

# Web APIs

# What is an API?

## **API: Application programming interface**

An API is how we interact with an external program in order to exchange data.

This is how applications do things like

- Access your calendar
- Give you up-to-date weather information

# Why use an API?

If we wanted to, we could scrape web pages for most of the data that we want.

- Load website
- Make a search
- Scrape the page for relevant information

This means loading lots of unnecessary data, as well as being restricted to (mostly) public data.

# Why use an API?

With an API, we can make requests to the server for specific information.

- We can make authenticated requests for **private information**
  - MUCH harder when scraping,
  - Often impossible, and
  - Typically unethical
- We don't have to load whole websites
- We don't have to hunt through HTML for the information we care about.

# Useful APIs

- [Quandl Financial Data](#) - Information on many unique financial metrics
- [Twitter Search](#) - Track historic trends on a given topic (realtime)
- [Sentiment Analysis](#) - What is the sentiment in a given block of text?
- [Sports Updates](#) - API to gather data on US sports teams (Soccer/Football)
- [Mapping Data](#) - Collect information on routes, distances, directions, etc.

# Cool! So how can I use one?

Let's walk through using an API with the [Google Distance Matrix API](#).

First, let's get set up:

- Need a Google account
- Need to register on Google Developer services
- Need to set up an API Key (ties our requests to us for billing purposes, but Google offers everyone a \$200 credit per month for maps API requests, so we can all just mess with my account for now)

# WARNING

**Using APIs frequently requires setting up a billing account.**

- When we scrape the web, we pretend to be customers, so websites allow us to load their content at no cost (which is why many sites prohibit scraping)
- When we use APIs, we pay for access, because we are purchasing access to the firm's data, rather than looking to purchase goods/services
- PAY ATTENTION TO THE REQUESTS YOU MAKE... THEY COST MONEY

# Setting up a Google Developer API

First, head to [console.cloud.google.com](https://console.cloud.google.com), so we can set up our accounts.

- You will get a \$300 credit to play around with on the platform, but we won't need it, since the Maps API offers its own monthly credit
- We need to create a project (do this in the blue bar)
- Head to the API menu, and choose credentials
- Follow the create credentials instructions for an API key



# Using our API

Now, let's go back to the [Google Distance Matrix API](#)

- We can use the API key that we just created to complete the example link provided in the documentation
- When we copy and paste the link, we will see a page with JSON in our browser

# Making Requests via URLs

When we want to request data from the Google Maps API, we do so with a custom URL that specifies

- the information we would like to collect
- additional parameters to clarify our request

The response provided when accessing that URL gives us the information that we requested from the API.

# Automating API Requests

```
import requests
import json
import time
import datetime
import pandas as pd
```

- `requests` enables Python to process url requests
- `json` provides native JSON handling
- `time` helps us to check the system clock
- `datetime` provides the ability to parse dates and times

# Automating API Requests

```
def fetch_data(url):  
    success = False  
    while success is False:  
        try:  
            response = requests.get(url)  
  
            if response.status_code == 200:  
                success = True  
        except:  
            time.sleep(5)  
  
            print("Error for URL {0}: {1}".format(  
                url, datetime.datetime.now()))  
            print("Retrying")  
    return response.text
```

# Automating API Requests

```
def get_distance(req_url):
    results = {"timestamp" : [],
              "travel_time" : [],
              "distance" : []
             }

    data = json.loads(fetch_data(req_url))
    results['timestamp'].append(
        datetime.datetime.now())
    results['travel_time'].append(
        data['rows'][0]['elements'][0]['duration']['value'])
    results['distance'].append(
        data['rows'][0]['elements'][0]['distance']['value'])

    results = pd.DataFrame(results)

    return results
```

# Automating API Requests

```
api_key = "AIzaSyAwVHvWNPNOV05zA-hXBHC7Dx0BK8AT0qs" # example key (not valid)
origin = '6708+Pine+Street+Omaha+NE' # work
destination = '2010+184th+Ave+NE+Redmond+WA' #my childhood home

site = "https://maps.googleapis.com" +
      "/maps/api/distancematrix/json?"
origin = "origins={}&".format(origin)
destination = "destinations={}&".format(destination)
key = "key={}".format(api_key)

req_url = site + origin + destination + key
```

We can start to see how we can use parameters to create an automated URL builder. Let's formalize this as a function

# Automating API Requests

```
def map_data(api_key, origin, destination,
             frequency, duration):
    site = "https://maps.googleapis.com" +
          "/maps/api/distancematrix/json?" # put above
    origin = "origins={}&".format(origin)
    destination = "destinations={}&".format(destination)
    key = "key={}".format(api_key)

    req_url = site + origin + destination + key

    results = {
        "timestamp" : [],
        "travel_time" : [],
        "distance" : []
    }
    step = 1
    ... # to be continued on the next slide
```

# Automating API Requests

```
def map_data(api_key, origin, destination,
             frequency, duration):
    ... # continued from last slide
    while (step <= int(duration*60 / frequency)):
        data = json.loads(fetch_data(req_url))
        results['timestamp'].append(
            datetime.datetime.now())
        results['travel_time'].append(
            data['rows'][0]['elements'][0]['duration']['value'])
        results['distance'].append(
            data['rows'][0]['elements'][0]['distance']['value'])

        print("Query Completed at {}".format(
            datetime.datetime.now()))
        step+=1
        time.sleep(frequency*60)

    return pd.DataFrame(results)
```



# Executing our Query

We now have the functions in place to make queries automatically:

```
api_key = input('Please Enter Your API Key: ')
origin = '6708+Pine+Street+Omaha+NE' # work
destination = '2010+184th+Ave+NE+Redmond+WA' #my childhood home
frequency = 5 # In minutes
duration = 24 # In hours

if __name__ == '__main__':
    data = map_data(api_key, origin, destination,
                    frequency, duration)
```

At this point, we will (eventually) get a DataFrame of our results when the function terminates (in 24 hrs)

# Results

timestamp	travel_time	distance
2019-04-09 11:37:30.747668	1343	23942
2019-04-09 11:38:30.958629	1343	23942
2019-04-09 11:39:31.504978	1343	23942
2019-04-09 11:40:31.738479	1343	23942
2019-04-09 11:41:31.931956	1343	23942
...	...	...

# Lab Time

We are using the [zippopotam.us](https://zippopotam.us) API for our assignment so that nobody has to register in order to access the API