Practical Business Python (http://pbpython.com/)

Taking care of business, one python script at a time

Tue 09 June 2015

Collecting Data with Google Forms and Pandas (http://pbpython.com/pandas-google-forms-part1.html)

Posted by Chris Moffitt (http://pbpython.com/author/chris-moffitt.html) in articles (http://pbpython.com/category/articles.html)

Introduction

Google Forms (https://www.google.com/forms/about/) is a service that allows you to collect information via simple web forms. One of the useful features is that the forms will automatically save your data to a Google Sheet. This article will walk through how to create a form, authenticate using OAuth 2 and read all the responses into a pandas dataframe. Because the initial setup and authentication process is a little time consuming, this article will be the first in a two part series.

Before going too far, if you would like to take the short survey, here is the link to the survey (http://goo.gl/forms/64PCaQN0T2) we will discuss. Thanks in advance for filling it out!

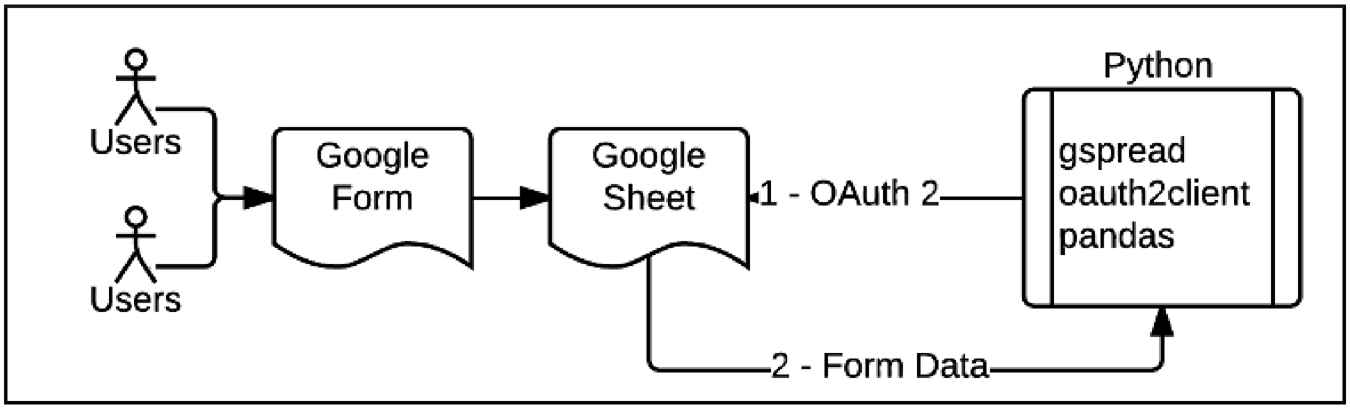
Why would someone want to use pandas to read a Google Sheet? The key functionality this setup provides is a simple way to allow a large number of people to provide you information (don't just think of a standard survey) and collect it all in a single place. You can then analyze the data with the full power of python and pandas. Google takes care of making sure that all the data gets consistently entered into one clean format - no matter how many people access the form.

This blog has mentioned many times about how Excel can be a great tool but is so often abused and made to do more than it really should. One use case I have seen is creating a simple Excel-based form which someone sends to people to fill out, then collate into a master spreadsheet. This process is extremely manual and error prone. Google Forms is a possible alternative to the spreadsheet wrangling you might do with Excel.

The other scenario is that sometimes you need a very simple UI to capture information and act on it. Once you start to play around with Google Forms you may realize that there are other uses for it outside of the standard survey process.

Overview

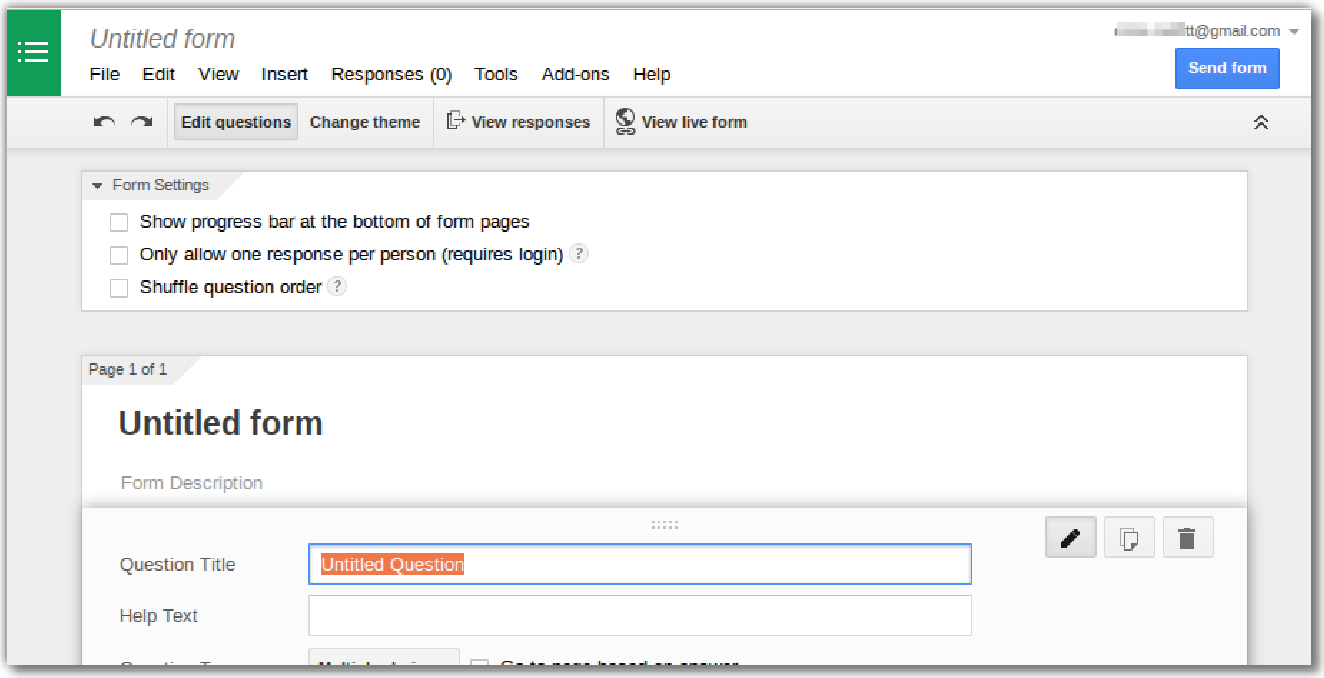
As they say, a picture is worth a thousand words; so here is what we'll be doing in this article:



Form Creation

The first part of the process is creating the Form. If you haven't used Forms before, go to Google Forms (https://www.google.com/forms/about/) to learn more about the service and what it can be used for.

Once you decide to create your form, you'll be shown a screen similar to this:



Show progress bar at the bottom of form pages

Only allow one response per person (requires login)

Shuffle question order

Untitled form

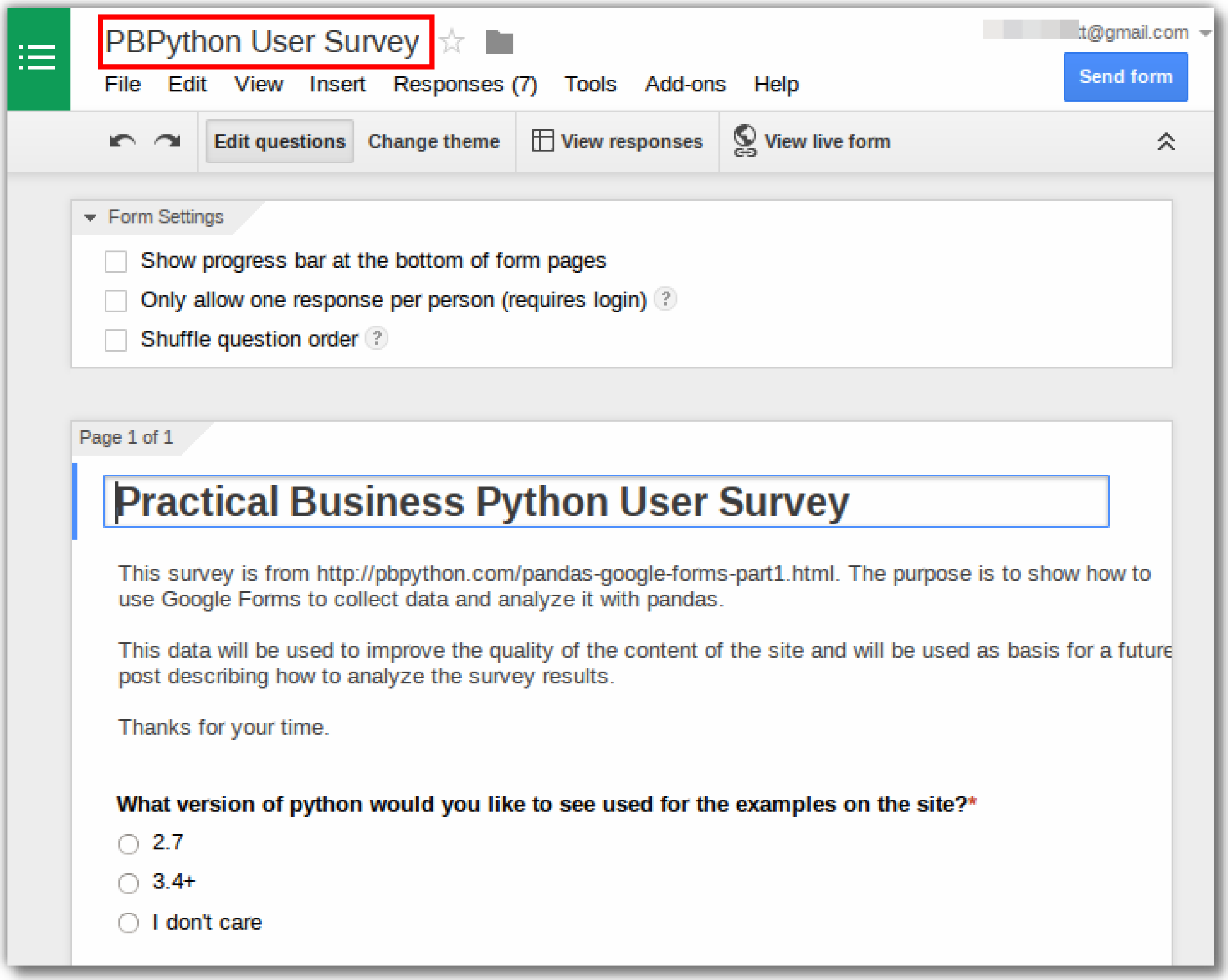
Form Description

Question Title: Untitled Question

Help Text:

Go ahead and create a Form. It is all fairly intuitive.

The main thing you need to pay attention to is the name of the form. In this case - **PBPython User Survey**.


PBPython User Survey
t@gmail.com
Send form
File Edit View Insert Responses (7) Tools Add-ons Help
Edit questions Change theme View responses View live form

Form Settings

- Show progress bar at the bottom of form pages
- Only allow one response per person (requires login)
- Shuffle question order

Page 1 of 1

Practical Business Python User Survey

This survey is from http://pbpython.com/pandas-google-forms-part1.html. The purpose is to show how to use Google Forms to collect data and analyze it with pandas.

This data will be used to improve the quality of the content of the site and will be used as basis for a future post describing how to analyze the survey results.

Thanks for your time.

What version of python would you like to see used for the examples on the site?*

- 2.7
- 3.4+
- I don't care

When you are ready, you can publish the survey by clicking on the Send form button. Here is the link to the survey (http://goo.gl/forms/64PCaQN0T2) for this site.

Now that you have the basic form set up, it is ready to store your data in a Google Sheet. The next step is setting up access so that your python script can connect to Google and download the data.

Authentication

In the good old days, you could authenticate with something as simple as an email address and password. However, this simplicity was very unsecure so one of the attempts to make a more secure process is OAuth 2.0 (http://oauth.net/2/)

I won't go into the details of OAuth 2.0 but the basic summary is that it is an open standared that defines a protoccol for granting access to resources. The key here is that it is a protoccol so there are several steps in the process to get it set up. The other bad news is that everyone tends to implement things slightly differently so you need to understand each provider's setup. The good news is that once it is setup, it should run without further intervention and it is more secure than the old username + password combo!

The basic steps we will follow are:

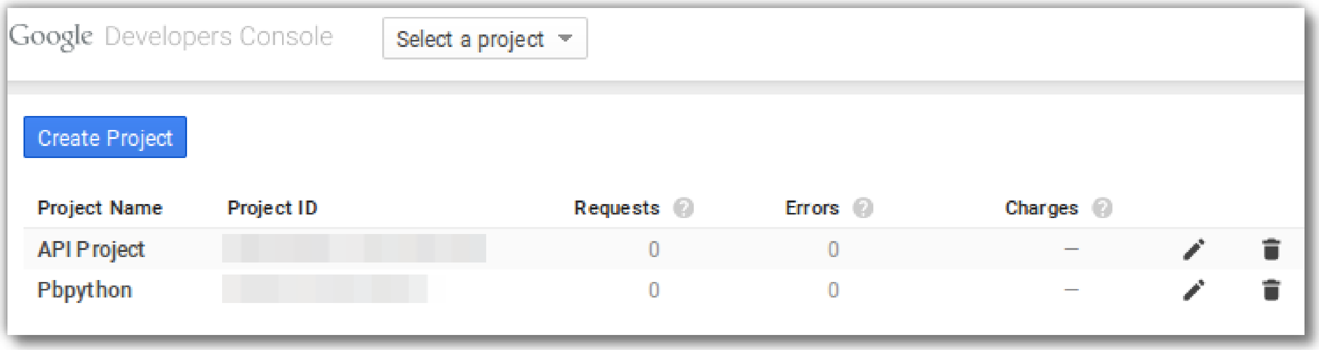
- Enable the API
- Create our credentials
- Enable sharing of the sheet to our email address associated with the credentials

Google Developer Console

The first step in getting authentication working is to enable our google drive API.

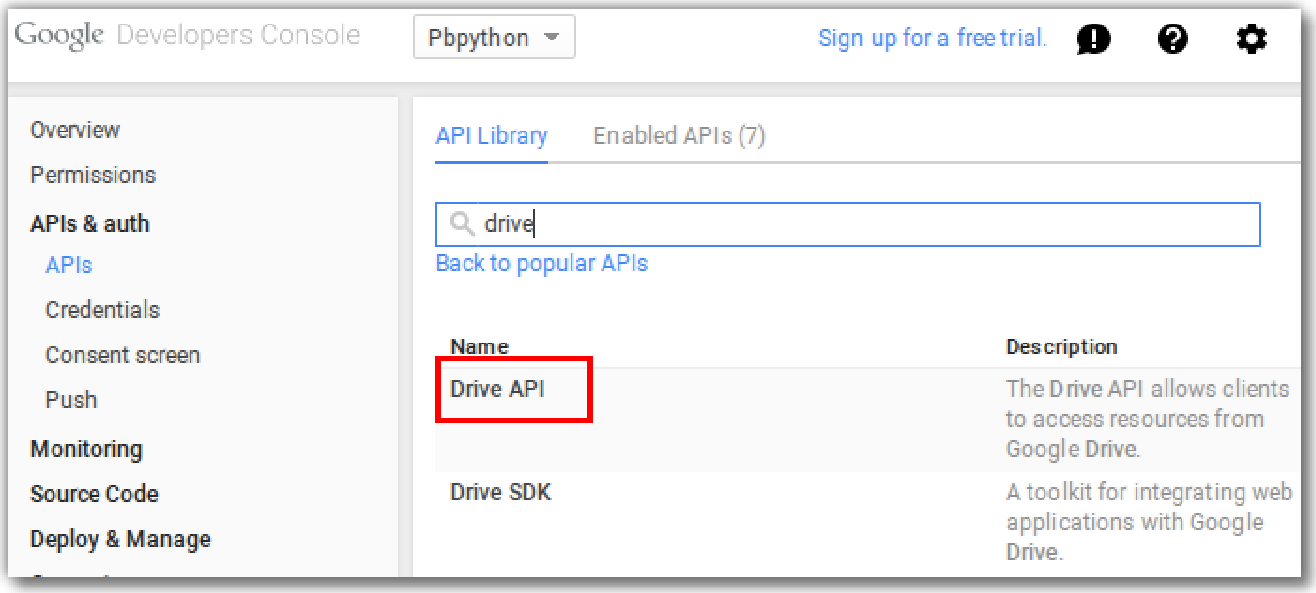
Google has many API's available to you and the Developer's Console allows you to selectively turn on and off the various API's. For our purposes, the Drive API must be enabled.

Go to the developers console (https://console.developers.google.com/project) and create a project (or use an existing one). Here is mine for Pbpython:



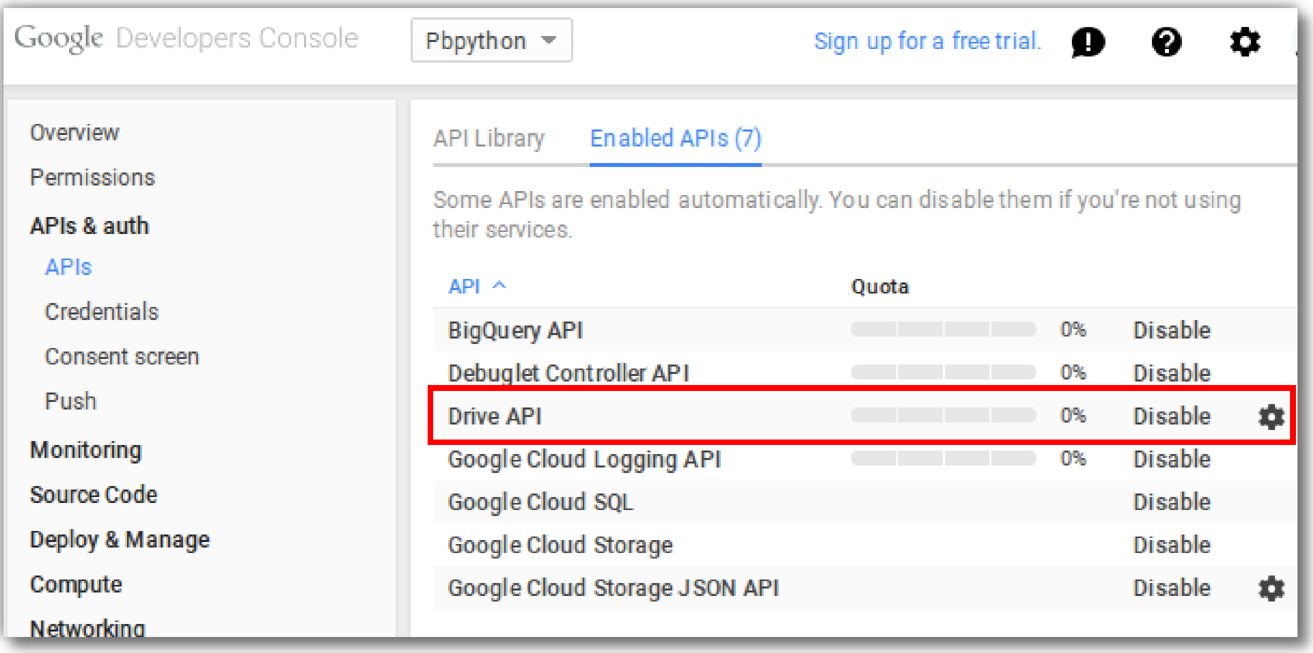
Project Name	Project ID	Requests	Errors	Charges
API Project	[redacted]	0	0	–
Pbpython	[redacted]	0	0	–

Once in your project, you need to enable to Google Drive API. You can search the API library for Drive API and enable it:



Name	Description
Drive API	The Drive API allows clients to access resources from Google Drive.
Drive SDK	A toolkit for integrating web applications with Google Drive.

Here is what it looks like when it is enabled:



Some APIs are enabled automatically. You can disable them if you're not using their services.

API	Quota		
BigQuery API	0%	Disable	
Debuglet Controller API	0%	Disable	
Drive API	0%	Disable	⚙
Google Cloud Logging API	0%	Disable	
Google Cloud SQL		Disable	
Google Cloud Storage		Disable	
Google Cloud Storage JSON API		Disable	⚙

Once the API's are enabled, you need to create your credentials.

One quick aside on credentials: there are three options for the types of credentials you can use:

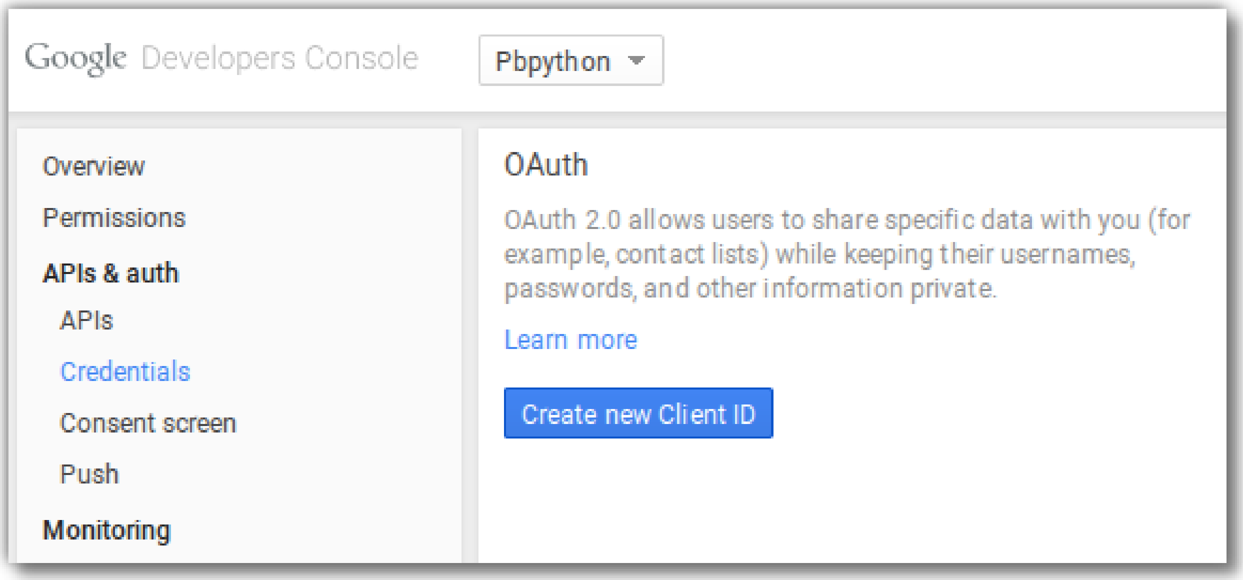
- **Web Applications**
- **Native Applications**
- **Service account**

The **Web Application** would be useful if you were building a web app (shocking) and the user could interact with the site to enable access. The problem for our case is that this application will be run from the command line so it will not be a good fit for our solution.

The **Native Application** ID looks like it might be useful but when you dive into it some more you will learn that it does not support the roles that we need; so it does not work.

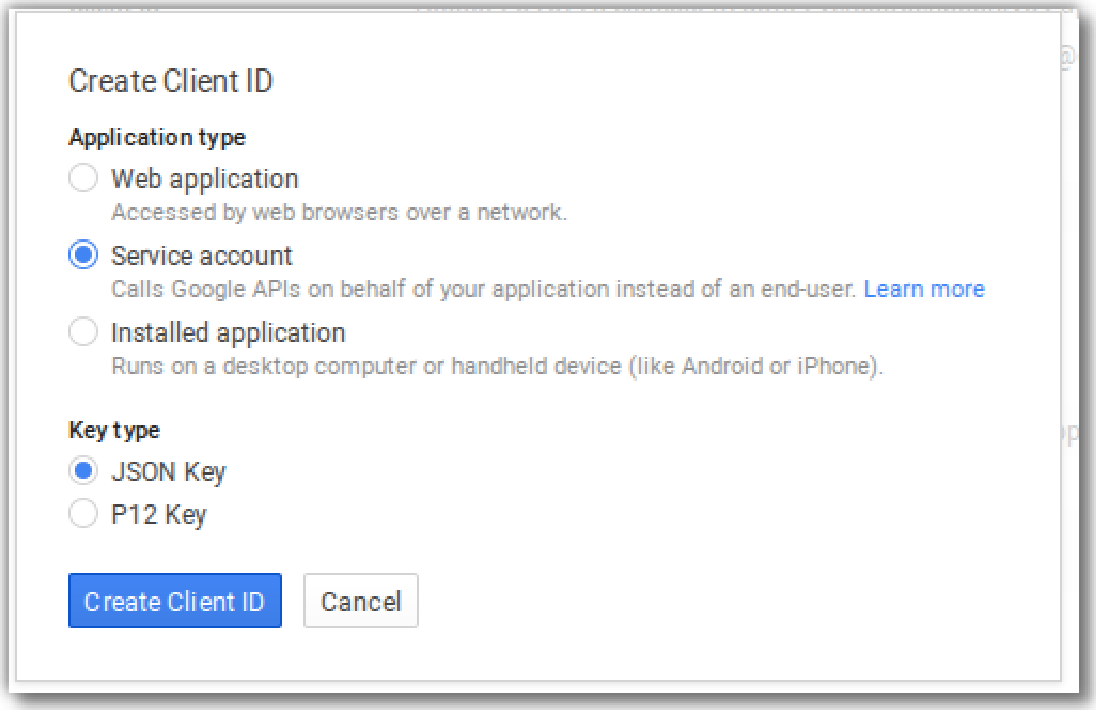
The **Service account** ID is meant to be used for these types of scripts so make sure you create one and select the JSON key.

The first step is to click "Create new Client ID":



OAuth 2.0 allows users to share specific data with you (for example, contact lists) while keeping their usernames, passwords, and other information private.

Then Create a client ID for the Service account. Make sure to select JSON key for the key type.



Create Client ID

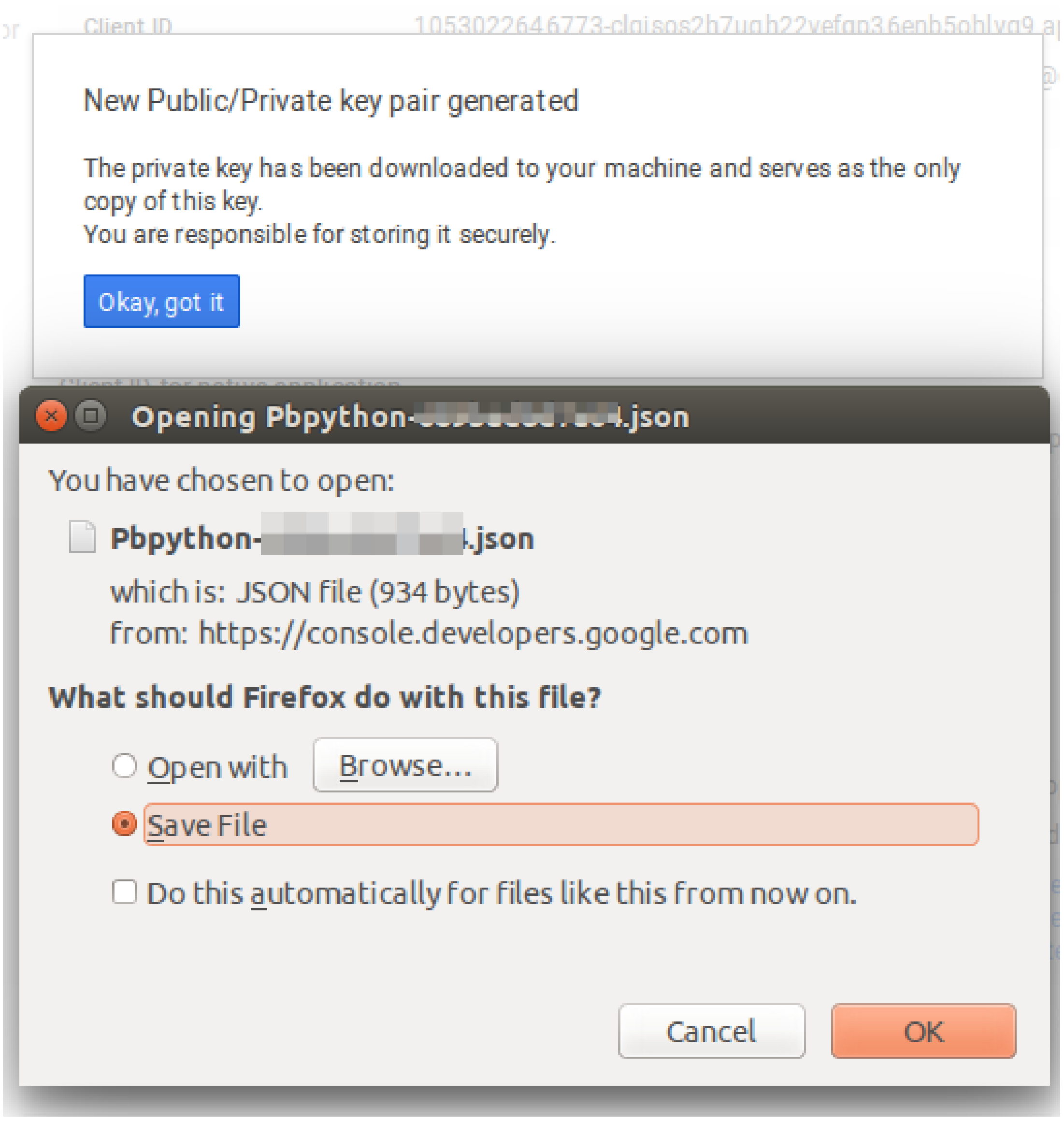
Application type

- Web application
  Accessed by web browsers over a network.
- [✓ Service account]
  Calls Google APIs on behalf of your application instead of an end-user. Learn more
- Installed application
  Runs on a desktop computer or handheld device (like Android or iPhone).

Key type

- [✓ JSON Key]
- P12 Key

You will get a prompt to download the JSON key:



Client ID 1053022646773-clqisos2h7uqh22vefqn36enb5ohlvq9.a

New Public/Private key pair generated

The private key has been downloaded to your machine and serves as the only copy of this key.
You are responsible for storing it securely.

Opening Pbpython-[redacted].json

You have chosen to open:

Pbpython-[redacted].json

which is: JSON file (934 bytes)
from: https://console.developers.google.com

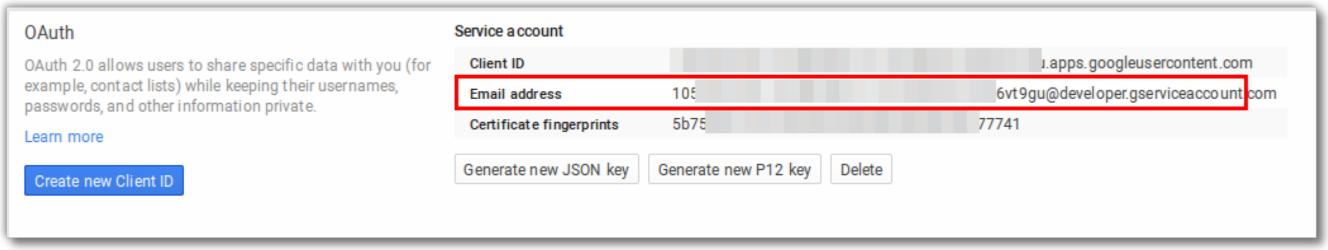
What should Firefox do with this file?

Open with [✓ Save File]

Do this automatically for files like this from now on.

Make sure to save the JSON key somewhere safe and not to check it into a public version control system!

Finally, here is what the Service Account screen looks like:



OAuth

OAuth 2.0 allows users to share specific data with you (for example, contact lists) while keeping their usernames, passwords, and other information private.

Service account

Client ID	[redacted].apps.googleusercontent.com
Email address	105[redacted]6vt9gu@developer.gserviceaccount.com
Certificate fingerprints	5b75[redacted]77741

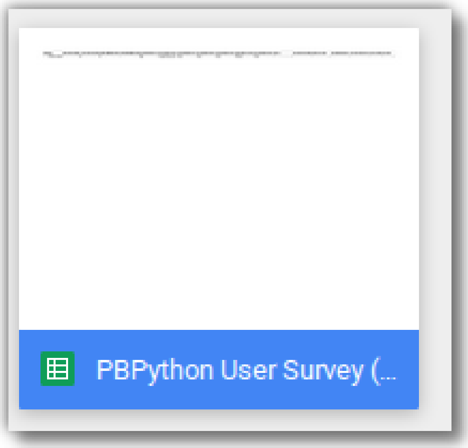
Keep track of the email address. You will need it in a bit.

Sharing the Google Sheet

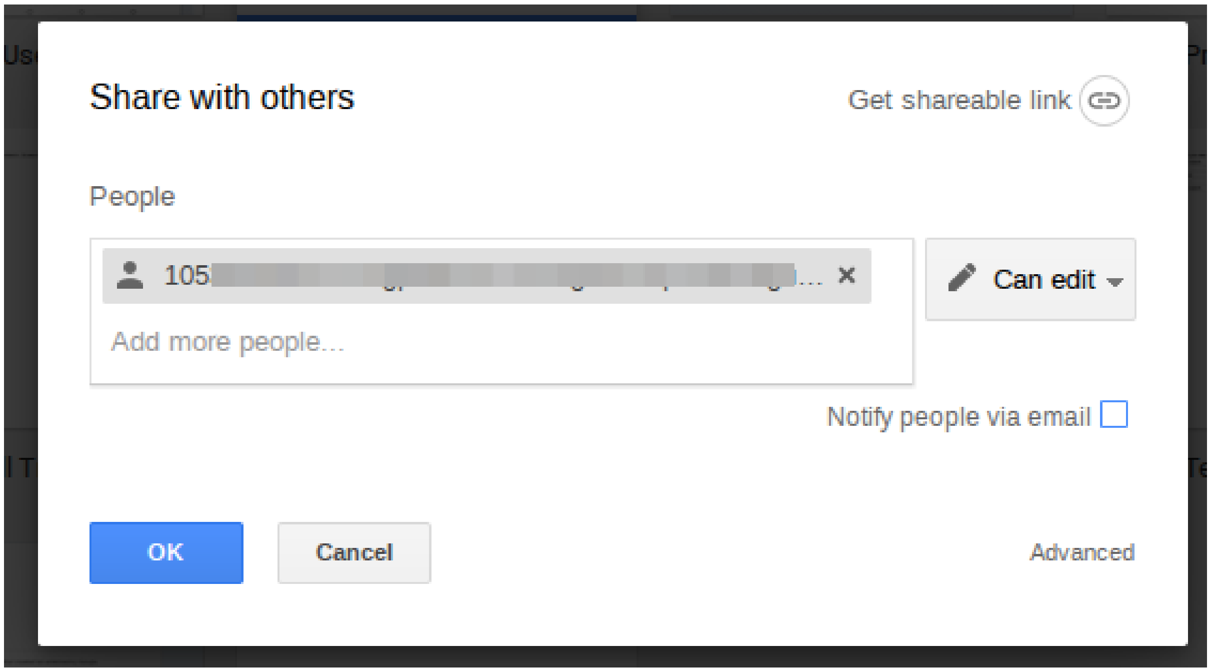
So now that you have your key, and have enabled your API, you need to allow the google sheet to be accessed by the user specified in the email address that was created for the service account.

Go into your drive and enable sharing of that response sheet to the email you have listed.

From your Google Drive (https://drive.google.com), find the response sheet. In this case, **PBPython User Survey (results)** and right click on it:

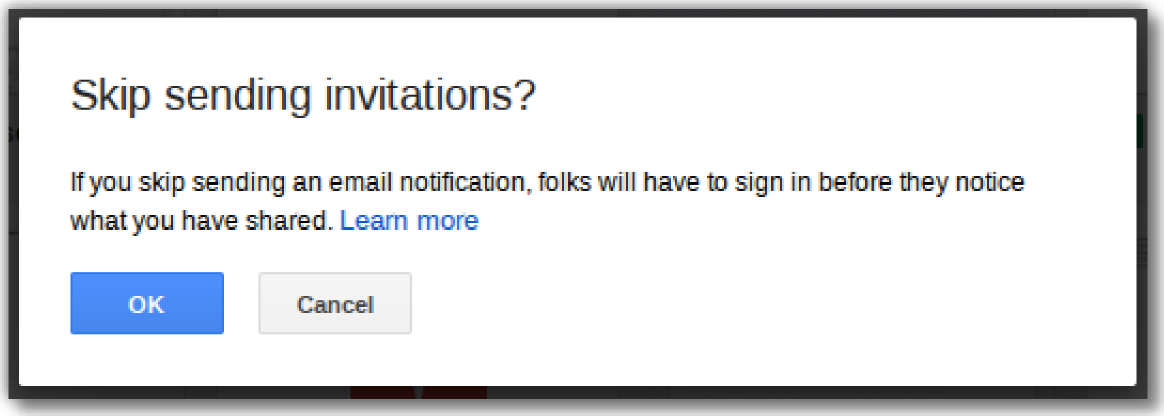


You will need to share this with the email address from your Service Account email:



105[redacted]

Click ok:



If you skip sending an email notification, folks will have to sign in before they notice what you have shared. Learn more

Go ahead and click ok. There is no one to send the invites to so you should be good.

Ok. That's a lot of initial setup work. However, I hope that the steps I've laid out are clear enough so that you won't stumble through it as much as I did!

Python Libraries

We will use to two python libraries to make the authentication and data extraction simple.

First install gspread (https://github.com/burnash/gspread)

```
pip install gspread
```

This library allows us to easily access, then read and write google sheets. The authentication documentation I show above is heavily based on the gspread docs (http://gspread.readthedocs.org/en/latest/oauth2.html). You should check them out to learn all about the options available to you with this app. We will only be using a very small portion for this exercise.

In order to use OAuth 2 authentication I will be using google's oauth2client (https://github.com/google/oauth2client)

```
pip install oauth2client
```

Connect to Google

We are almost there!

The final two pieces of the puzzle are determining the scope we need access to and what type of OAuth 2 flow we are using. Scopes are simply a way of managing how much information you can have access to once you authenticate. In this example, we need to make sure we have access to the following scope:

```
https://spreadsheets.google.com/feeds
```

OAuth 2 has multiple types of authentication methods. I won't go into the differences between them but for the purposes of this script, we will used `SignedJwtAssertionCredentials` .

Don't worry if this doesn't make sense right now. You'll use it in a second. Now we will piece together the script.

Let's setup our imports:

```
from __future__ import print_function
import gspread
from oauth2client.client import SignedJwtAssertionCredentials
import pandas as pd
import json
```

As you can see, I've imported the `print_function` to keep this python 2/3 compatible as well as the `gspread` module and `SignedJwtAssertionCredentials` as described above. I am also going to use the `json` module to read our secret file for the authentication handshake.

The next step is to define a couple of variables:

```
SCOPE = ["https://spreadsheets.google.com/feeds"]
SECRETS_FILE = "Pbpython-key.json"
SPREADSHEET = "PBPython User Survey (Responses)"
```

As mentioned earlier, you are required to pass the `SCOPE` when authenticating so just know that this allows you to access and read a google sheet. The `SECRETS_FILE` is the name of the json file you downloaded from the google developer console. This script will assume that the file is in the same directory as your script.

The `SPREADSHEET` variable is the name of the google sheet where the results are stored.

Now that everything is set up, let's authenticate to google by reading in our json key and using `SignedJwtAssertionCredentials`:

```
json_key = json.load(open(SECRETS_FILE))
# Authenticate using the signed key
credentials = SignedJwtAssertionCredentials(json_key['client_email'],
                                            json_key['private_key'], SCOPE)
```

It was a lot of work to get to these two lines of code but this is where the authentication magic happens.

To recap those two lines, we read in the `SECRETS_FILE` which will look something like this:

```
{
  "private_key_id": "ABCXXX",
  "private_key": "-----BEGIN PRIVATE KEY-----\nXXXYY\n-----END PRIVATE KEY-----\n",
  "client_email": "YYYYYY@developer.gserviceaccount.com",
  "client_id": "1233XXXXX.apps.googleusercontent.com",
  "type": "service_account"
}
```

We take out the email, and private key, combine it with our scope and authenticate to google. If all works, google will give us some valid credentials.

Once you have the credentials, you can authenticate with google sheets using `gspread.authorize` :

```
gc = gspread.authorize(credentials)
```

If you want to see which sheets are available, this code will return all that you can access:

```
print("The following sheets are available")
for sheet in gc.openall():
    print("{} - {}".format(sheet.title, sheet.id))
```

Here is what it looks like for my site:

```
The following sheets are available
PBPython User Survey (Responses) - 1QsZXXXXXXaPjEIhI
Test Form For PBPython (Responses) - 1mFMXXXXQyYnXeA
```

If you can not see any sheets here, make sure you have shared them to the correct email.

To access our specific sheet:

```
workbook = gc.open(SPREADSHEET)
# Get the first sheet
sheet = workbook.sheet1
```

Once we have the sheet, it only takes one line to read it into a DataFrame and use all the pandas power you are used to!

```
data = pd.DataFrame(sheet.get_all_records())
```

After all that work, we're now home free.

Simple Pandas Manipulation

Once you get the data into your dataframe, you can do whatever you would like. In the follow-on article, I will go through some more details but here are two simple steps that will make further manipulation easier.

First, the column names are the full text of the question. Trying to work with this would be highly painful. I recommend renaming all the columns to shorter names. Here is how I did it with this example:

```
column_names = {'Timestamp': 'timestamp',
                'What version of python would you like to see used for the examples 
                'How useful is the content on practical business python?': 'useful',
                'What suggestions do you have for future content?': 'suggestions',
                'How frequently do you use the following tools? [Python]': 'freq-py'
                'How frequently do you use the following tools? [SQL]': 'freq-sql',
                'How frequently do you use the following tools? [R]': 'freq-r',
                'How frequently do you use the following tools? [Javascript]': 'freq
                'How frequently do you use the following tools? [VBA]': 'freq-vba',
                'How frequently do you use the following tools? [Ruby]': 'freq-ruby'
                'Which OS do you use most frequently?': 'os',
                'Which python distribution do you primarily use?': 'distro',
                'How would you like to be notified about new articles on this site?'
                }
data.rename(columns=column_names, inplace=True)
```

Finally, since we have timestamps, let's convert the timestamp column to an actual pandas time series:

```
data.timestamp = pd.to_datetime(data.timestamp)
```

Full Code Example

I know it has taken a while to get to the end of this article. While the steps may seem a bit daunting, once you do it once, it will be simple to do it again for future forms.

Speaking of forms, here is the link to the survey (http://goo.gl/forms/64PCaQN0T2) please take a moment to fill it out. Having more data will make the survey that much more useful for the next article.

Here is the complete code snippet. It is also available on github (https://github.com/chris1610/pbpython/blob/master/code/panda_gform.py):

```
from __future__ import print_function
import gspread
from oauth2client.client import SignedJwtAssertionCredentials
import pandas as pd
import json

SCOPE = ["https://spreadsheets.google.com/feeds"]
SECRETS_FILE = "Pbpython-key.json"
SPREADSHEET = "PBPython User Survey (Responses)"
# Based on docs here - http://gspread.readthedocs.org/en/latest/oauth2.html
# Load in the secret JSON key (must be a service account)
json_key = json.load(open(SECRETS_FILE))
# Authenticate using the signed key
credentials = SignedJwtAssertionCredentials(json_key['client_email'],
                                            json_key['private_key'], SCOPE)

gc = gspread.authorize(credentials)
print("The following sheets are available")
for sheet in gc.openall():
    print("{} - {}".format(sheet.title, sheet.id))
# Open up the workbook based on the spreadsheet name
workbook = gc.open(SPREADSHEET)
# Get the first sheet
sheet = workbook.sheet1
# Extract all data into a dataframe
data = pd.DataFrame(sheet.get_all_records())
# Do some minor cleanups on the data
# Rename the columns to make it easier to manipulate
# The data comes in through a dictionary so we can not assume order stays the
# same so must name each column
column_names = {'Timestamp': 'timestamp',
                'What version of python would you like to see used for the examples
                'How useful is the content on practical business python?': 'useful',
                'What suggestions do you have for future content?': 'suggestions',
                'How frequently do you use the following tools? [Python]': 'freq-py'
                'How frequently do you use the following tools? [SQL]': 'freq-sql',
                'How frequently do you use the following tools? [R]': 'freq-r',
                'How frequently do you use the following tools? [Javascript]': 'freq
                'How frequently do you use the following tools? [VBA]': 'freq-vba',
                'How frequently do you use the following tools? [Ruby]': 'freq-ruby'
                'Which OS do you use most frequently?': 'os',
                'Which python distribution do you primarily use?': 'distro',
                'How would you like to be notified about new articles on this site?'
                }
data.rename(columns=column_names, inplace=True)
data.timestamp = pd.to_datetime(data.timestamp)
print(data.head())
```

Thank you for reading all the way to the end. I hope this is helpful to you and I look forward to reviewing the survey results with you.

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Aseem • a month ago

I spent 7 hours trying to find out how the h*ll I was going to read from a google spreadsheet. All tuts are either outdated or indecipherable.

Your blog has helped me before - regarding xlsxwriter. This is the second time you have saved the day for me. You are doing great work. Knowledge is one thing but the ability to make others understand is quite another. It is a rare talent.

• Reply • Share ›

Chris Moffitt Mod Aseem • a month ago

Thank you for the compliments and I'm glad I could help.

• Reply • Share ›

Charles Bueche • 5 months ago

Chris, this is great stuff. I used it to extract sailors registered by google forms for a regatta and to post content to the regatta web page. Spares me a lot of work, thanks !

A small issue, with Python 3, I had to use a slightly different call to load my private key:

credentials = SignedJwtAssertionCredentials(json_key['client_email'],
bytes(json_key['private_key'], 'UTF-8'),
SCOPE)

• Reply • Share ›

Dana Swanstrom Charles Bueche • a month ago

Also big thanks Charles. This is exactly what I needed in addition to all the work from Chris.

• Reply • Share ›

Chris Moffitt Mod Charles Bueche • 5 months ago

Great! I am glad it was useful and that you were able to find a good use for Forms outside of the standard survey approach.

I did not test my snippet in python 3 so thanks for pointing out the change. I'll have to think if there is a way to do this that is compatible in python 2 and 3.

• Reply • Share ›

skipmontanaro • 5 months ago

Thank you for this! I have been struggling mightily trying to get OAuth2 working for what I think will be a fairly straightforward application (sucking up an old mailing list archive and inserting its messages into a Google Group). I have been unable to get past the authorization step. This should help...

• Reply • Share ›

Chris Moffitt Mod skipmontanaro • 5 months ago

I agree that is is hard to piece it together but once it works, it is pretty slick. Good luck!

• Reply • Share ›

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7 comments • a year ago

laurencerowe — The standard library `sets` module is a relic from before `set` type was made a builtin type in Python

Improving Pandas's Excel Output - Practical Business Python

15 comments • 7 months ago

Chris Moffitt — Thank you. I am glad it's helpful to you.

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Simple Graphing with IPython

Practical Business Python

1 comment • 16 days ago

Denis Akhiyarov — it would be nice if pandas pivottable exported to excel the equivalent pivottable excel object instead

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16 comments • a year ago

UB — Thanks for an excellent series of posts. I've recently came across plot.ly that takes plotting into a whole new level,

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