginning update. This process may take several minutes.

All components are up to date.
sid$
```

ID	Size
gke-gcloud-auth-plugin	4.2 MiB
kpt	10.6 MiB
kubect	6.5 MiB
kubectl	35.1 MiB
kubectl-oidc	42.4 MiB
pkg	66.4 MiB
bq	7.3 MiB
gsutil	7.2 MiB
core	2.0 MiB
gcloud-crc32c	3.9 MiB
gke-gcloud-auth-plugin	11.7 MiB
kpt	31.3 MiB
kubect	13.5 MiB
kubectl	20.0 MiB
kubectl-oidc	< 1 MiB
pkg	18.8 MiB
bq	52.2 MiB
gsutil	< 1 MiB
core	< 1 MiB
gcloud-crc32c	64.6 MiB
gke-gcloud-auth-plugin	8.5 MiB
kpt	27.3 MiB
kubect	7.1 MiB
kubectl	12.5 MiB
kubectl-oidc	< 1 MiB
pkg	18.8 MiB
bq	1.6 MiB
gsutil	15.5 MiB
core	20.5 MiB
gcloud-crc32c	1.1 MiB

To install or remove components at your current SDK version [430.0.0], run:

```
$ gcloud components install COMPONENT_ID
$ gcloud components remove COMPONENT_ID
```

To update your SDK installation to the latest version [430.0.0], run:

```
$ gcloud components update
```

Modify profile to update your \$PATH and enable shell command completion?

Do you want to continue (Y/n)? y

The Google Cloud SDK installer will now prompt you to update an rc file to bring the Google Cloud CLIs into your environment.

Enter a path to an rc file to update, or leave blank to use [/home/sid/.bashrc]:

No changes necessary for [/home/sid/.bashrc].

For more information on how to get started, please visit:
<https://cloud.google.com/sdk/docs/quickstarts>

sid@sid-desktop: ~/Documents/CS131/google-cloud-sdk\$

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

Google Cloud | My First Project | Search (/) for resources, docs, products, and more

Create an instance

To create a VM instance, select one of the options:

- New VM instance (Create a single VM instance from scratch)
- New VM instance from template (Create a single VM instance from an existing template)
- New VM instance from machine image (Create a single VM instance from an existing machine image)
- Marketplace (Deploy a ready-to-go solution onto a VM instance)

License type: Free

Image: Debian GNU/Linux 11 (bullseye)

CHANGE

Pricing summary

Monthly estimate: \$30.58

That's about \$0.04 hourly

Pay for what you use: no upfront costs and per second billing

Identity and API access

Service accounts: Compute Engine default service account

Access scopes: Allow default access

Firewall: Allow HTTP traffic, Allow HTTPS traffic

Advanced options

CREATE CANCEL EQUIVALENT CODE

Equivalent code option to run on CLI

Equivalent code

COMMAND LINE REST TERRAFORM

```
1 gcloud compute instances create instance-1 \
2 --project=global-tine-386519 \
3 --zone=us-west2-a \
4 --machine-type=e2-medium \
5 --network-interface=network-tier=PREMIUM,stack-type=IPV4_ONLY,subnet=default \
6 --maintenance-policy=MIGRATE \
7 --provisioning-model=STANDARD \
8 --service-account=143380574173-compute@developer.gserviceaccount.com \
9 --scopes=https://www.googleapis.com/auth/devstorage.read_only,https://www.googleapis.com/auth/logging.write,https://www.googleapis.com/auth/monitoring.write,https://www.googleapis.com/auth/servicecontrol,https://www.googleapis.com/auth/service.management.readonly,https://www.googleapis.com/auth/trace.append \
10 --tags=http-server,https-server \
11 --create-disk=auto-delete=yes,boot=yes,device-name=instance-1,image=projects/debian-cloud/global/images/debian-11-bullseye-v20230509,mode=rw,size=10,type=projects/global-tine-386519/zones/us-central1-a/diskTypes/pd-balanced \
12 --no-shielded-secure-boot \
13 --shielded-vtpm \
14 --shielded-integrity-monitoring \
15 --labels=ec-src=vm_add-gcloud \
16 --reservation-affinity=any
```

we got the basic command + flags for custom settings

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

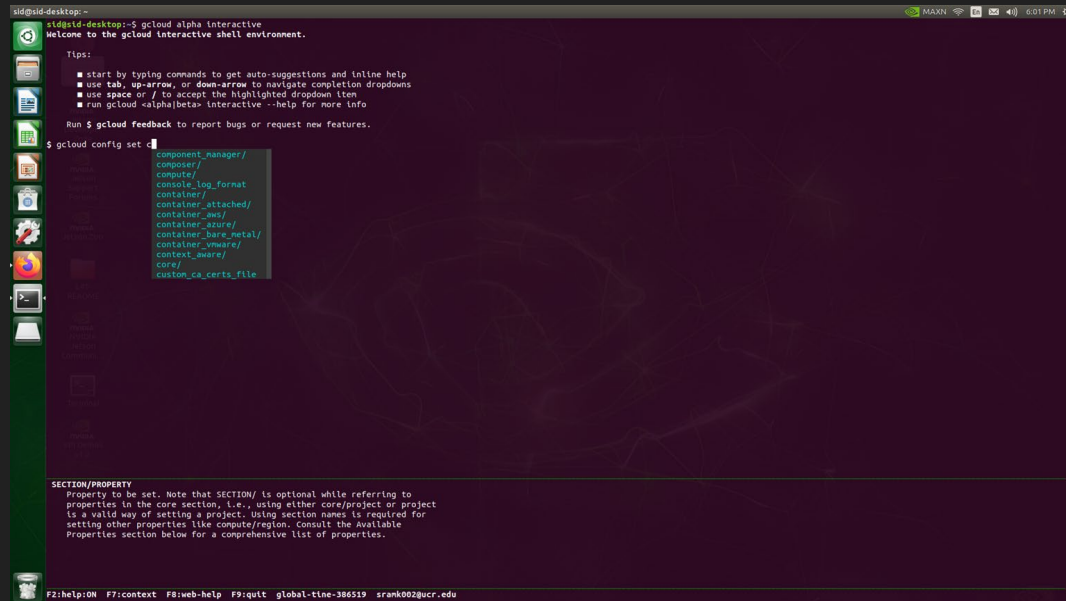
Configure Your Environment

- 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`



The screenshot shows a terminal window titled 'sid@sid-desktop:~'. The prompt is 'sid@sid-desktop:~\$ gcloud alpha interactive'. Below the prompt, a welcome message reads 'Welcome to the gcloud interactive shell environment.' followed by a 'Tips:' section. The tips include: 'start by typing commands to get auto-suggestions and inline help', 'use tab, up-arrow, or down-arrow to navigate completion dropdowns', 'use space or / to accept the highlighted dropdown item', and 'run gcloud <alpha|beta> interactive --help for more info'. Below the tips, it says 'Run \$ gcloud feedback to report bugs or request new features.' The user has entered '\$ gcloud config set' and a list of configuration options is shown in a box: 'component_manager/', 'composer/', 'compute/', 'console_log_format', 'container/', 'container_attached/', 'container_aws/', 'container_azure/', 'container_bare_metal/', 'container_gcpware/', 'context_aware/', 'core/', and 'custom_ca_certs_file'. At the bottom of the terminal, there is a 'SECTION/PROPERTY' section with instructions on how to set properties and a list of available properties.

```
sid@sid-desktop:~$ gcloud alpha interactive
Welcome to the gcloud interactive shell environment.

Tips:
  ■ start by typing commands to get auto-suggestions and inline help
  ■ use tab, up-arrow, or down-arrow to navigate completion dropdowns
  ■ use space or / to accept the highlighted dropdown item
  ■ run gcloud <alpha|beta> interactive --help for more info

Run $ gcloud feedback to report bugs or request new features.

$ gcloud config set
component_manager/
composer/
compute/
console_log_format
container/
container_attached/
container_aws/
container_azure/
container_bare_metal/
container_gcpware/
context_aware/
core/
custom_ca_certs_file

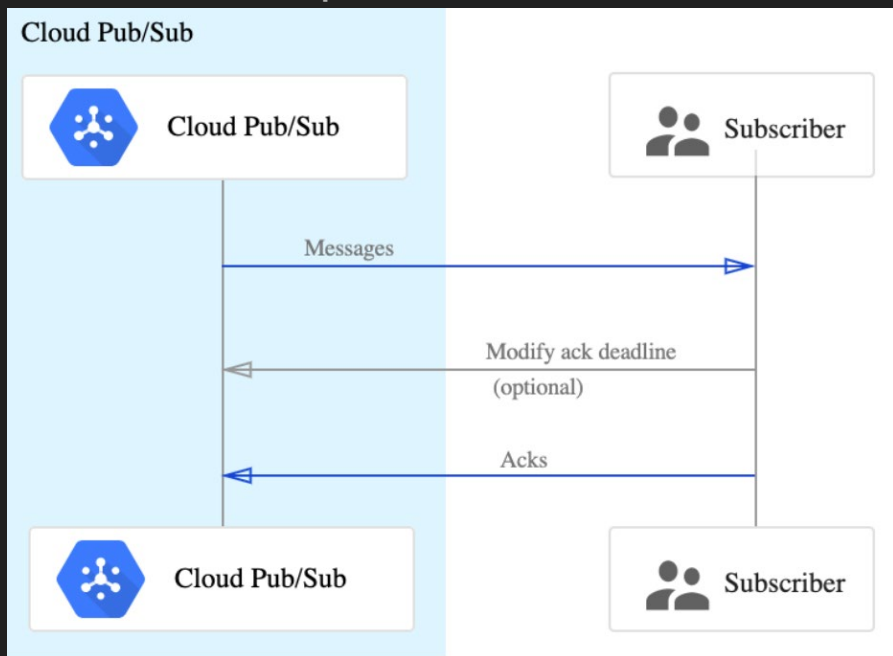
SECTION/PROPERTY
Property to be set. Note that SECTION/ is optional while referring to
properties in the core section, i.e., using either core/project or project
is a valid way of setting a project. Using section names is required for
setting other properties like compute/region. Consult the Available
Properties section below for a comprehensive list of properties.
```

Using the Pub/Sub API

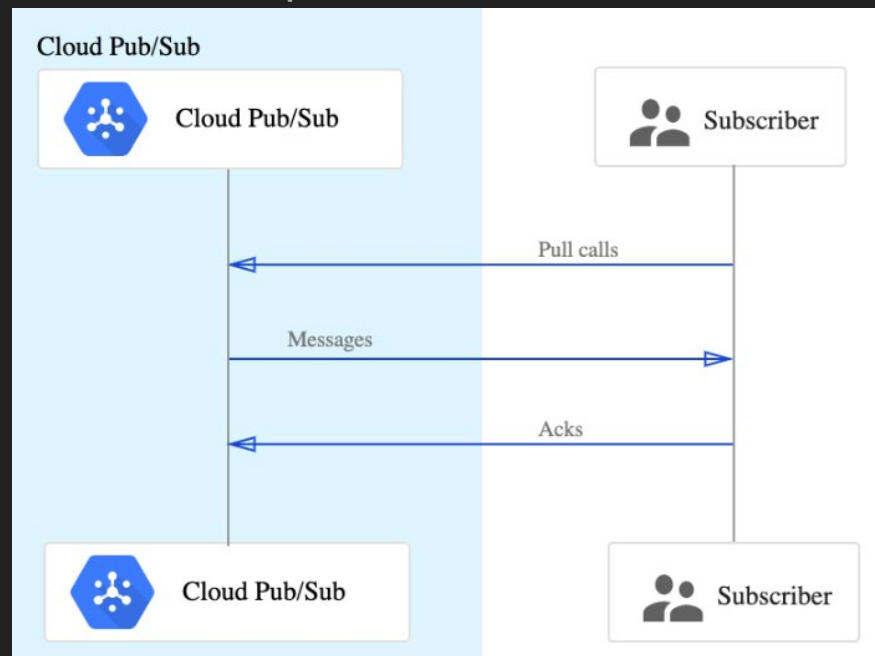
- Cloud Pub/Sub is scalable, durable, and fully managed messaging system
- Brings flexibility of MOMs to the cloud
- Many-to-many asynch messaging model
 - Secure and highly available communication
 - Used for independently written applications
 - Used for low-latency
- Many of Google's Products use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

Two kinds of Subscriptions

Push Subscriptions



Pull Subscriptions



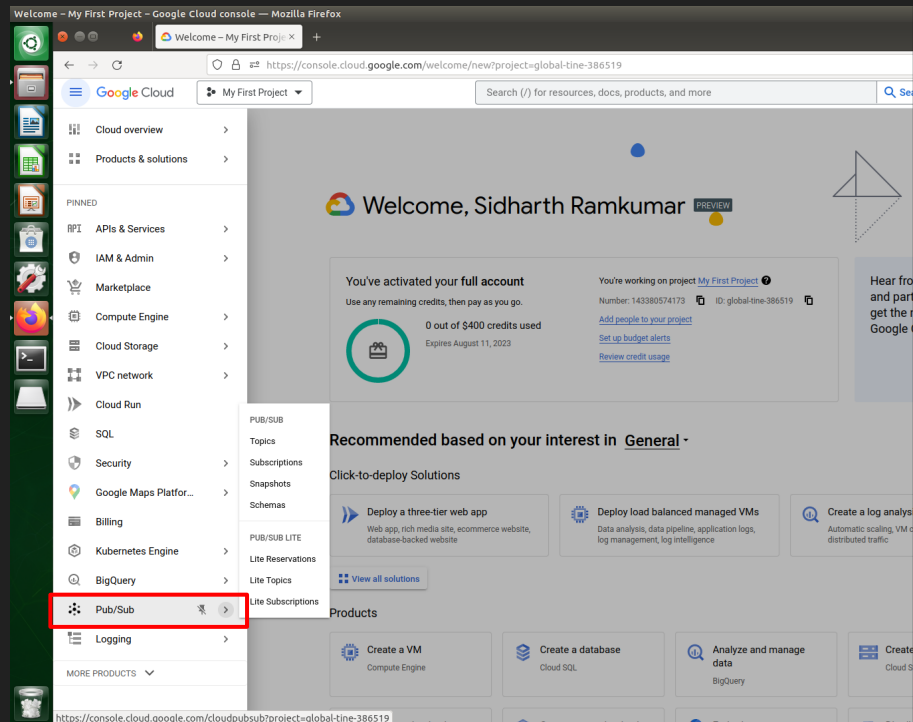
Choosing Push vs. Pull

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.

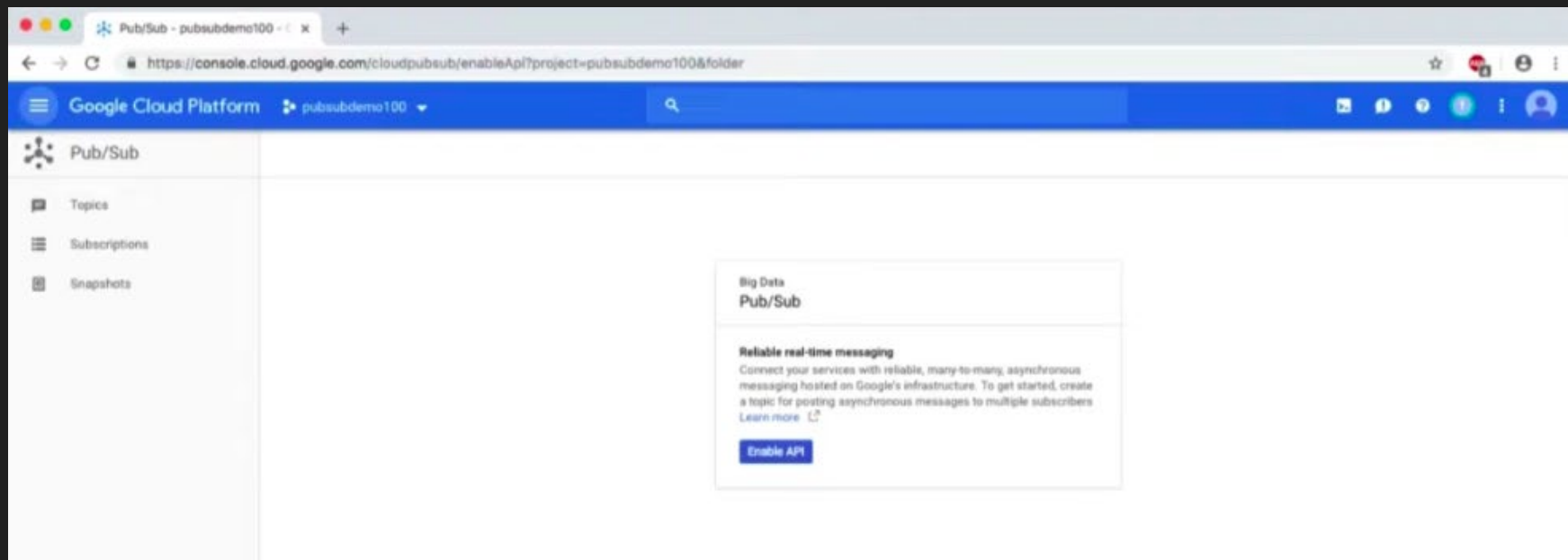
Navigating your GCP Console

- 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* & *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

sid@sid-desktop: ~\$

Tips:

- start by typing commands to get auto-suggestions and inline help
- use **tab**, **up-arrow**, or **down-arrow** to navigate completion dropdowns
- use **space** or **/** to accept the highlighted dropdown item
- run `gcloud <alpha|beta> interactive --help` for more info

Run `$ gcloud feedback` to report bugs or request new features.

```
$ gcloud pubsub topics create my-topic
Created topic [projects/global-tine-386519/topics/my-topic].
$ gcloud pubsub subscriptions create my-sub --topic my-topic --ack-deadline=60
ERROR: (gcloud.pubsub.subscriptions.create) unrecognized arguments:
  -topic
  my-topic
  --ack-deadline=60 (did you mean '--ack-deadline=?')
To search the help text of gcloud commands, run:
gcloud help -- SEARCH_TERMS
$ gcloud pubsub subscriptions create my-sub --topic my-topic --ack-deadline=60
Created subscription [projects/global-tine-386519/subscriptions/my-sub].
$ gcloud pubsub topics list
...
name: projects/global-tine-386519/topics/my-topic
$ gcloud pubsub subscriptions list
...
ackDeadlineSeconds: 60
expirationPolicy:
  ttl: 2678400s
messageRetentionDuration: 604800s
name: projects/global-tine-386519/subscriptions/my-sub
pushConfig: {}
state: ACTIVE
topic: projects/global-tine-386519/topics/my-topic
$ gcloud pubsub topics publish my-topic --message hello
messageIds:
- '7694073859954477'
$ gcloud pubsub topics publish my-topic --message goodbye
messageIds:
- '7694102888367669'
$ gcloud pubsub subscriptions pull --auto-ack --limit=2 my-sub
```

DATA	MESSAGE_ID	ORDERING_KEY	ATTRIBUTES	DELIVERY_ATTEMPT	ACK_STATUS
hello	7694102888367669				SUCCESS
goodbye	7694073859954477				SUCCESS

\$

MQTT server

gRPC Pub/Sub supports the MQTT protocol by running a managed broker that listens to the port 1883. gRPC Pub/Sub uses MQTT 3.1.1. MQTT 3.1.1 is the standard MQTT protocol used with MQTT for secure MQTT connections. Connections to this port need use TLS/TLS+SSL, which is supported by open source clients like Mosquitto.

Port 1883 is reserved by your firewall, you can also use port 443. `work -gcp-projects -port 443`

Note: This is using the default configuration for the broker, however, port 1883 is not required. The port 443 is optional. If you are interested in configuring the broker to use a custom port, you should use the following using the `work -gcp-projects -port 443` command.

Running a full gRPC Pub/Sub broker inside Docker. However, the managed MQTT broker has the benefit of automatic scaling and managed infrastructure and security, so we recommend using the managed MQTT broker. You can learn more about the managed MQTT broker by reading the `work -gcp-projects` command.

Quality of Service (QoS)

The MQTT specification describes three Quality of Service (QoS) levels:

F2:help:ON F7:context F8:web-help F9:quit global-tine-386519 srank002@ucr.edu

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				RVNEUAYWLF1GSFE3GQhoUQ5PX1M_NSAoRRYFCBQFh1xQ1R1XVgaB1ENGXJ8aX1rW0UDV0dQL1VaEQ16bVxttaq4lkRfQXJsUxcAAkxVflpZHg9gW19du5j2sqnjhEh
wYSuz-fDASH_1r_N7Z1A9XxJLLD5-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

The screenshot shows the Google Cloud Pub/Sub console interface. The left sidebar contains navigation options: Pub/Sub, Topics, Subscriptions, Snapshots, Schemas, Pub/Sub Lite, Lite Reservations, Lite Topics, and Lite Subscriptions. The main content area displays the details for a topic named 'my-topic'. At the top, there are buttons for EDIT, TRIGGER CLOUD FUNCTION, IMPORT, and DELETE. Below these are two export options: 'Export to BigQuery' and 'Export to Cloud Storage'. The 'SUBSCRIPTIONS' tab is selected and highlighted with a red box. It contains a table with one subscription named 'my-sub'. The table has columns for Subscription ID, Subscription name, and Project. The 'EXPORT' button is also visible.

Subscription ID	Subscription name	Project
my-sub	projects/global-tine-386519/subscriptions/my-sub	global-tine-386519

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

The screenshot displays the Google Cloud Platform console interface. On the left, a vertical navigation menu is visible, listing various services under the 'PINNED' section. The 'Logging' service is highlighted, and a sub-menu is open, showing 'Logs Explorer' as the selected option. The main content area shows a 'Welcome, Sidharth Ramkumar' message with a 'PREVIEW' badge. Below this, there's a section for account activation and credit usage, followed by a 'Recommended based on your interest in General' section. The 'Click-to-deploy Solutions' section is visible, featuring options like 'Deploy a three-tier web app', 'Deploy load balanced managed VMs', and 'Create a log analysis pipeline'. The 'Products' section at the bottom shows options like 'Create a VM', 'Create a database', 'Analyze and manage data', and 'Create a storage bucket'. The URL bar at the bottom indicates the path to the Logs Explorer: <https://console.cloud.google.com/logs?project=global-time-386519>.

PINNED

- API APis & Services
- IAM & Admin
- Marketplace
- Compute Engine
- Cloud Storage
- VPC network
- Cloud Run
- SQL
- Security
- Google Maps Platfor...
- Billing
- Kubernetes Engine
- BigQuery
- Pub/Sub
- Logging

MORE PRODUCTS

Welcome, Sidharth Ramkumar **PREVIEW**

You've activated your **full account**
Use any remaining credits, then pay as you go.

0 out of \$400 credits used
Expires August 11, 2023

You're working on project **My First Project**
Number: 143380574173 ID: global-time-386519
[Add people to your project](#)
[Set up budget alerts](#)
[Review credit usage](#)

Hear from our experts and partners on how to get the most from Google Cloud

Recommended based on your interest in **General**

Click-to-deploy Solutions

- Deploy a three-tier web app
Web app, rich media site, ecommerce website, database-backed website
- Deploy load balanced managed VMs
Data analysis, data pipeline, application logs, log management, log intelligence
- Create a log analysis pipeline
Automatic scaling, VM cluster, lift-and-shift, distributed traffic

View all solutions

Products

- Create a VM
Compute Engine
- Create a database
Cloud SQL
- Analyze and manage data
BigQuery
- Create a storage bucket
Cloud Storage

<https://console.cloud.google.com/logs?project=global-time-386519>

Observe Cloud Pub/Sub Logs

- Information via Stackdriver can be identified through these Logs

The screenshot displays the Google Cloud Logs Explorer interface in a Mozilla Firefox browser. The page title is "Logs Explorer - Logging - My First Project - Google Cloud console". The URL bar shows a query for resource type "pubsub_subscription" and log name "projects/global-time-386519/logs/cloudaudit.googleapis.com%2Factivity".

The interface includes a search bar with the text "Search (/) for resources, docs, products, and more". Below the search bar, the "Logs Explorer" section shows a query for "Cloud Pub/Sub Subscription" activity. The query results are displayed as a histogram and a list of log entries.

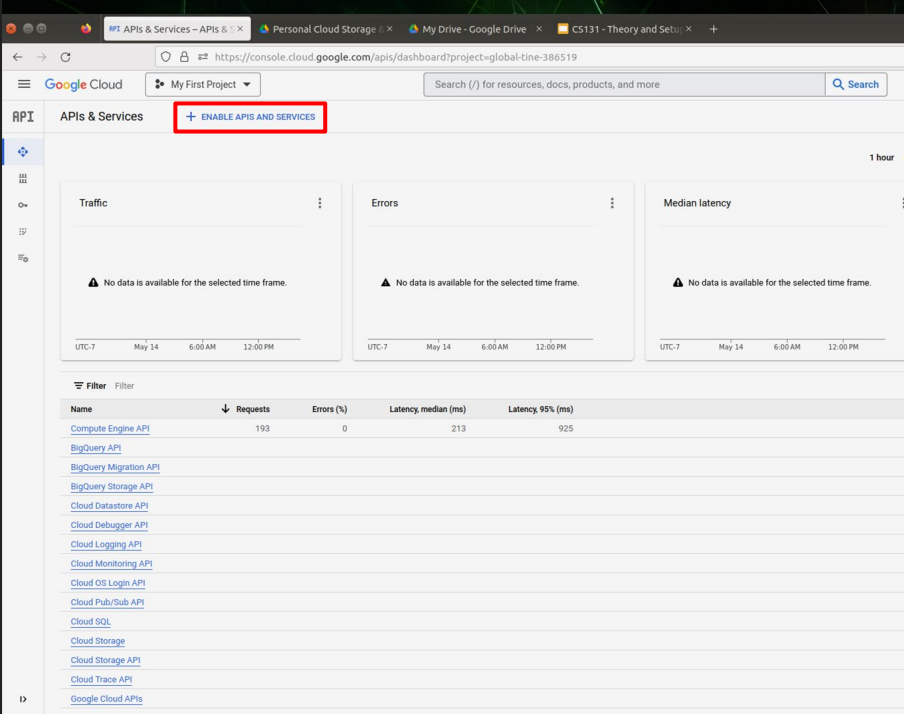
The histogram shows a single log entry at May 12, 2:09 PM. The log entry details are as follows:

SEVERITY	TIMESTAMP	LOG MESSAGE
Notice	2023-05-12 14:48:02.152 PDT	pubsub.googleapis.com ...ub.v1.Subscriber.CreateSubscription .../global-time-386519/subscriptions/my-sub sramk002@ucr.edu audit_log, method: "google.pubsub.v1.Subscriber.CreateSub-

The left sidebar shows the "Log fields" section with filters for "RESOURCE TYPE" (Cloud Pub/Sub Subscription), "SEVERITY" (Notice), "LOG NAME" (cloudaudit.googleapis.com), "PROJECT ID" (global-time-386519), and "SUBSCRIPTION ID" (projects/global-time-386519/subscriptions/...).

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?



The screenshot displays the GCP Console 'APIs & Services' page. The top navigation bar includes the Google Cloud logo, the project name 'My First Project', and a search bar. The main heading is 'APIs & Services', with a red box highlighting the '+ ENABLE APIS AND SERVICES' button. Below this, there are three charts: 'Traffic', 'Errors', and 'Median latency', each showing 'No data is available for the selected time frame.' At the bottom, there is a table of APIs with columns for Name, Requests, Errors (%), Latency, median (ms), and Latency, 95% (ms). The table lists various APIs, including Compute Engine API, BigQuery API, Cloud Datastore API, and Cloud Storage API.

Name	Requests	Errors (%)	Latency, median (ms)	Latency, 95% (ms)
Compute Engine API	193	0	213	925
BigQuery API				
BigQuery Migration API				
BigQuery Storage API				
Cloud Datastore API				
Cloud Debugger API				
Cloud Logging API				
Cloud Monitoring API				
Cloud OS Login API				
Cloud Pub/Sub API				
Cloud SQL				
Cloud Storage				
Cloud Storage API				
Cloud Trace API				
Google Cloud APIs				

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](#)