Connecting to Google Cloud Platform

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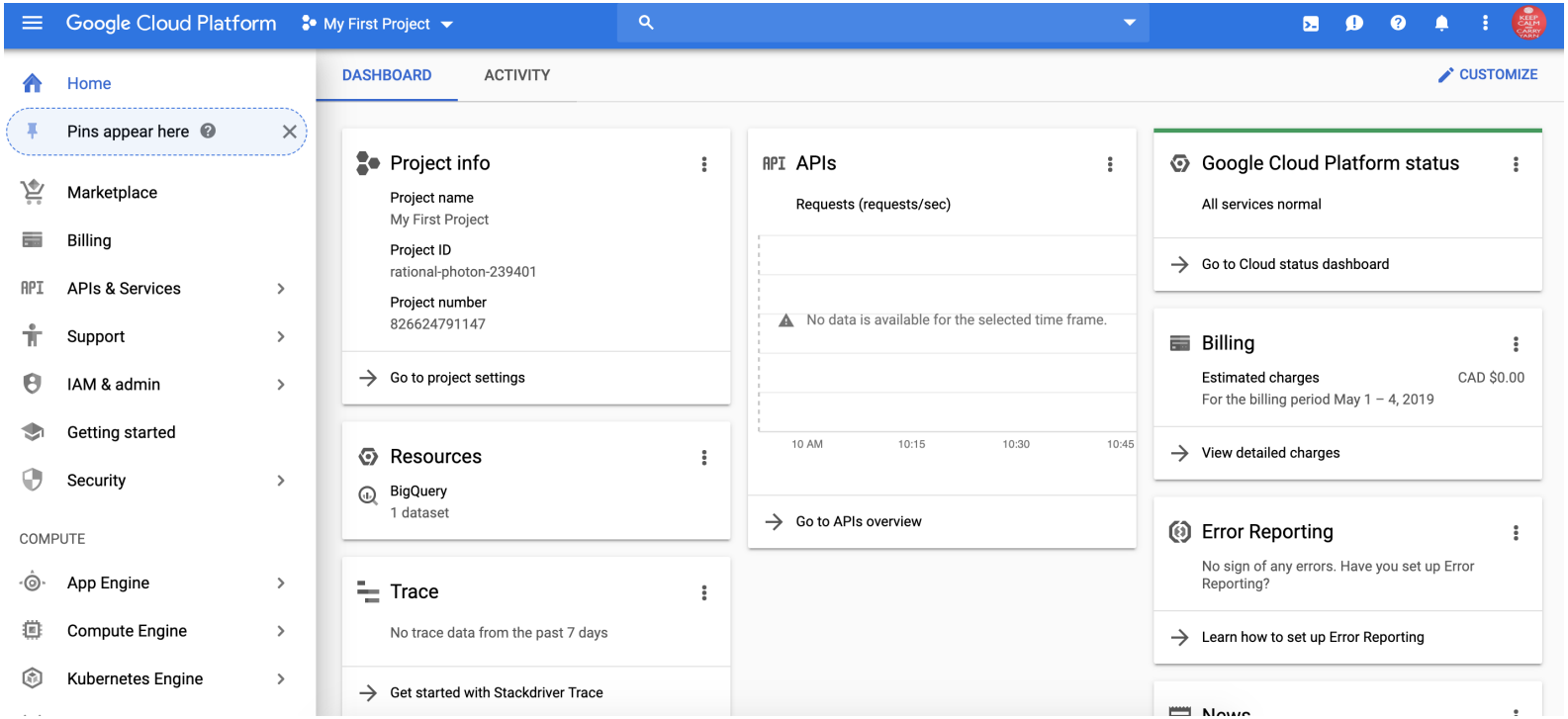
Google Cloud Platform



Follow along at: https://github.com/MCDAngelo/connectGCP

Google Cloud Platform

Today I'll be focusing two parts of Google Cloud Platform that I've used to access data: Google Cloud Storage and BigQuery

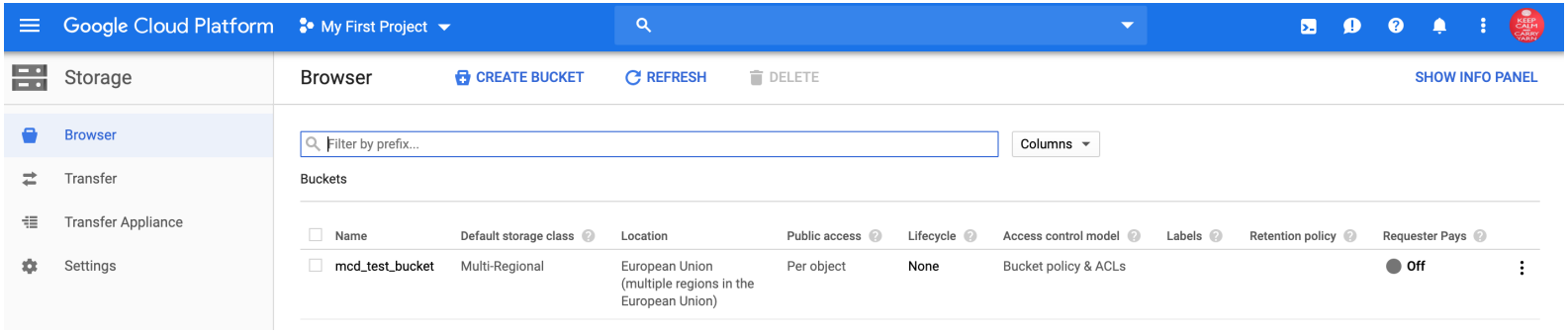
Google Cloud Storage

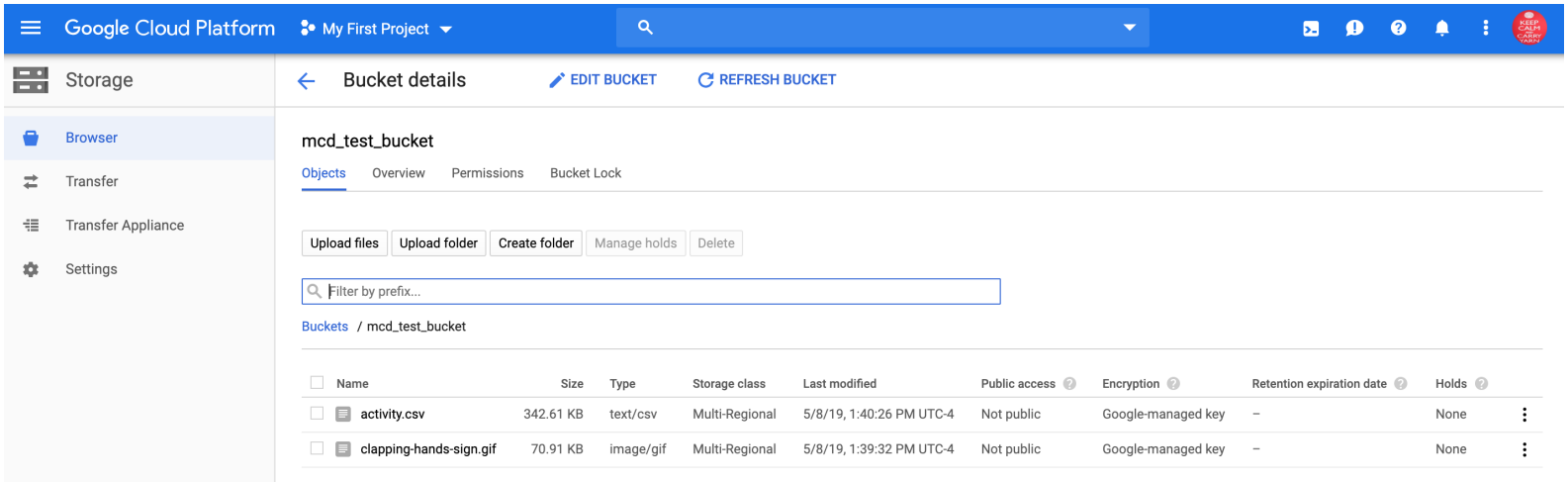
- Online file storage service for storing and accessing data on Google Cloud Platform
- Can be accessed from R using the **`googleCloudStorageR`** package

BigQuery

- Set of tables that enables interactive analysis of massively large datasets working in conjunction with Google Storage
- Can be accessed from R using the **`bigrquery`** package

Google Cloud Storage





Google Cloud Storage

Important terms

Project

- Organizes all your Google Cloud Platform resources.
- Name is shown at the top of the window (e.g. "My First Project" in the previous slide).
- If you click on the project name, you'll see the corresponding **`project ID`** (used later in the presentation).

Bucket

- Similar to a folder or directory in your file system
- Can be nested

Object

- A file (e.g. **`.csv`**, **`.Rda`**, **`.gif`**)

The `googleCloudStorageR` Package

1. Getting set up
   - How to authenticate

2. What's in my project?
   - Listing & inspecting buckets

3. Saving data, models, scripts
   - Creating buckets & uploading objects

4. I'd like some data, please!
   - Downloading objects

Getting set up

Background: I volunteered to do this talk because of how hard I found it to get started with **`googleCloudStorageR`** 😬

I initially found authentication confusing because two different authentication files are mentioned in the documentation.

1. Credentials for auto-authentication (**`gcs-auto-auth.json`**)
2. Client ID for authenticating an application (**`client-id.json`**). Sets up authentication for an app (e.g. a Shiny App)

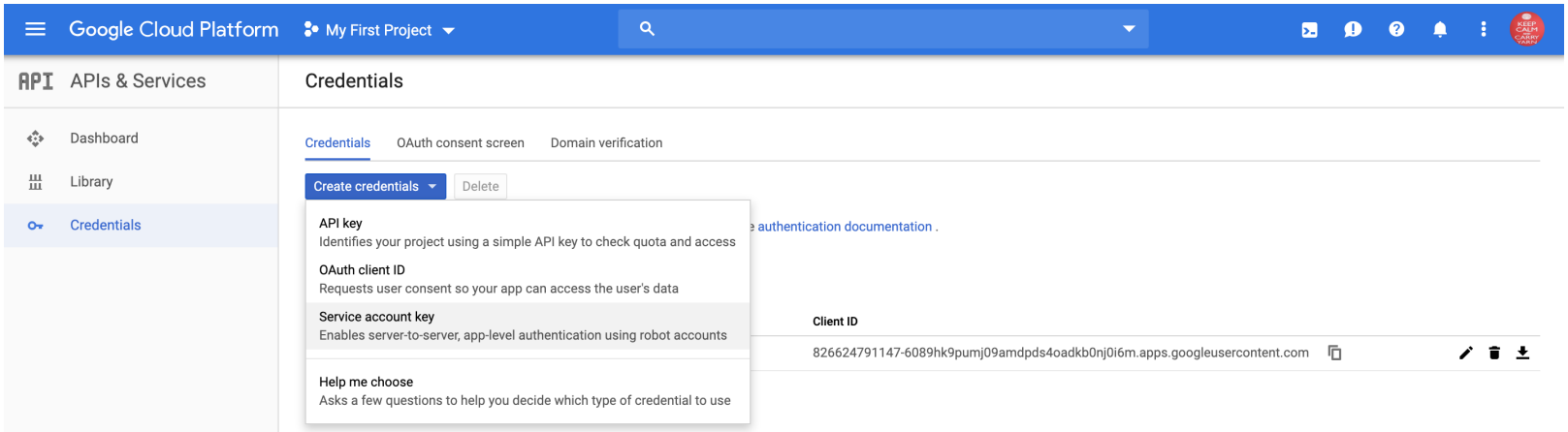
You only need credentials for auto-authentication for local R sessions (*this was not obvious to me*).

I'll focus on how to set up the credentials for auto-authentication in this talk, but have slides at the end on setting up a Client ID.

More helpful details on the two files can be found in the discussion of issue #94 in **`googleCloudStorageR`**.

🔐 Authentication in `googleCloudStorageR`

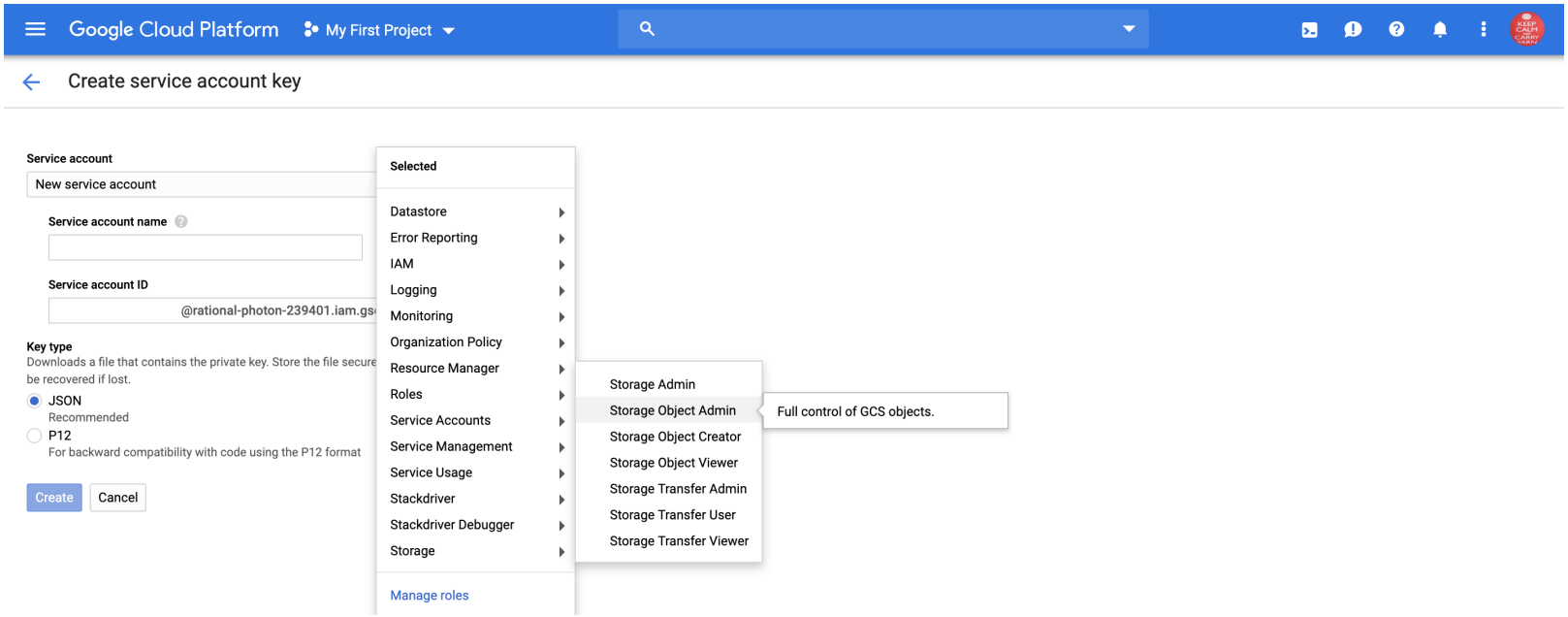
To get started, you need a **`service account key`**.



🔐 Authentication in `googleCloudStorageR`

To create a new service account, you'll need to give the service account a name and permissions.
Warning: I selected Storage Object Admin for my personal account - this may be dangerous.
- Check with your friendly neighbourhood dev-ops/security person for help with this step.

Select the **`JSON`** key type and when you click on **`create`** you'll be prompted to download **`.json`** file.
*- I named my file **`gcs-auto-auth.json`**.*



🔐 Authentication in `googleCloudStorageR`

Once you have your credentials file, set the environment variable **`GCS_AUTH_FILE`** to the file location.

- TIL: if you set this variable before you load the library, then **`gcs_auth()`** will be called when the **`googleCloudStorageR`** library is loaded.

```
# Authenticate service account
Sys.setenv("GCS_AUTH_FILE" = "gcs-auto-auth.json")
library(googleCloudStorageR)

## Setting scopes to https://www.googleapis.com/auth/devstorage.full_control

## Successfully authenticated via gcs-auto-auth.json

# gcs_auth()  # no longer needed :)
```

We're in!

- What's in my project? *Listing & inspecting buckets*
- Saving data, models, scripts *Creating buckets & uploading objects*
- I'd like some data, please! *Downloading objects*

Listing Buckets

- **`gcs_list_buckets`**: will return a data frame with the buckets in your project
- Each bucket will have a name, storage class, location, and time-stamp the bucket was last updated

```
## get your project ID by clicking on the name of it on GCP
my_project <- "rational-photon-239401"
buckets <- gcs_list_buckets(my_project)
buckets
```

```
##              name   storageClass location             updated
## 1 mcd_test_bucket MULTI_REGIONAL       EU 2019-05-08 17:57:12
```

🔎 Inspecting Buckets

- **`gcs_get_bucket`**: will return meta data for a bucket

```
buckets$name[[1]]
```

```
## [1] "mcd_test_bucket"
```

```
gcs_get_bucket(buckets$name[[1]])
```

```
## ==Google Cloud Storage Bucket==
## Bucket:          mcd_test_bucket
## Project Number:  826624791147
## Location:        EU
## Class:           MULTI_REGIONAL
## Created:         2019-05-05 17:02:55
## Updated:         2019-05-08 17:57:12
## Meta-generation: 4
## eTag:            CAQ=
```

📂 Creating Buckets

- **`gcs_create_bucket()`**: will create a bucket in your project

```
new_bucket_name <- "rladies_example"
gcs_create_bucket(new_bucket_name, projectId = my_project, location = "EU")
```

```
## 2019-05-09 16:23:03 -- Bucket created successfully:rladies_example in EU
```

```
## ==Google Cloud Storage Bucket==
## Bucket:          rladies_example
## Project Number:  826624791147
## Location:        EU
## Class:           MULTI_REGIONAL
## Created:         2019-05-09 20:23:10
## Updated:         2019-05-09 20:23:10
## Versioning:      FALSE
## Meta-generation: 1
## eTag:            CAE=
```

```
gcs_list_buckets(my_project)
```

```
##              name   storageClass location             updated
## 1 mcd_test_bucket MULTI_REGIONAL       EU 2019-05-08 17:57:12
## 2 rladies_example MULTI_REGIONAL       EU 2019-05-09 20:23:10
```

⬆️ Uploading Objects to Buckets

- **`gcs_upload()`**: will upload file to the specified bucket
- Can specify a file or data frame. Data frames are converted to csv by default

```
buckets <- gcs_list_buckets(my_project)
gcs_upload(iris, bucket = buckets$name[[2]])
```

```
## 2019-05-09 16:23:04 -- File size detected as 4.7 Kb
```

```
## ==Google Cloud Storage Object==
## Name:                iris.csv
## Type:                text/csv
## Size:                4.7 Kb
## Media URL:           https://www.googleapis.com/download/storage/v1/b/rladies_example/o/iris.csv?ge
## Download URL:        https://storage.cloud.google.com/rladies_example/iris.csv
## Public Download URL: https://storage.googleapis.com/rladies_example/iris.csv
## Bucket:              rladies_example
## ID:                  rladies_example/iris.csv/1557433392904290
## MD5 Hash:            iFpB0GOnkjro0OhATZKRow==
## Class:               MULTI_REGIONAL
## Created:             2019-05-09 20:23:12
## Updated:             2019-05-09 20:23:12
## Generation:          1557433392904290
## Meta Generation:     1
## eTag:                COLwlMGjj+ICEAE=
## crc32c:              c+bZLQ==
```

Listing Objects

- **`gcs_list_objects()`**: will list objects in a specified bucket

```
(objects <- gcs_list_objects(bucket = buckets$name[[2]]))
```

```
##                                         id
## 1 rladies_example/iris.csv/1557433392904290
##                                                              selfLink
## 1 https://www.googleapis.com/storage/v1/b/rladies_example/o/iris.csv
##       name          bucket       generation metageneration contentType
## 1 iris.csv rladies_example 1557433392904290              1    text/csv
##           timeCreated             updated   storageClass
## 1 2019-05-09 20:23:12 2019-05-09 20:23:12 MULTI_REGIONAL
##    timeStorageClassUpdated   size                  md5Hash
## 1 2019-05-09T20:23:12.903Z 4.7 Kb iFpB0GOnkjro0OhATZKRow==
##
## 1 https://www.googleapis.com/download/storage/v1/b/rladies_example/o/iris.csv?generation=1557433392
##     crc32c             etag componentCount contentLanguage
## 1 c+bZLQ== COLwlMGjj+ICEAE=             NA              NA
```

⬇️ Downloading Objects

- **`gcs_get_object()`**: Will download an object directly into the R session *(watch out for large files!)*
- 💾 Can save the object directly to disk with **`saveToDisk = TRUE`**

```
gcs_eg_df <- gcs_get_object(object = objects$name[[1]],
                            bucket = buckets$name[[2]])
head(gcs_eg_df)
```

```
## # A tibble: 6 x 6
##       X1 Sepal.Length Sepal.Width Petal.Length Petal.Width Species
##    <dbl>        <dbl>       <dbl>        <dbl>       <dbl> <chr>
## 1     1          5.1         3.5          1.4         0.2 setosa
## 2     2          4.9         3            1.4         0.2 setosa
## 3     3          4.7         3.2          1.3         0.2 setosa
## 4     4          4.6         3.1          1.5         0.2 setosa
## 5     5          5           3.6          1.4         0.2 setosa
## 6     6          5.4         3.9          1.7         0.4 setosa
```

🔥 Deleting Objects and Buckets

(cleaning up - use with caution)

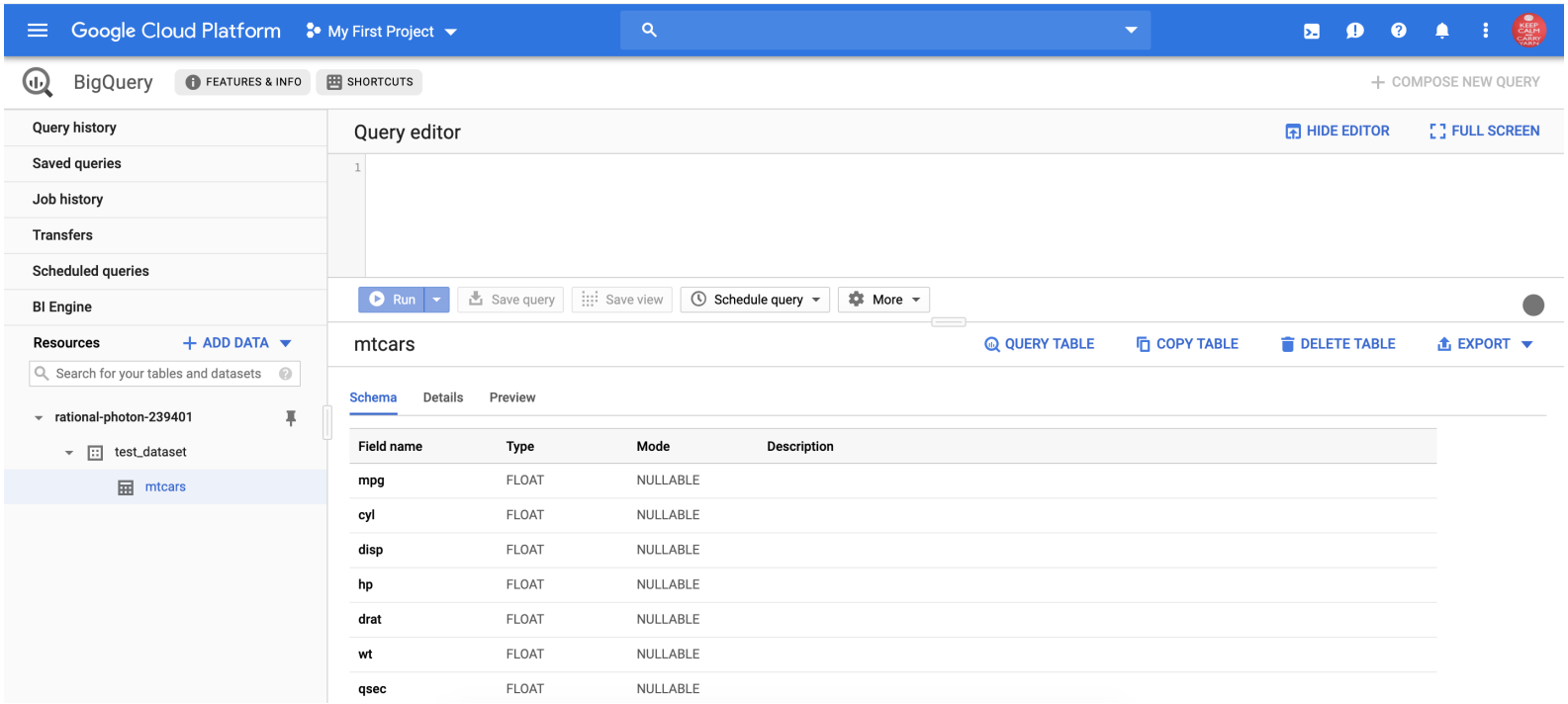
- **`gcs_delete_object()`**: will delete an object in a specified bucket
- **`gcs_delete_bucket()`**: will delete a bucket in your project
  Note: you cannot delete buckets that contain objects

```
if(new_bucket_name %in% buckets$name){
  obj_to_delete <- gcs_list_objects(bucket = new_bucket_name)
  gcs_delete_object(object_name = obj_to_delete$name[[1]],
                    bucket = new_bucket_name)
  gcs_delete_bucket(new_bucket_name)
}
```

```
## 2019-05-09 16:23:07 -- Bucket rladies_example deleted successfully.
```

```
## [1] TRUE
```

Google BigQuery



Google BigQuery

Important terms

Project ✓
Dataset
Table

lions and tigers and bears, oh my!

Google BigQuery

Important terms

Project

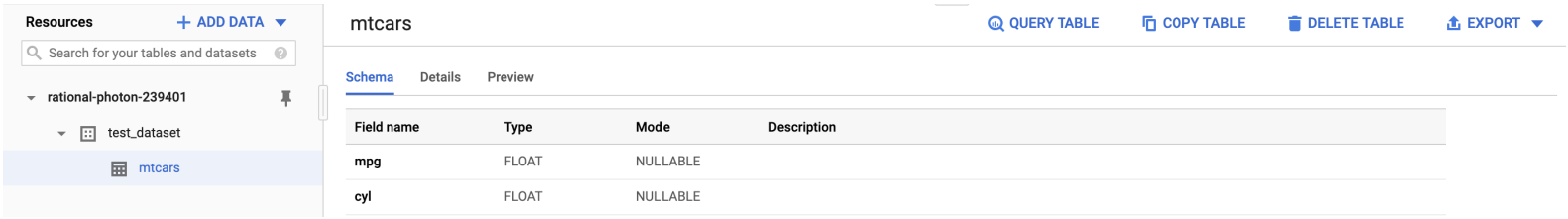
- Way to organize your Google Cloud Platform resources. In this example, my project is called **`rational-photon-239401`**.

Dataset

- Like buckets or folders, a way to organize tables. In this example, there is one dataset called **`test_dataset`**.

Table

- A table of data. In this example, it is called **`mtcars`**.



`bigrquery` Package

1. Getting set up
   - How to authenticate

2. Sharing is caring
   - Creating and uploading tables

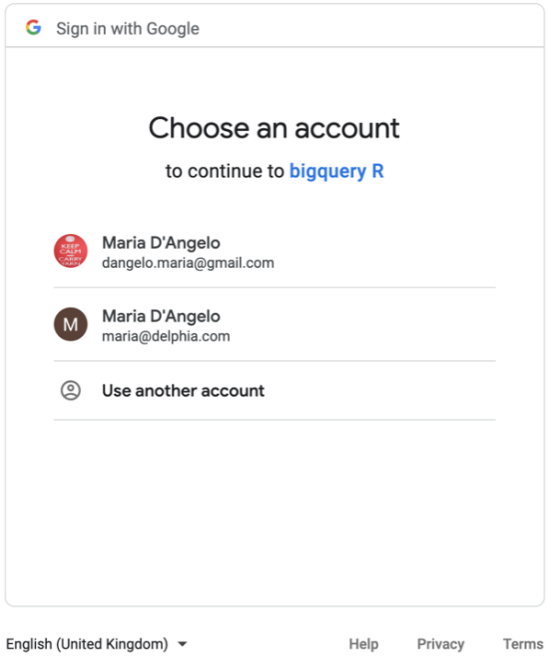
3. I'd like some data, please!
   - Querying and downloading tables
     - Low-level API
     - `DBI` interface
     - `dplyr` interface

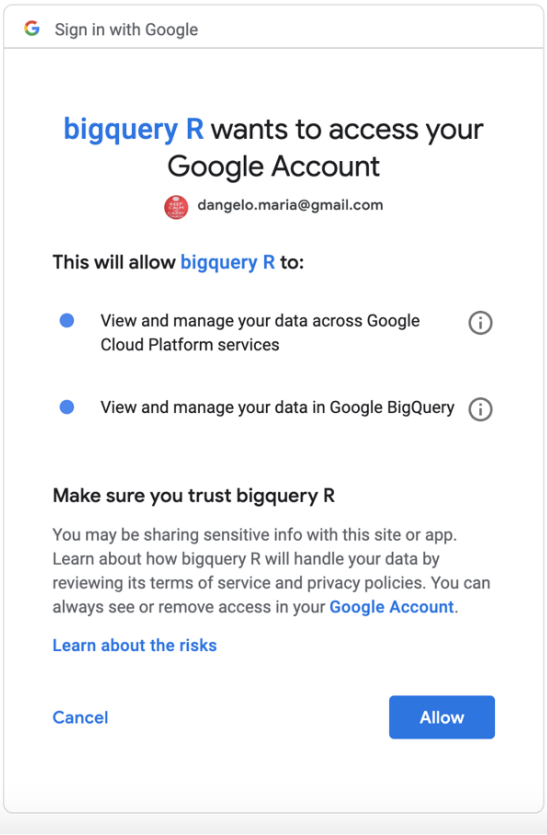
🔐 Authentication with `bigrquery`

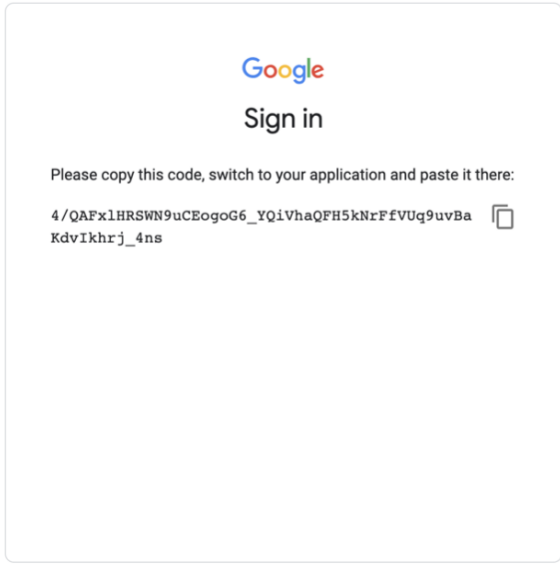
- When you run your first command with **`bigrquery`**, you will be prompted to authenticate.
- Note: to use **`bigrquery`** in a non-interactive session (i.e., when knitting a document), you will need to keep a local file to cache the access credentials. (Select 1 below)

```
Use a local file ('.httr-oauth'), to cache OAuth access credentials between R sessions?

1: Yes
2: No

Selection:
```

🔐 Authentication with `bigrquery`

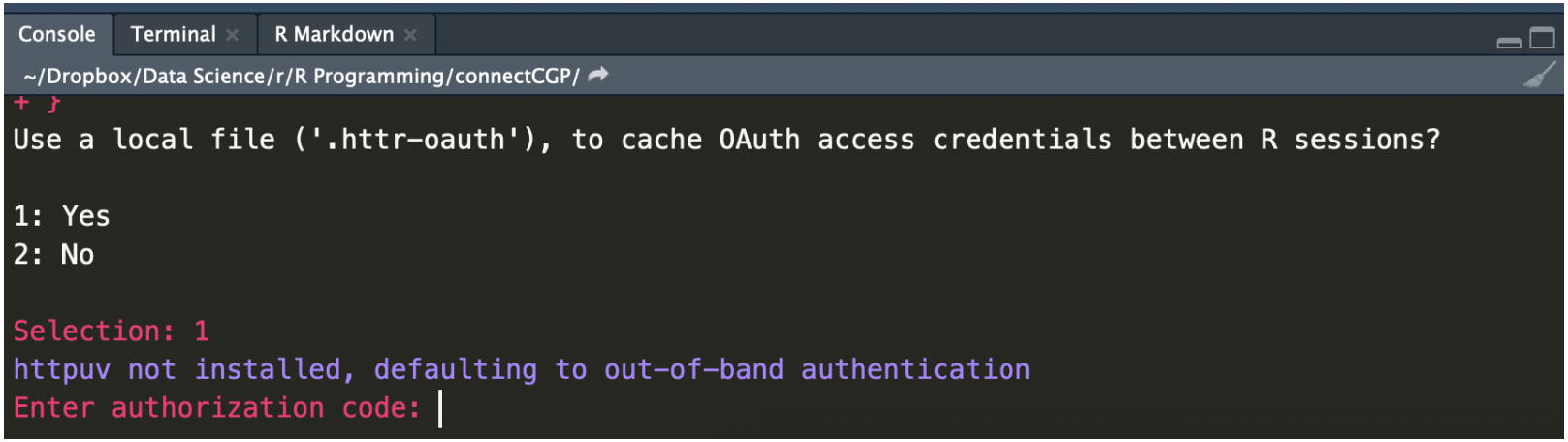






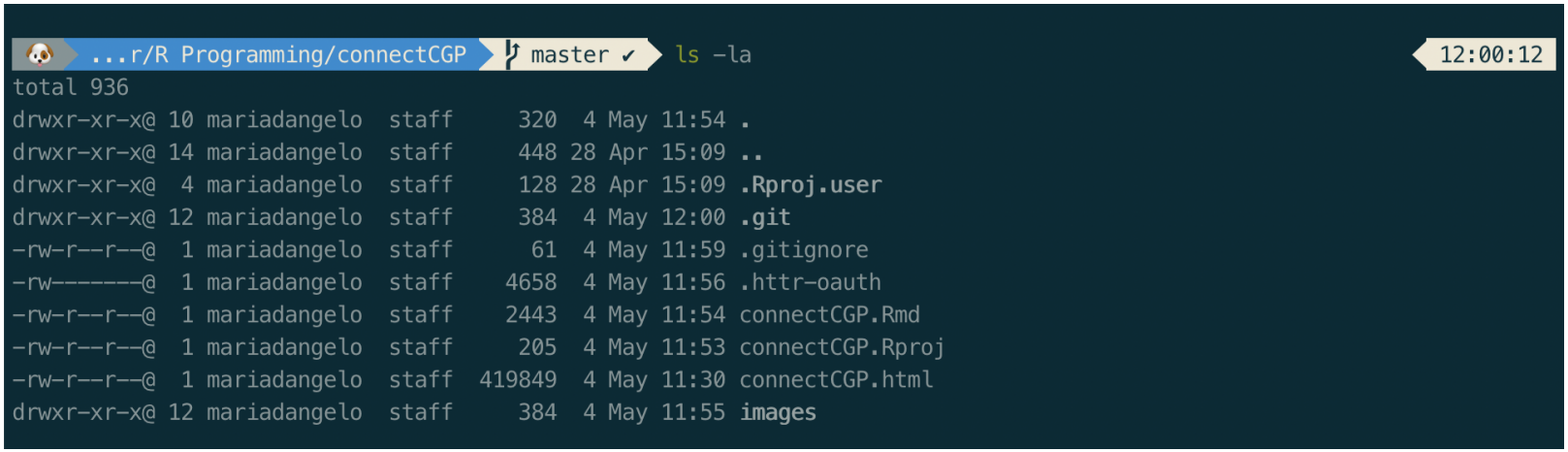
🔐 Authentication with `bigrquery`

Paste the authentication code you just copied into R.



🔐 Authentication with `bigrquery`

You'll now have a `.httr-oauth` file in your directory.



🔐 Authentication with `bigrquery`

The `.httr-oauth` file is automatically added to your `.gitignore` file

```
more .gitignore
```

```
## .Rproj.user
## .Rhistory
## .RData
## .Ruserdata
## .DS_Store
## .httr-oauth
## gcs-auto-auth.json
## client-id.json
```

What's Next?

- Sharing is caring *Creating and uploading tables*
- I'd like some data, please! *Querying and downloading tables*

🦆 Getting your ducks in a row

- **`bq_table()`**: set up information for **`bq_table`** object

```
library(bigrquery)
my_project <- "rational-photon-239401"
my_dataset <- "test_dataset"
my_table <- "ToothGrowth"

#Set up BQ info
my_bq_table_info <- bq_table(project = my_project,
                             dataset = my_dataset,
                             table = my_table)
```

🔨 Creating & Uploading Tables

- **`bq_table_create()`**: Creates the table
- **`bq_table_upload()`**: Uploads data; fields will create the schema from the data frame
  You might get an error if fields is not set

```
bq_table_create(my_bq_table_info)

## <bq_table> rational-photon-239401.test_dataset.ToothGrowth

bq_table_upload(x = my_bq_table_info,
                values = ToothGrowth,
                fields = as_bq_fields(ToothGrowth))

#Check if table exists
bq_table_exists(my_bq_table_info)

## [1] TRUE
```

↔ Translating to BQ Schema

- **`as_bq_fields()`**: Convert df schema information into BQ fields

```
str(ToothGrowth)
```

```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

```
as_bq_fields(ToothGrowth)
```

```
## <bq_fields>
##   len <FLOAT>
##   supp <STRING>
##   dose <FLOAT>
```

⬇️ Downloading Tables

- **`bq_project_query()`**: Submits a query, waits for it to complete, and returns a **`bq_table`**
- **`bq_table_download()`**: Retrieves rows from a **`bq_table`** object, can specify **`page_size`** for retrieval in chunks (useful for large tables, default is 10,000 rows)

```
library(glue)
sql <- glue("SELECT * FROM `{my_project}.{my_dataset}.{my_table}`")

tb <- bq_project_query(my_project, sql)
bq_eg_df <- bq_table_download(tb)

head(bq_eg_df)
```

```
## # A tibble: 6 x 3
##     len supp   dose
##   <dbl> <chr> <dbl>
## 1   4.2 VC      0.5
## 2  11.5 VC      0.5
## 3   7.3 VC      0.5
## 4   5.8 VC      0.5
## 5   6.4 VC      0.5
## 6  10   VC      0.5
```

`DBI` Interface

- **`DBI::dbConnect()`**: connect to BigQuery like any other database, only need to supply your project name
- **`DBI::dbGetQuery()`**: using the connection, execute the query provided
- **`DBI::dbReadTable()`**, **`DBI::dbWriteTable()`**: Read and write tables

```
sql <- glue("SELECT * FROM `{my_project}.{my_dataset}.{my_table}`")

con <- DBI::dbConnect(bigquery(), project = my_project)
dbi_eg_df <- DBI::dbGetQuery(con, sql)
head(dbi_eg_df)
```

```
## # A tibble: 6 x 3
##     len supp   dose
##   <dbl> <chr> <dbl>
## 1   4.2 VC      0.5
## 2  11.5 VC      0.5
## 3   7.3 VC      0.5
## 4   5.8 VC      0.5
## 5   6.4 VC      0.5
## 6  10   VC      0.5
```

```
DBI::dbDisconnect(con)
```

`dplyr` Interface

- **`tbl()`**: create a table from a data source (in our case: BigQuery)
- **`dbplyr`** is used to access BigQuery tables as if they are in-memory data frames, automatically converts dplyr code into SQL
- *Note*: This does not actually execute the query, **`nrow()`** gives **`NA`** and the class is a lazy connection

```
library(dplyr); library(dbplyr)
con <- DBI::dbConnect(bigrquery::bigquery(), project = my_project)
dplyr_eg <- tbl(con, glue("{my_dataset}.{my_table}"))
dplyr_query <- dplyr_eg %>% group_by(supp, dose) %>% count()
nrow(dplyr_query)
```

```
## [1] NA
```

```
class(dplyr_query)
```

```
## [1] "tbl_BigQueryConnection" "tbl_dbi"
## [3] "tbl_sql"                "tbl_lazy"
## [5] "tbl"
```

- Helpful vignette from **`dbplyr`** can be found here

`dplyr` Interface

- `collect()`: retrieves data into a local tibble
- We can now see the number of rows and that the output is a `data.frame`

```
dplyr_eg_df <- collect(dplyr_query)
nrow(dplyr_eg_df)
```

```
## [1] 6
```

```
class(dplyr_eg_df)
```

```
## [1] "grouped_df" "tbl_df"     "tbl"        "data.frame"
```

```
head(dplyr_eg_df)
```

```
## # A tibble: 6 x 3
## # Groups:   supp, dose [6]
##   supp   dose     n
##   <chr> <dbl> <int>
## 1 OJ      2      10
## 2 VC      2      10
## 3 VC      1      10
## 4 OJ      0.5    10
## 5 VC      0.5    10
## 6 OJ      1      10
```

```
DBI::dbDisconnect(con)
```

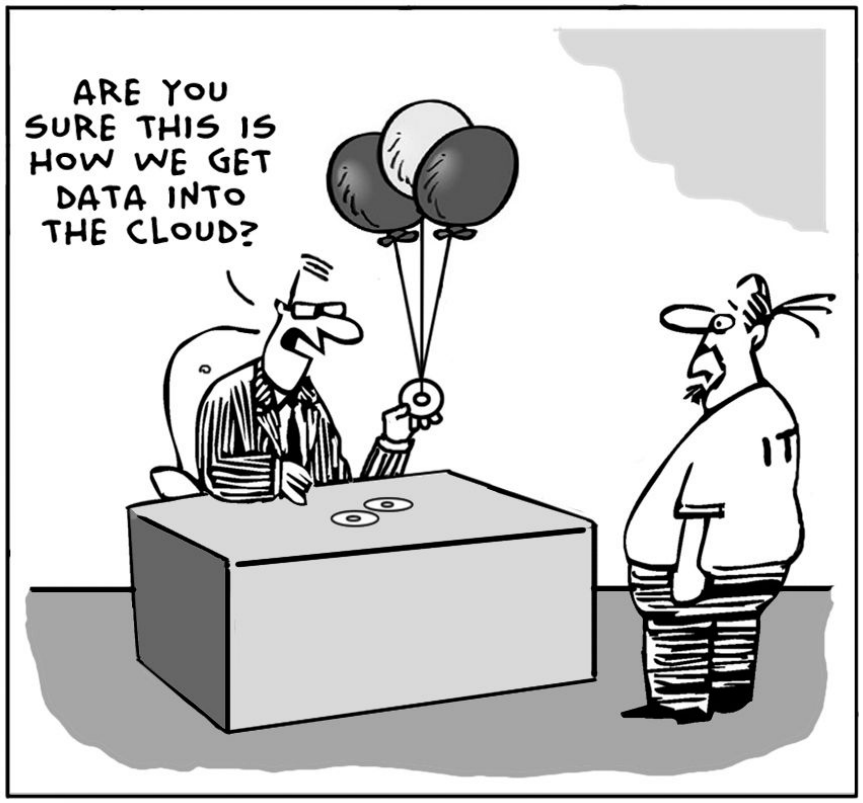
🔥 Deleting Tables

(cleaning up - use with caution)

- **`bq_table_exists()`**: checks to see if table exists, returns **`TRUE`** or **`FALSE`**
- **`bq_table_delete()`**: deletes table

```
if (bq_table_exists(my_bq_table_info)){
  bq_table_delete(my_bq_table_info)
}
```

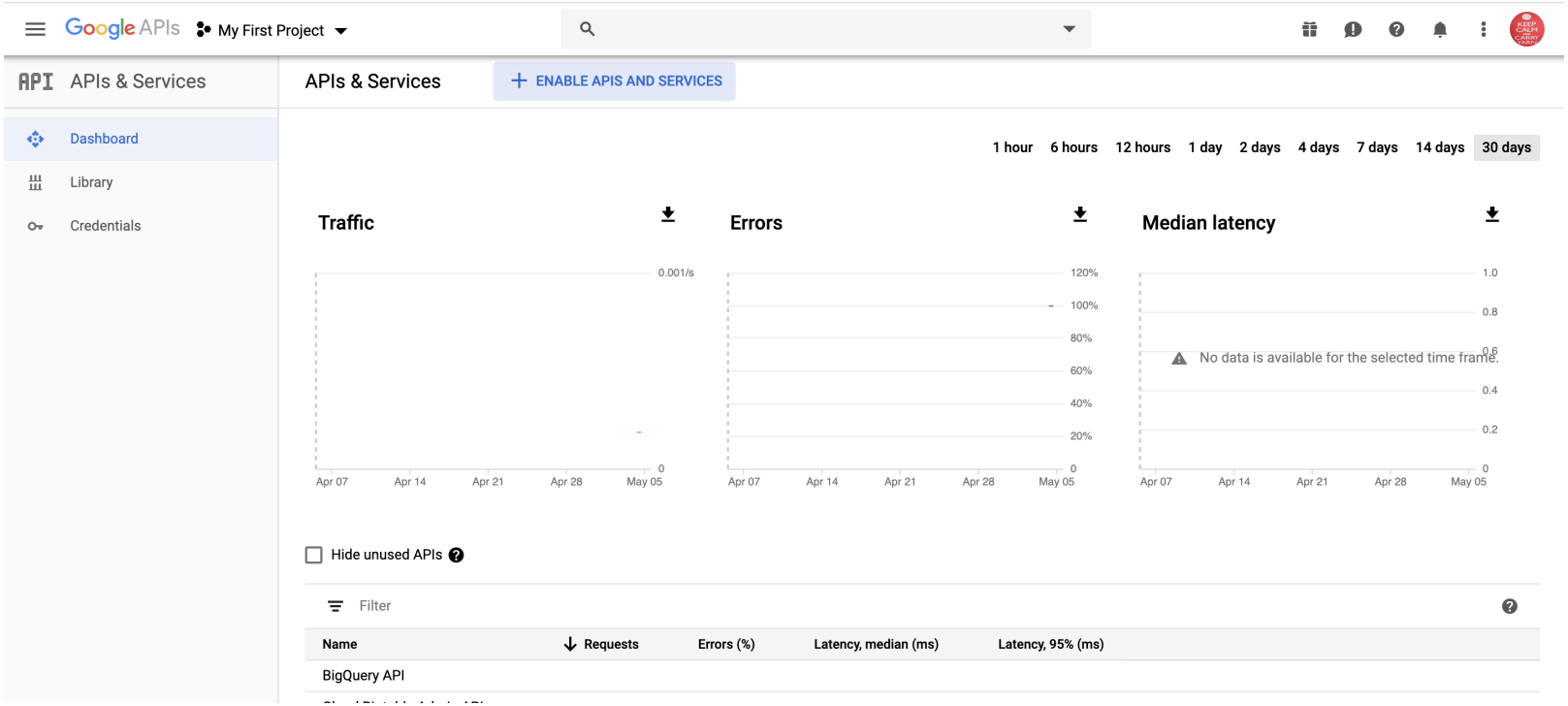
Thank you!



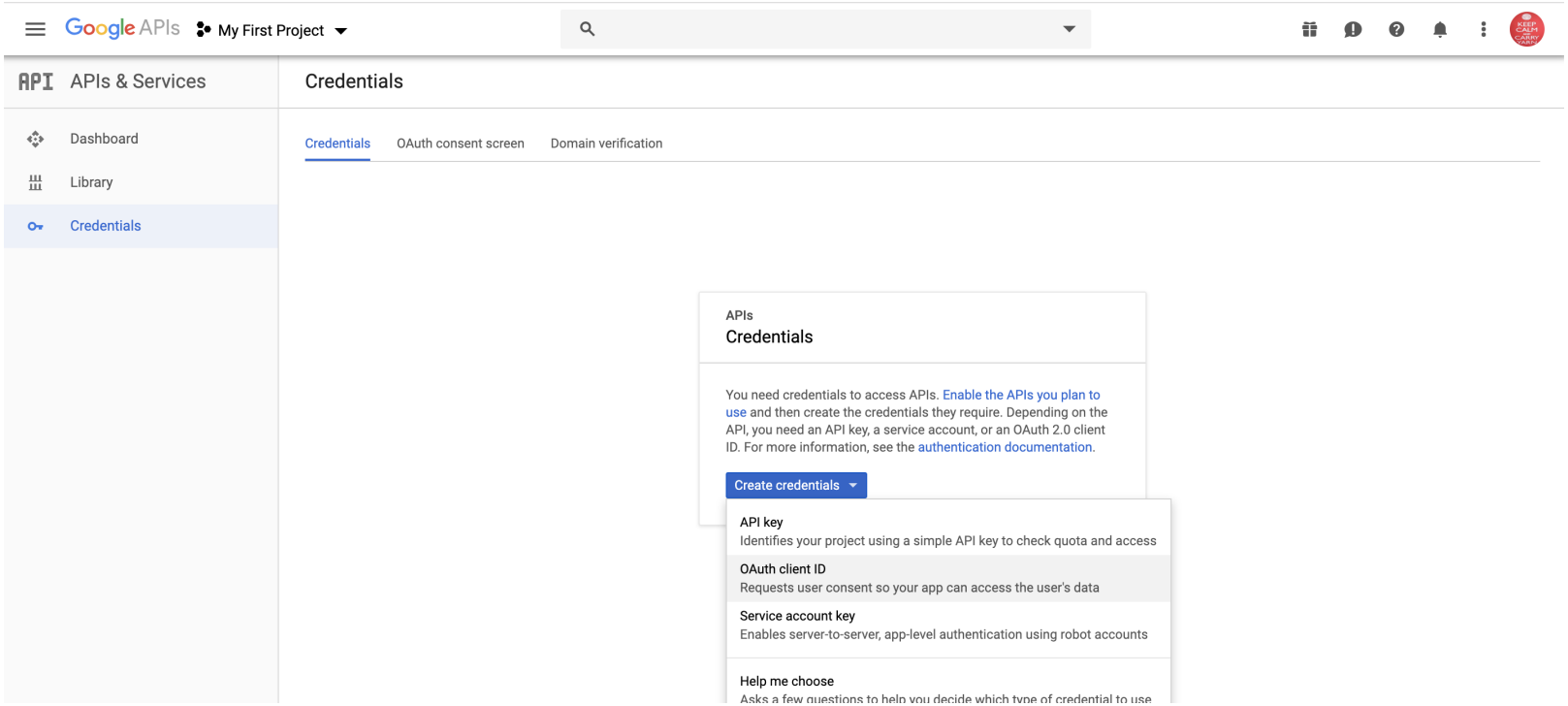
Any Questions?

🐦 Connect with me on Twitter!
@mariacdangelo

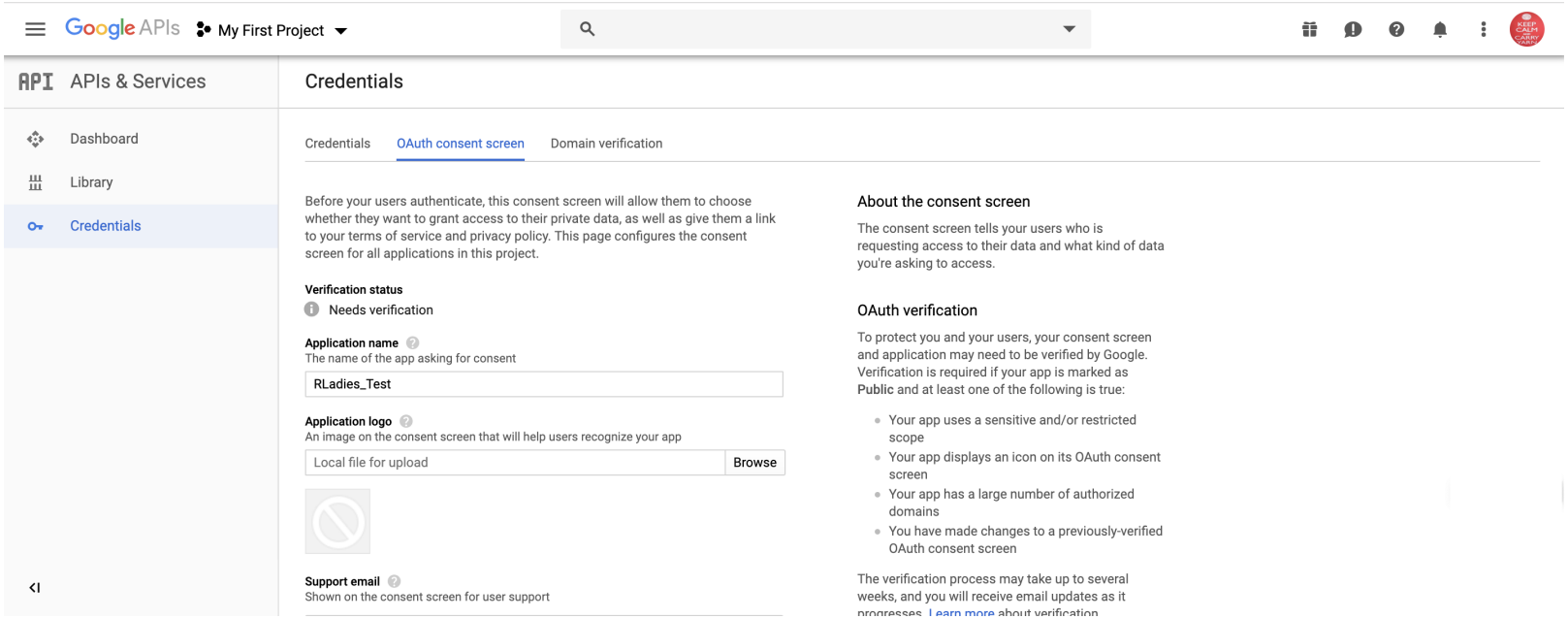
App Authentication with `googleCloudStorageR`



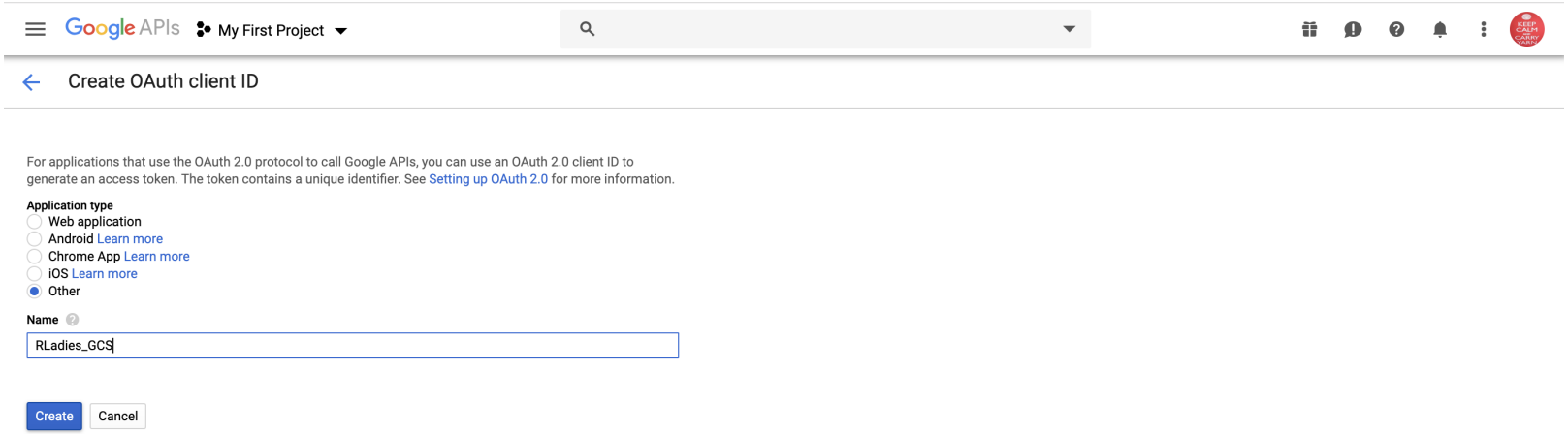
App Authentication with `googleCloudStorageR`



App Authentication with `googleCloudStorageR`

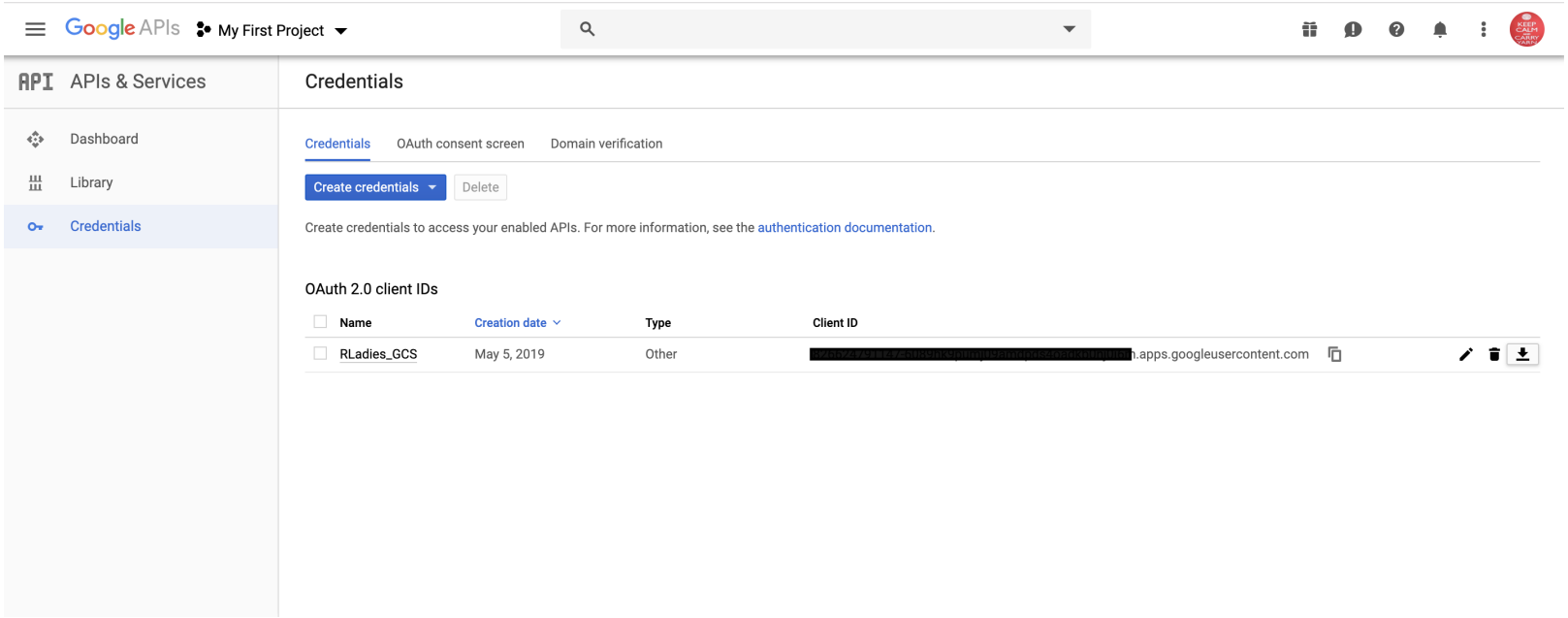


App Authentication with `googleCloudStorageR`



App Authentication with `googleCloudStorageR`

Create a client ID and download .json file (icon on far right) I've named it `client-id.json`



App Authentication with `googleCloudStorageR`

To authenticate the client ID run the following code:

```
scope = "https://www.googleapis.com/auth/cloud-platform"

# Authenticate ClientID
googleAuthR::gar_set_client("client-id.json", scopes = scope)
```

App Authentication with `googleCloudStorageR`