

# Python & the Web

April 25, 2023

# CS 41 So Far

Week 1: Python Basics

How do I do basic things in the Python world?  
What are some of Python's philosophies?

Week 2: Data Structures & OOP

Week 3: Electronics

How can I extend Python's functionality?  
How can I use Python to augment physical devices?

# Final Project

Final Project Proposal

End of Week 5

Meetings with Parth/Tara

Weeks 7/8

Presentations

Week 10 (May 31)

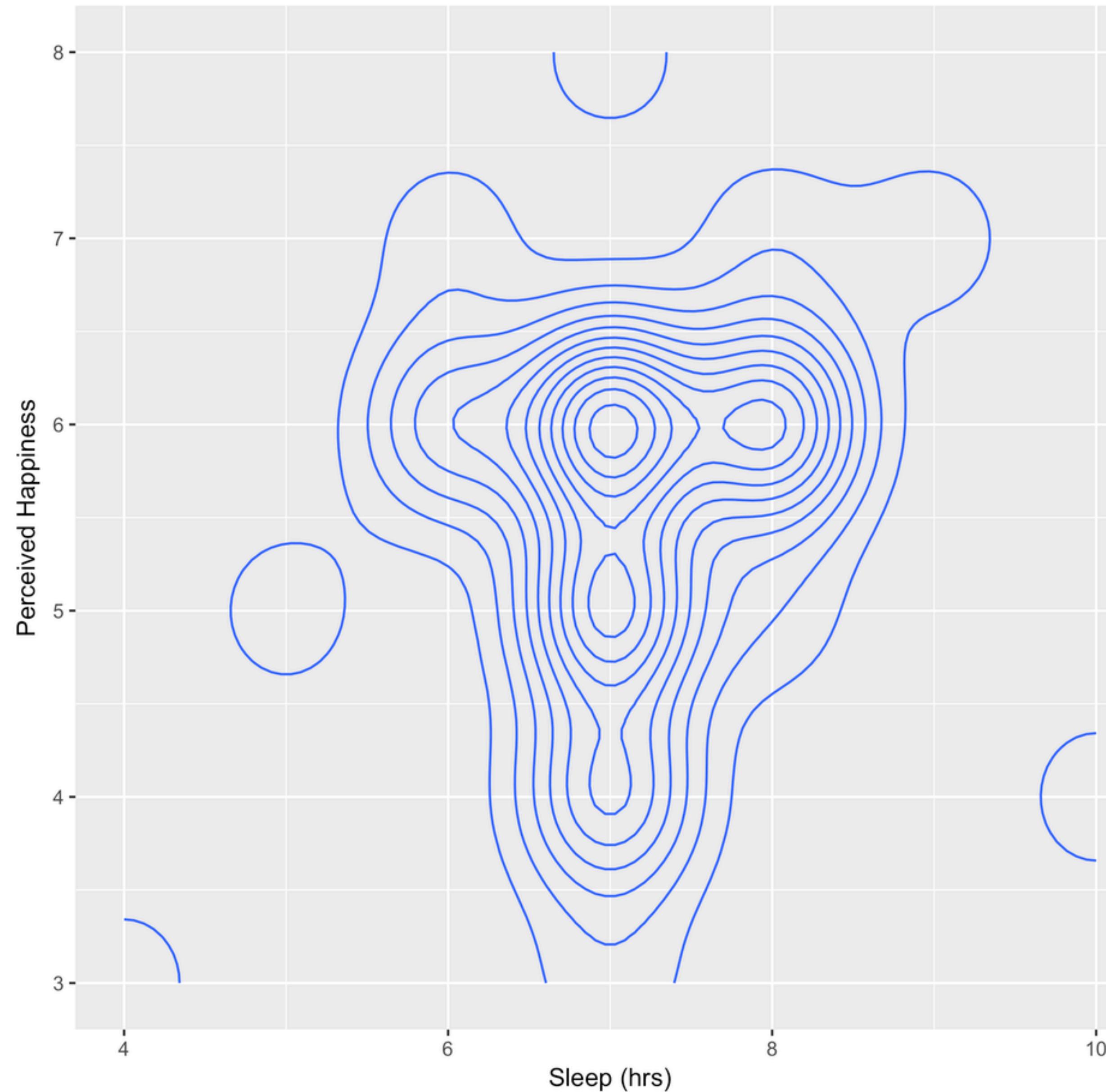
# Dear Data



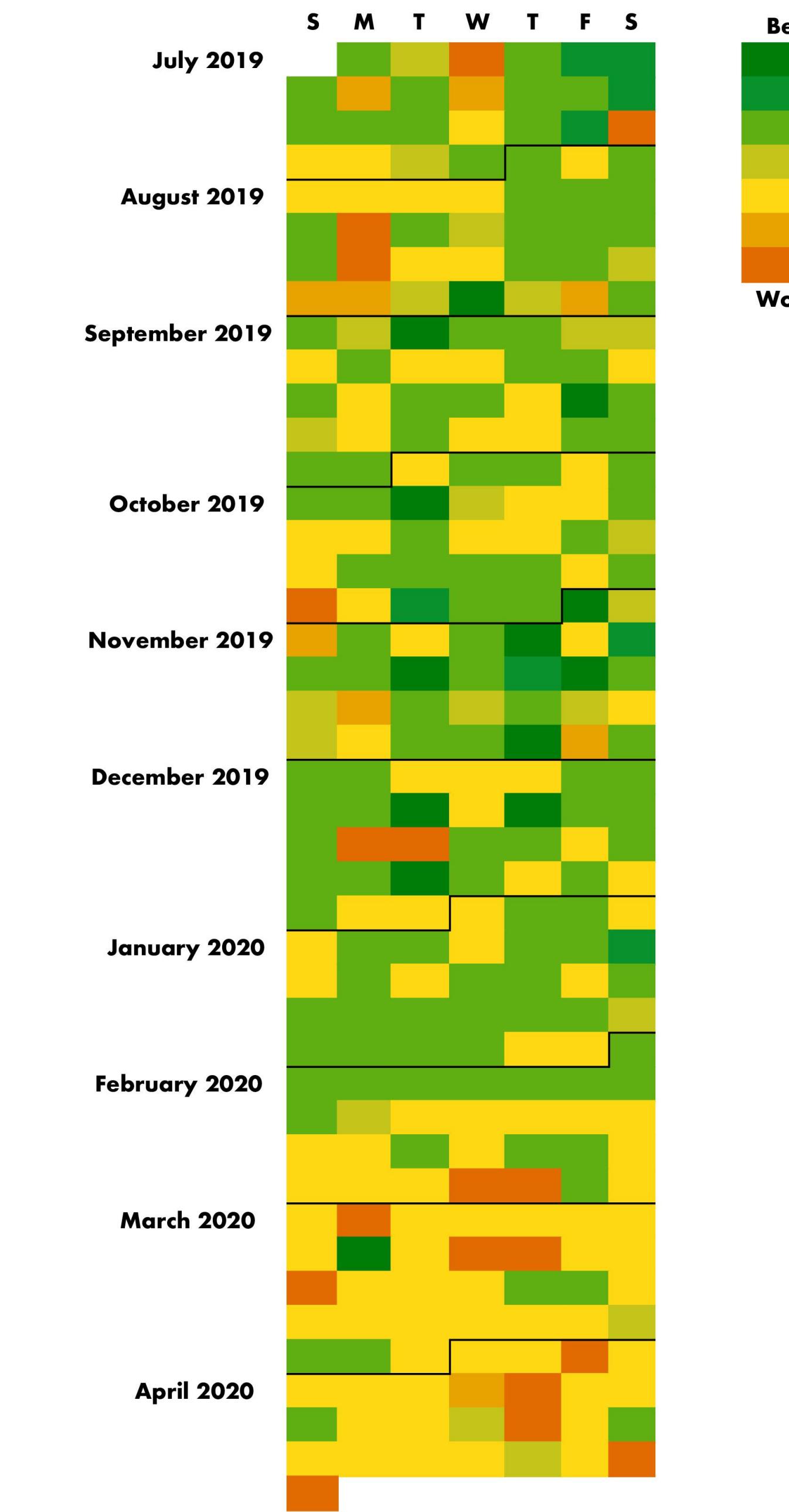
This graph shows the length of daily delays on one woman's 40-minute commute between Munich and a town in the German countryside during 2018. The commuter knitted two rows each day. Gray for delays under five minutes, pink for up to 30 minutes, and red for a delay of more than a half-hour or delays in both directions.

Credit: [The New York Times](#)

Hours of Sleep vs. Perceived Happiness



Credit: [u/avgsuperhero](#)

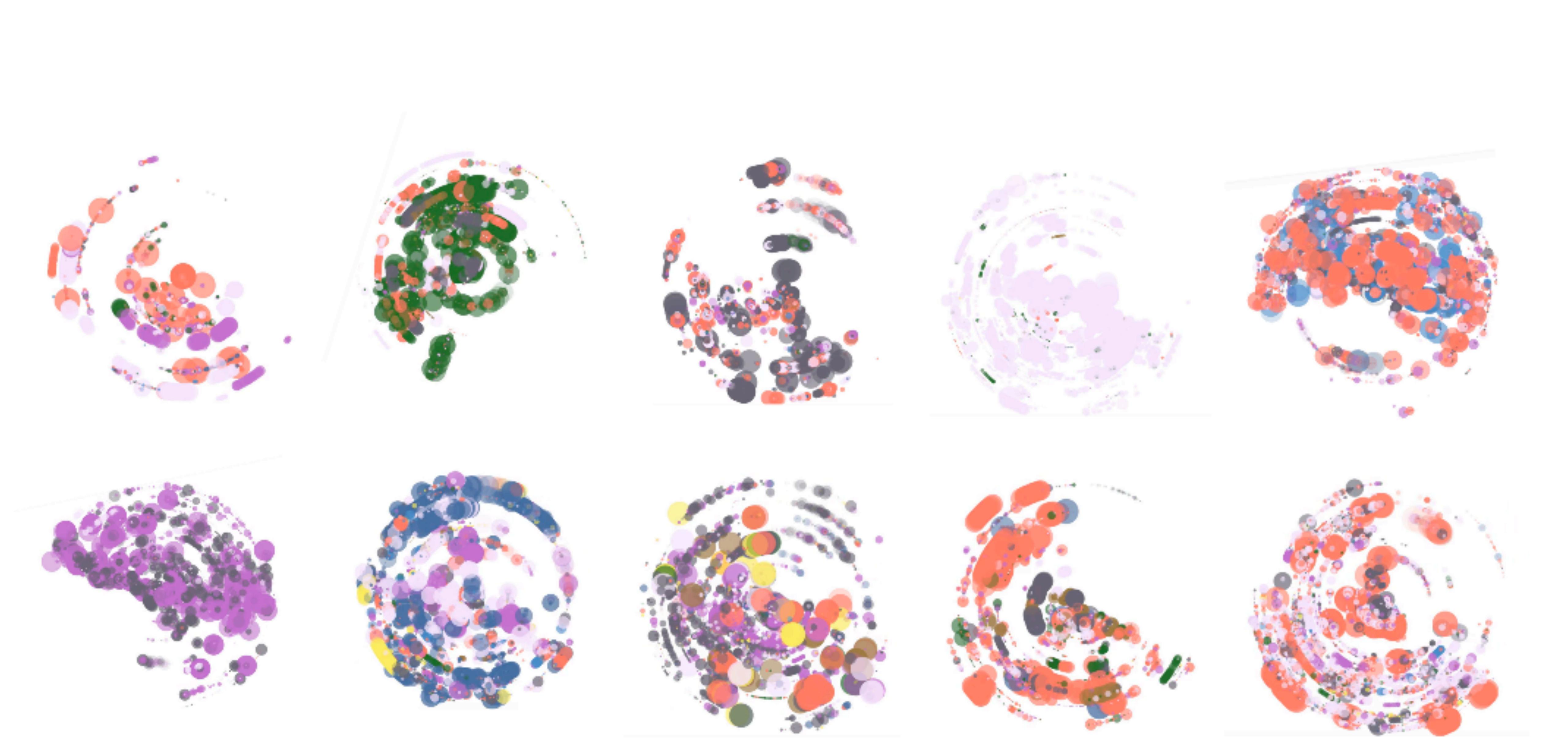


Credit: [u/joebidengarlicbread](#)

More mood visualizations:  
[Artistic, aggregate visualizations](#)  
[Using Spotify listening data as a proxy for mood](#)



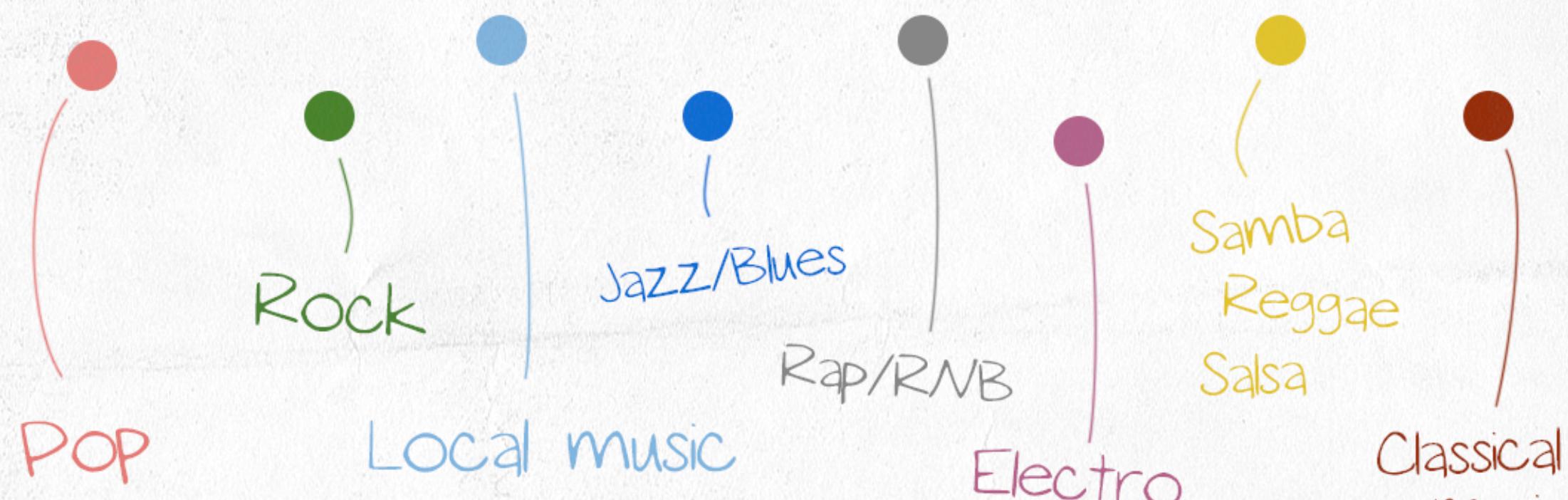
<https://www.robgreenfield.org/trashme/>



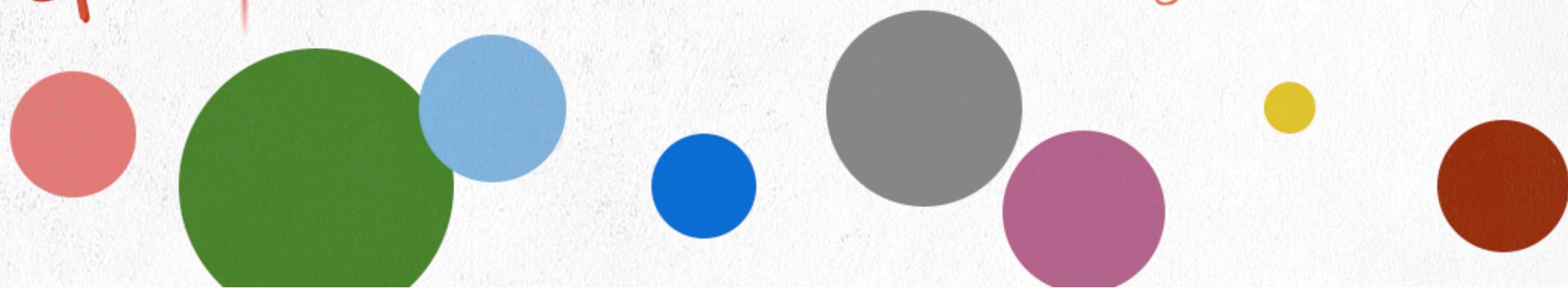
Step1 | 1 listen = 1 bubble



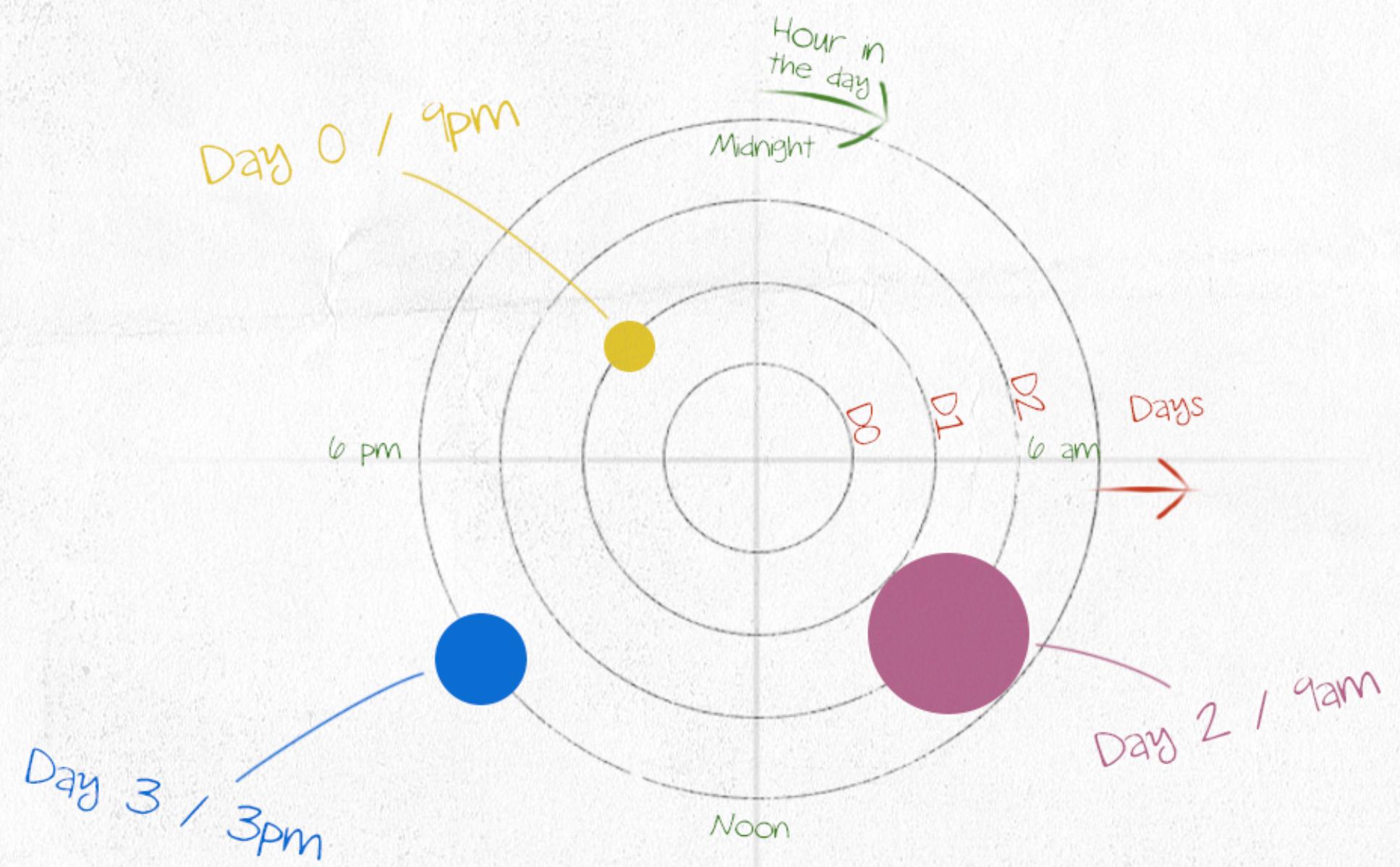
Step2 | Color the bubbles according to genre



Step3 | Size the bubbles according to stickiness



Step4 | Place the bubbles

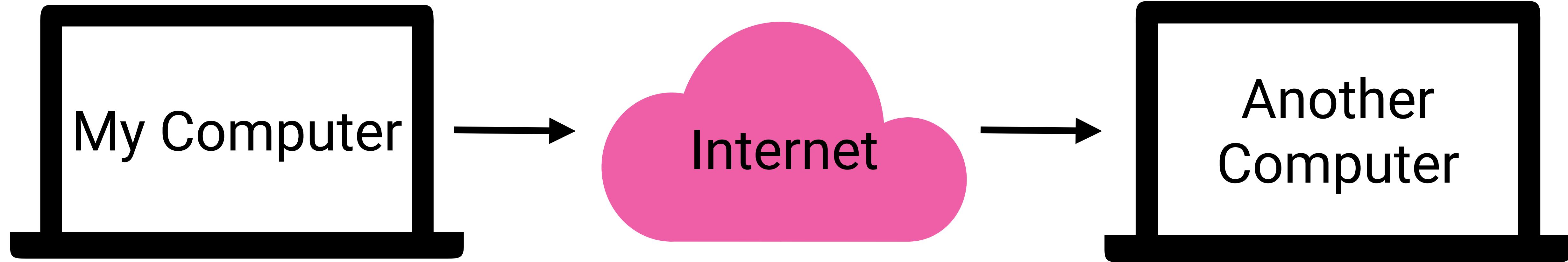


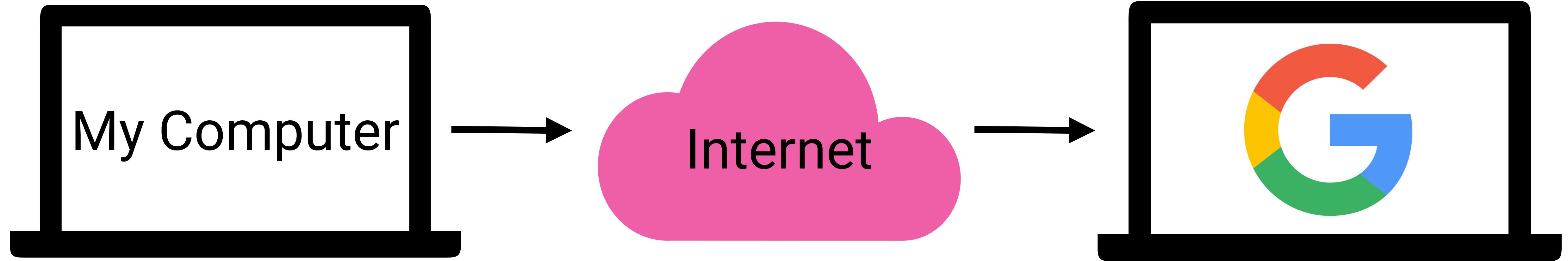
# Learning Goals

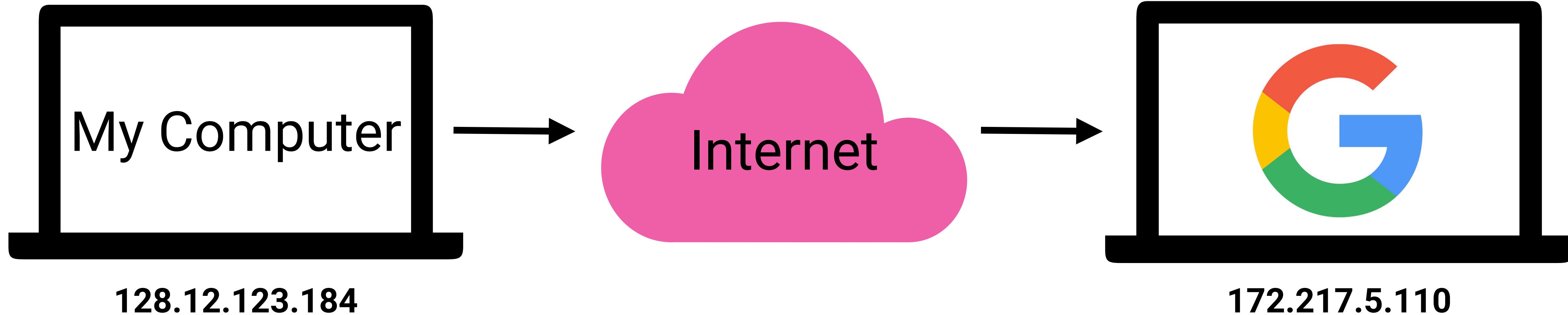
After today, you should be able to

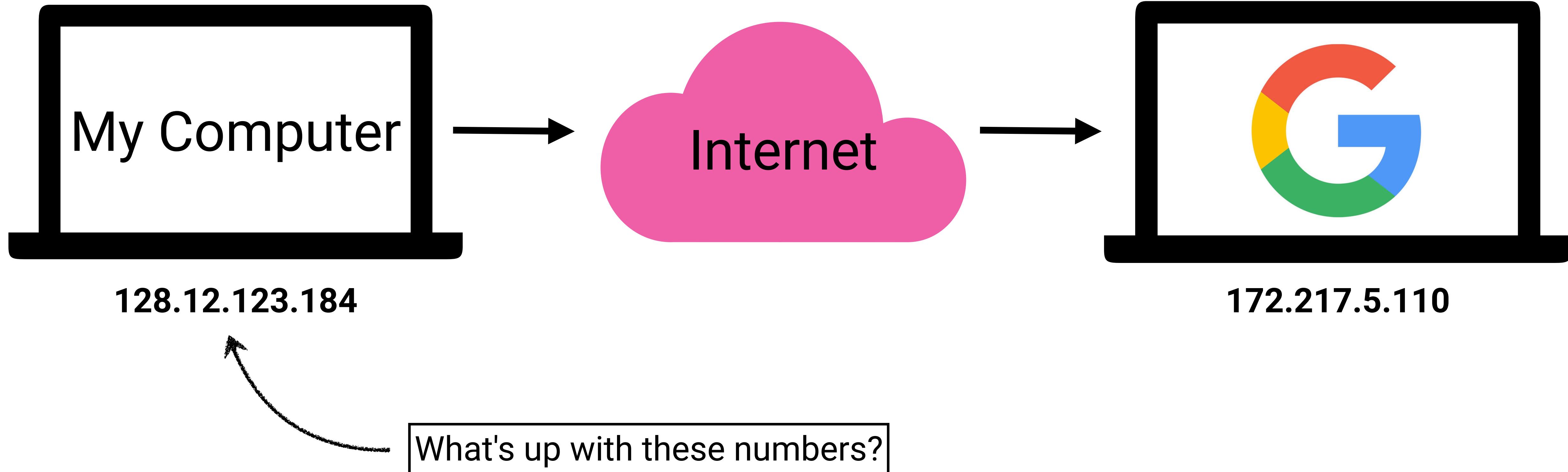
1. Describe, at a high level, how a web request works.
2. Query an API and convert the results to Python objects; include authentication headers in the request.
3. Integrate those queries into other Python applications.

# How the Internet Works





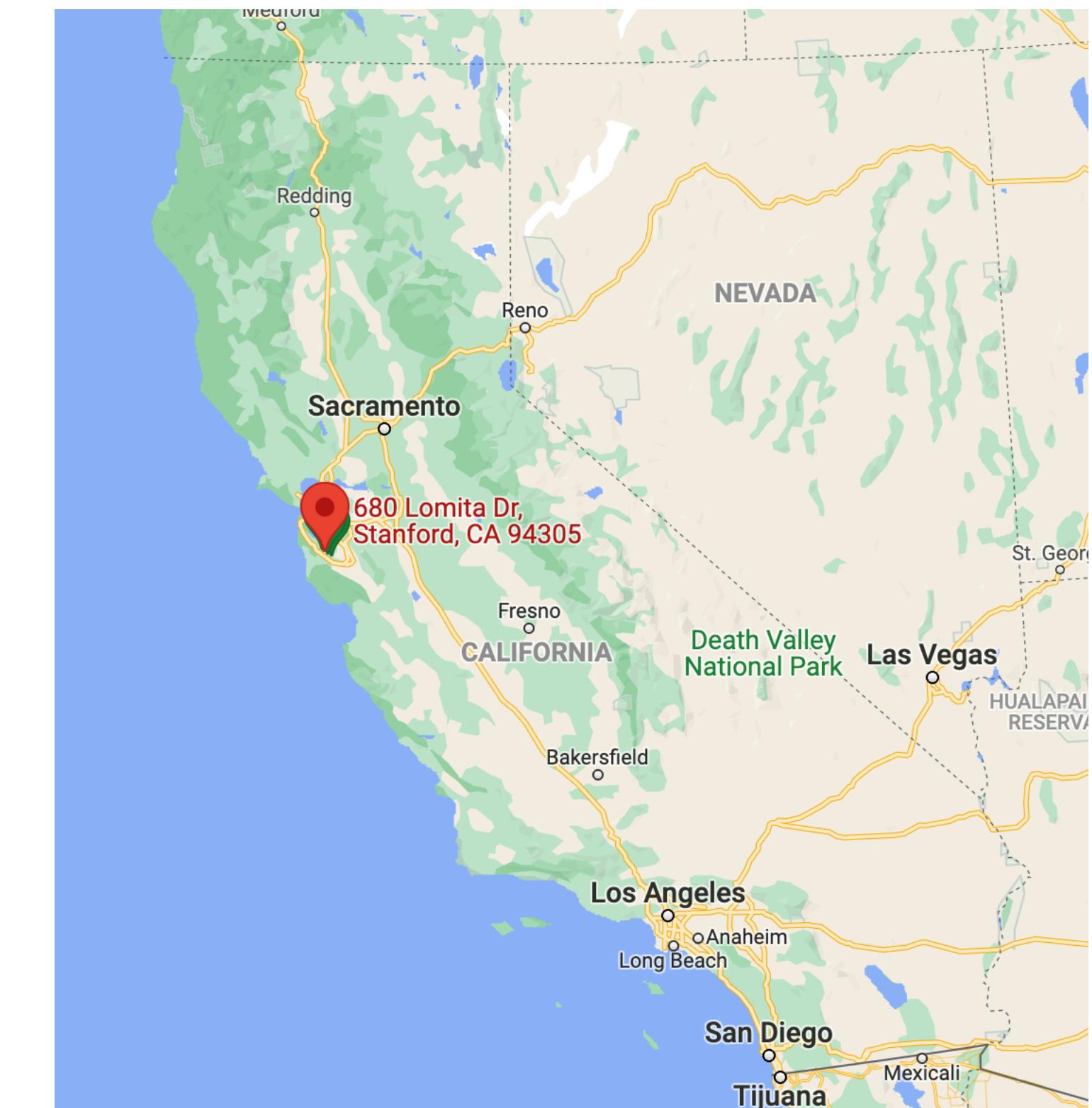
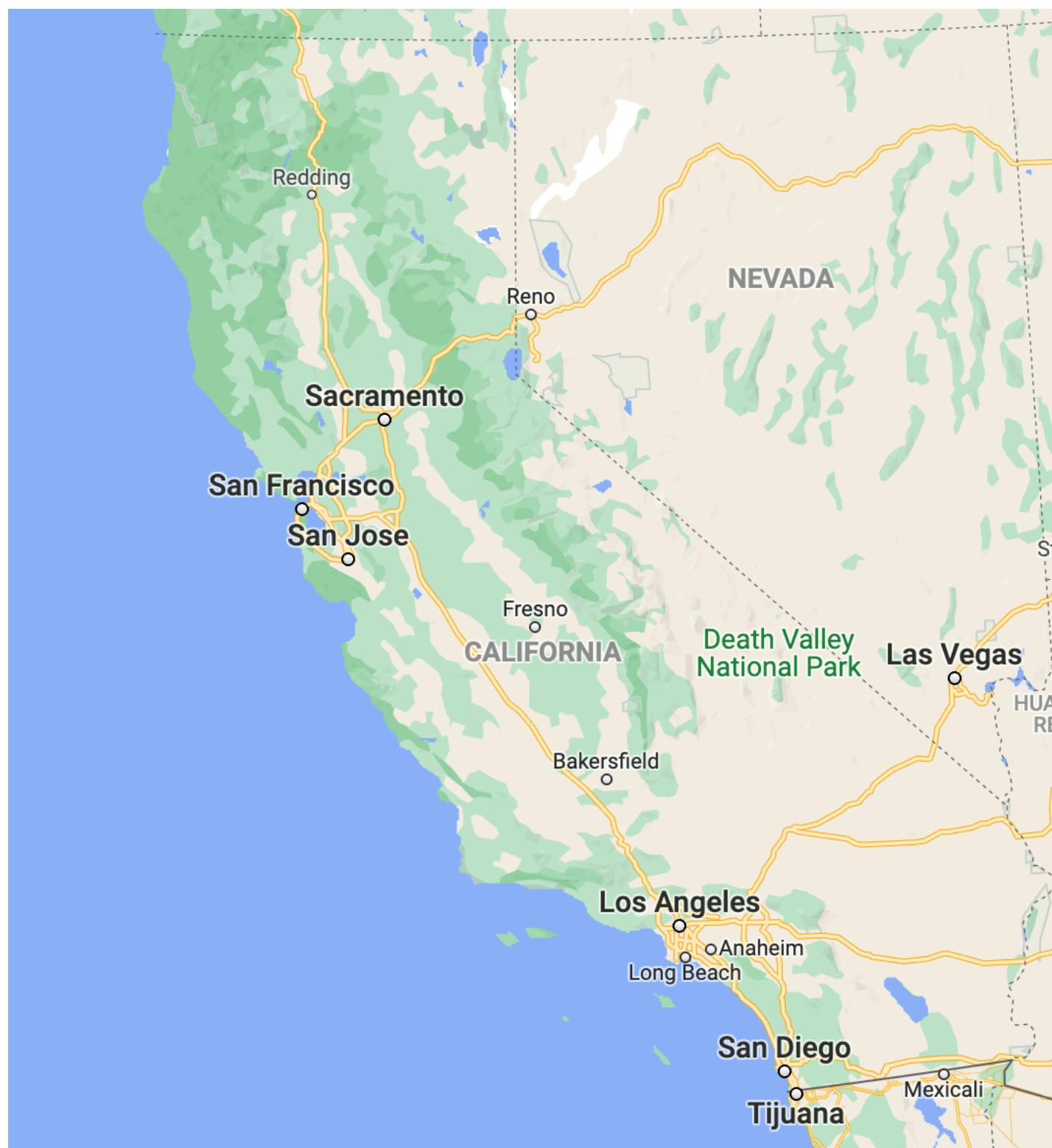


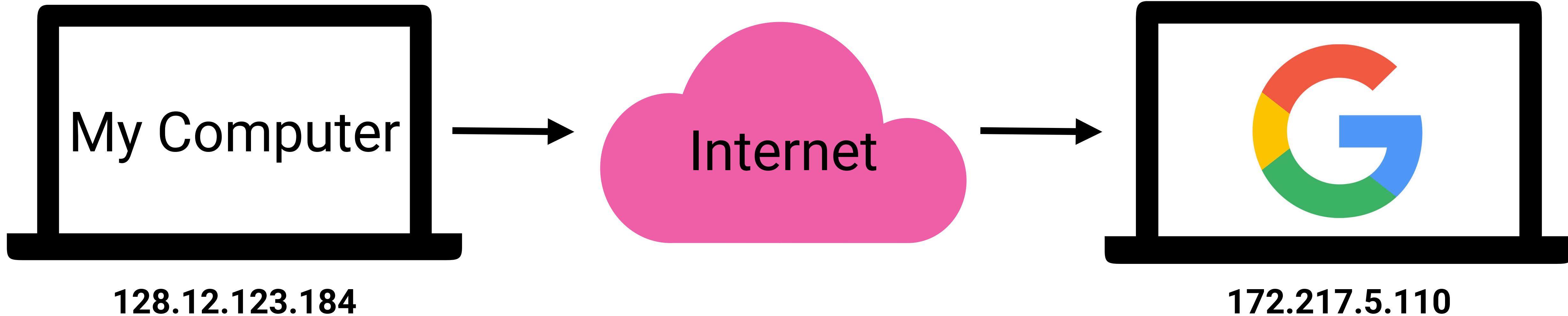


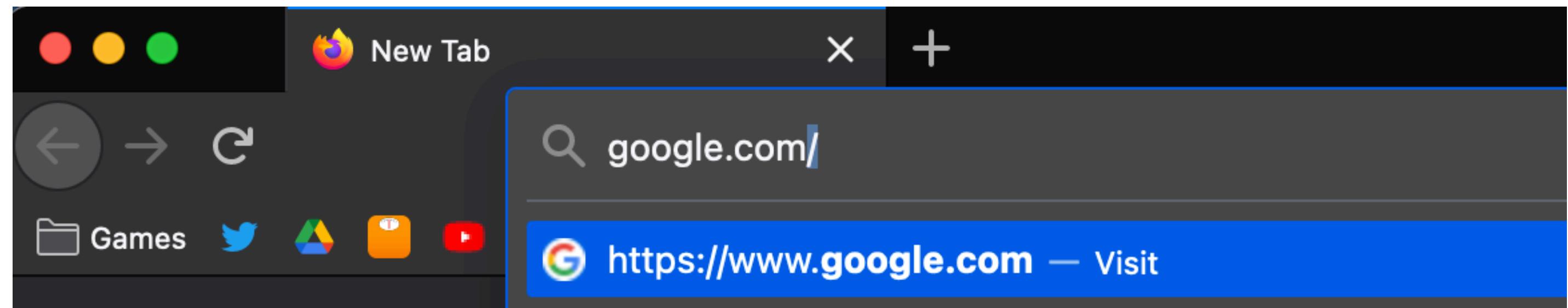
# 128.12.123.184

Network Identifier

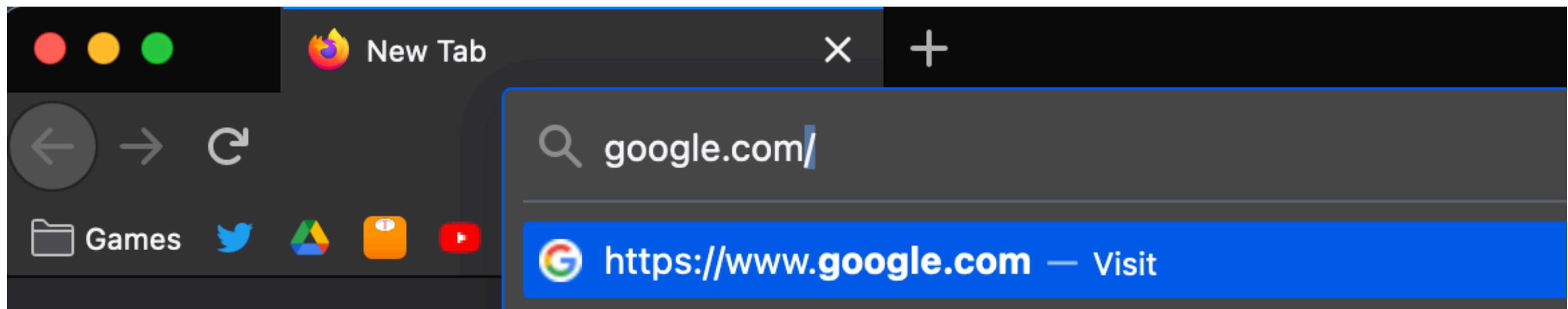
Host Identifier







I enter google.com into  
the browser bar

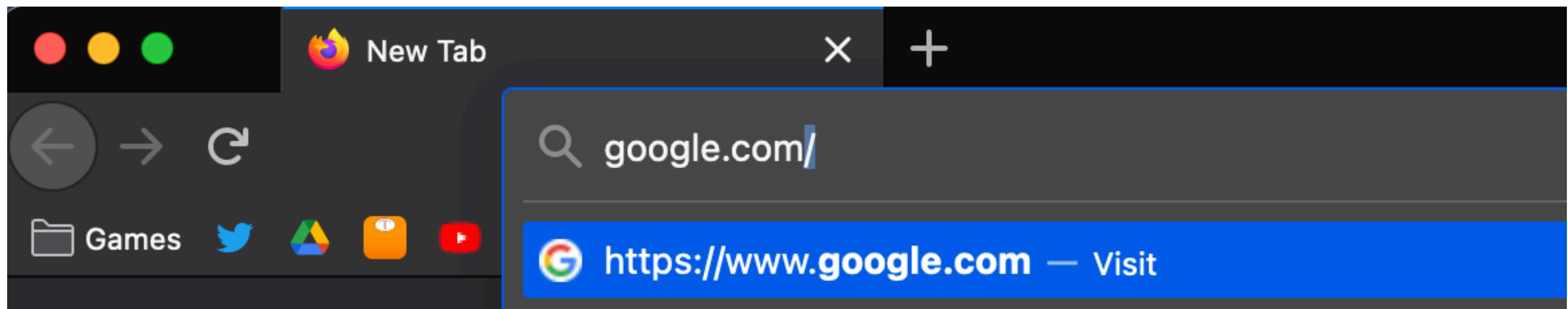


**172.217.5.110**

I enter google.com into  
the browser bar

"DNS"

That name gets  
converted into the  
computer's IP address

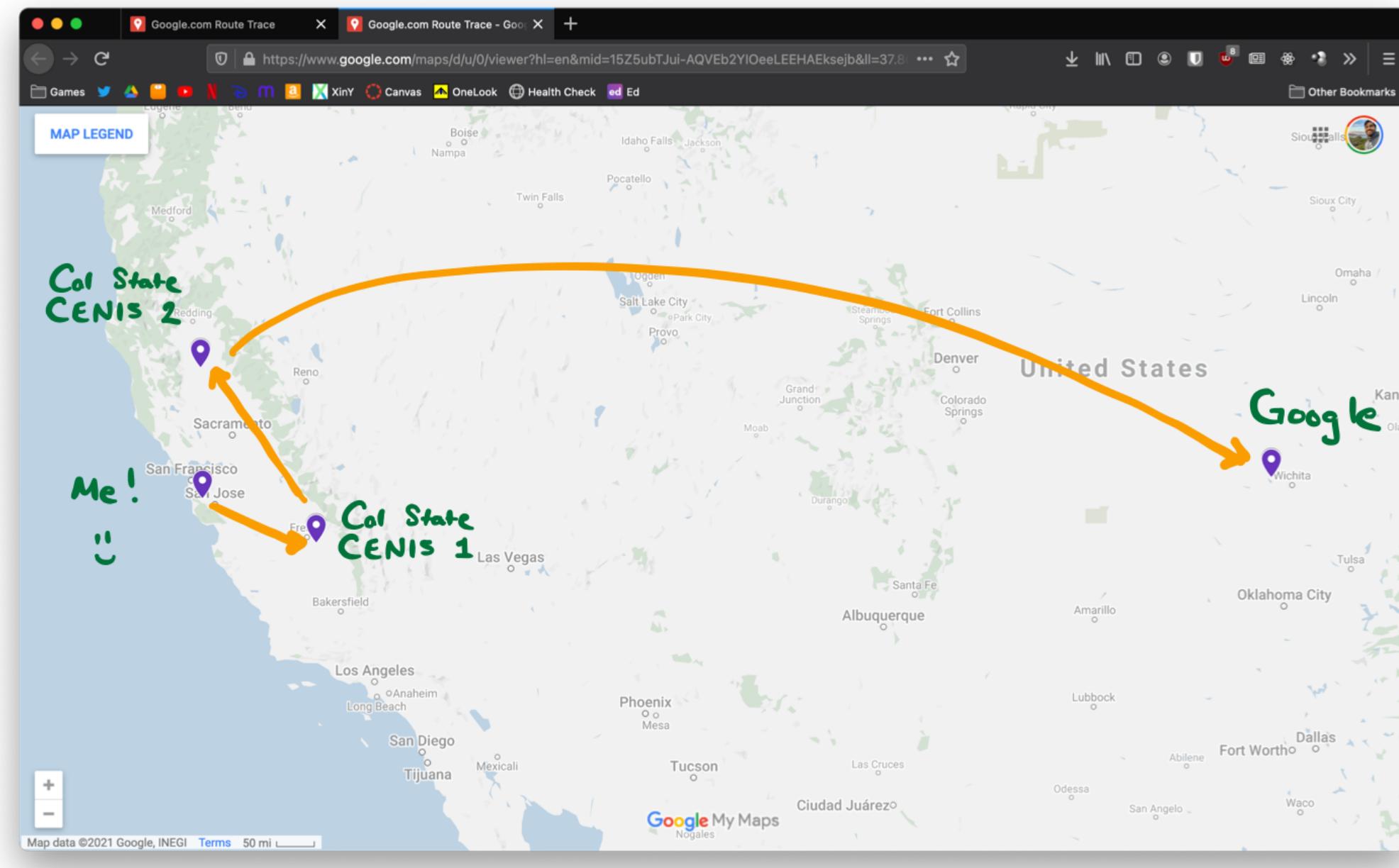


**172.217.5.110**

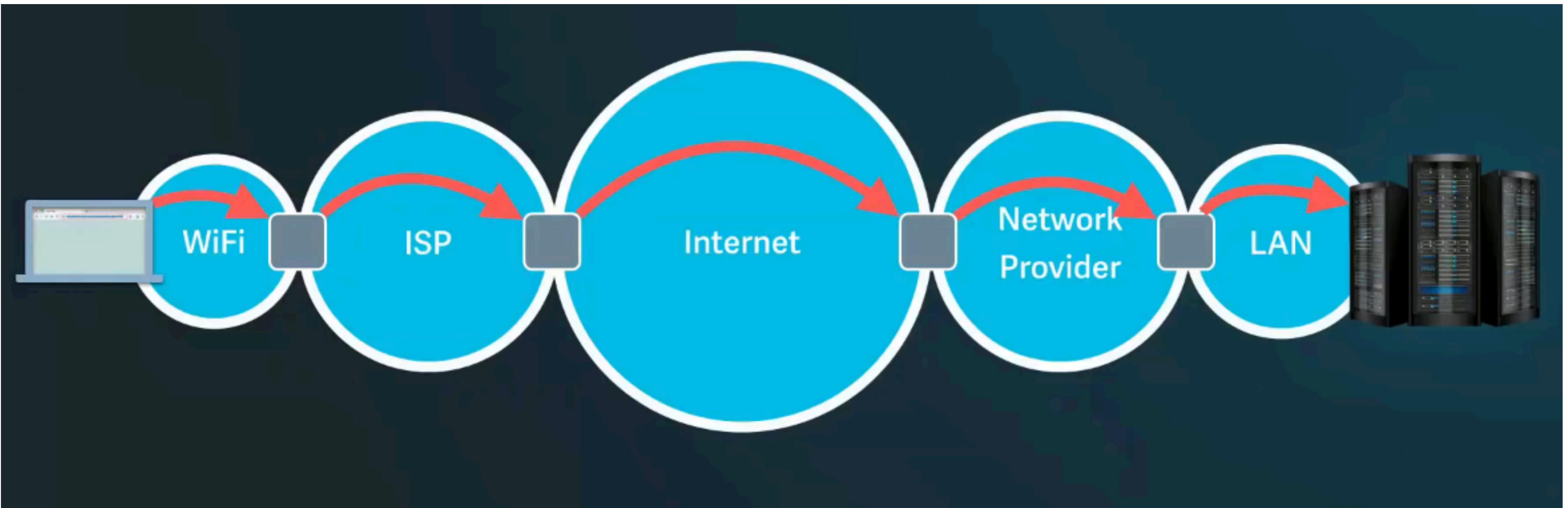
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The request actually  
goes to Google



```
$ traceroute google.com
traceroute to google.com (172.217.5.110), 64 hops max, 52 byte packets
 1 sc-srtr-vl3566.sunet (128.12.72.1)  1.239 ms  0.676 ms  0.668 ms
 2 res-press-mx240-temp-rtr.mgmt.sunet (192.168.190.164)  2.018 ms  1.964 ms  1.242 ms
 3 xb-nw-rtr-vlan11.sunet (171.64.0.193)  0.947 ms  1.031 ms  0.936 ms
 4 dc-svl-rtr-vl3.sunet (171.66.255.190)  1.860 ms
    dc-svl-rtr-vl2.sunet (171.64.255.190)  1.716 ms
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 5 dc-svl-agg4--stanford-100ge.cenic.net (137.164.23.144)  2.958 ms  2.271 ms  2.171 ms
 6 dc-lax-agg8--svl-agg8--100ge--2.cenic.net (137.164.11.20)  9.889 ms  9.768 ms  9.540 ms
 7 dc-lax-agg10--lax-agg8-300g.cenic.net (137.164.11.70)  9.157 ms  9.014 ms  9.122 ms
 8 74.125.49.165 (74.125.49.165)  9.255 ms
    72.14.222.56 (72.14.222.56)  9.481 ms  9.103 ms
 9 108.170.247.147 (108.170.247.147)  14.406 ms  10.177 ms *
10 108.170.230.131 (108.170.230.131)  10.513 ms  10.146 ms *
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    172.253.70.153 (172.253.70.153)  10.751 ms
    172.253.70.149 (172.253.70.149)  9.995 ms
14 108.170.236.63 (108.170.236.63)  9.821 ms
    108.170.236.61 (108.170.236.61)  11.795 ms
    142.250.210.184 (142.250.210.184)  12.378 ms
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Established in 1997, this nonprofit organization operates the California Research and Education Network (CalREN), a high-capacity computer network with more than 8,000 miles of optical fiber. The network serves over 20 million users across California, including the vast majority of K-20 students together with educators, researchers, and individuals at other vital public-serving institutions.

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CENIC



Week 5 - Google Drive | Lesson Plan - Python and the W | the duolingo owl - Griefbacon | IP Address Lookup for 137.164.23.144 | +

https://whatismyipaddress.com/ip/137.164.23.144

Games Twitter Google YouTube Netflix M a XinY Canvas OneLook Health Check Ed Ed Other Bookmarks

What's MyIPAddress.com

Enter Keywords or IP Address... Search

ABOUT PRESS BLOG CONTACT

MY IP IP LOOKUP HIDE MY IP VPNS TOOLS LEARN

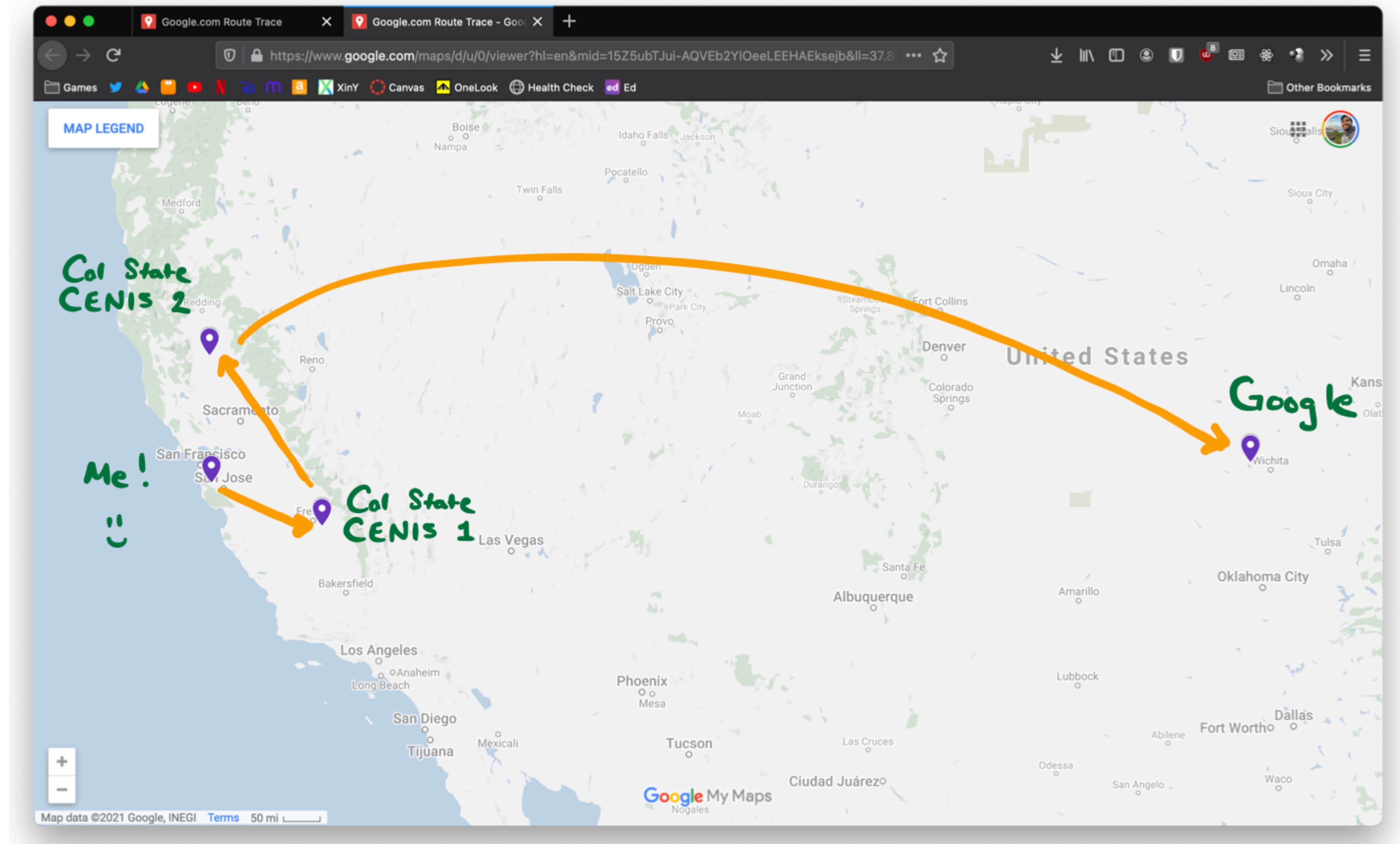
IP Details For: 137.164.23.144

Decimal: 2309232528  
Hostname: dc-svl-agg4--stanford-100ge.cenic.net  
ASN: 2152  
ISP: California State University, Office of the Chancel  
Organization: California State University, Office of the Chancel  
Services: None detected  
Type: Broadband  
Assignment: Likely Static IP  
Continent: North America  
Country: United States  
State/Region: California  
City: Parlier

Latitude: 36.6089 (36° 36' 32.04" N)  
Longitude: -119.5416 (119° 32' 29.76" W)  
Postal Code: 93648

CLICK TO CHECK BLACKLIST STATUS





# What's actually being sent?

**GET / HTTP/2**

**Host:** www.google.com

**User-Agent:** Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:88.0) Gecko/20100101 Firefox/88.0

**Accept:** text/html, application/xhtml+xml, application/xml;q=0.9, image/webp, \*/\*;q=0.8

**Accept-Language:** en-US, en; q=0.5

**Accept-Encoding:** gzip, deflate, br

**Connection:** keep-alive

**Upgrade-Insecure-Requests:** 1

**Cache-Control:** max-age=0

**TE:** Trailers

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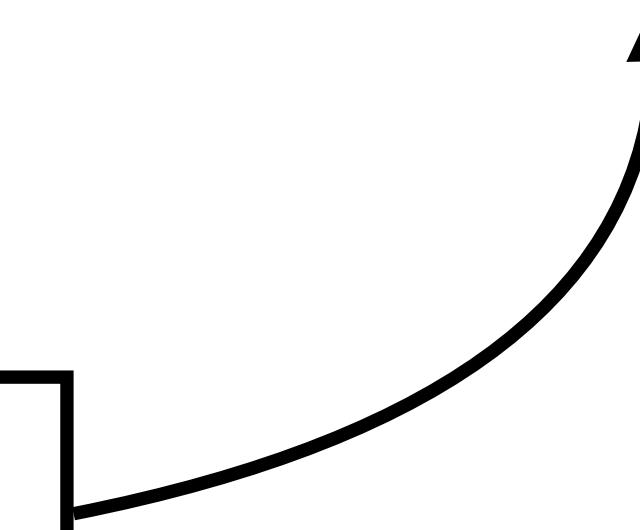
Path

Headers

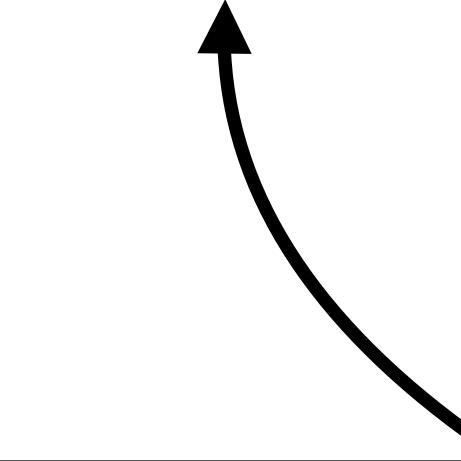
# Making Requests with Python

```
import requests  
r = requests.get(url)
```

Sends a GET request for  
that URL, with no headers



```
r = requests.get(  
    url,  
    headers={ 'Accept-Language': 'es' }  
)
```

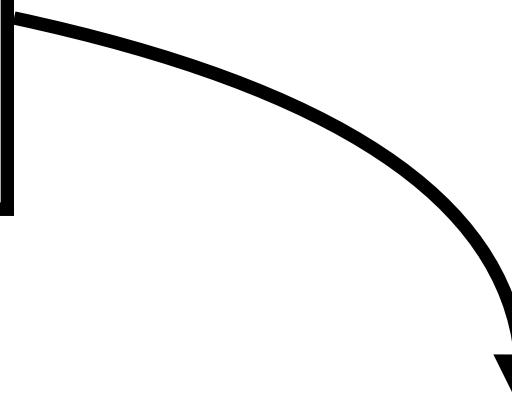


You can specify the headers  
as a dictionary if you want

```
r = requests.get(  
    'https://www.google.com/search',  
    params={ 'q': 'unicorns' }  
)
```

This queries [google.com/search?q=unicorns](https://www.google.com/search?q=unicorns)

There are other types of requests—this is a POST request



```
r = requests.post(  
    url,  
    data={'key1': 'value1'}  
)
```

# Interpreting the Response

# Data on the Web

## **HTML**

Built for web browsers—most of the web pages you browse are probably written in HTML.

## **JSON**

A way to represent objects as strings, not typically displayed to users.

## **Text**

Most webpages these days are not written in raw text, but some servers may respond with raw, unformatted text.

## **Other**

Other files on the web (images, PDFs, etc.) have their own formatting.

# JSON

Lots of things on the web use JSON!

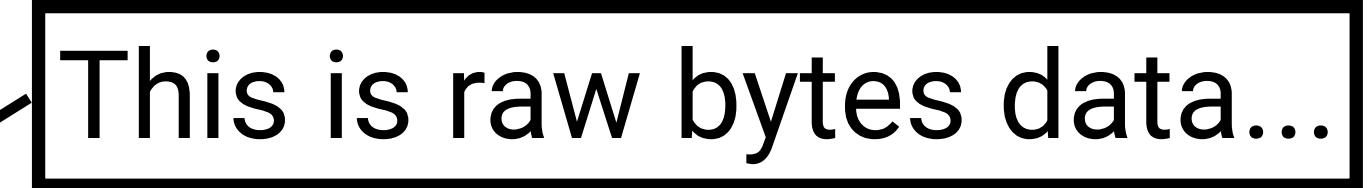
```
{  
  "id":317,  
  "type":"general",  
  "setup":"Why are oranges the smartest fruit?",  
  "punchline":"Because they are made to concentrate."  
}
```

```
import requests
r = requests.get(
    'https://official-joke-api.appspot.com/random_joke'
)
```

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r = requests.get(
    'https://official-joke-api.appspot.com/random_joke'
)

r.content
# => b'{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'
```

```
import requests
r = requests.get(
    'https://official-joke-api.appspot.com/random_joke'
)
This is raw bytes data...
r.content
# => b'{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'
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import requests
r = requests.get(
    'https://official-joke-api.appspot.com/random_joke'
)


This is raw bytes data...


r.content
# => b'{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'

r.text
# => '{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'
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import requests
r = requests.get(
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)
This is raw bytes data...
r.content
# => b'{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'
r.text
...this is a string
# => '{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'
```

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import requests
r = requests.get(
    'https://official-joke-api.appspot.com/random_joke'
)
This is raw bytes data...
r.content
# => b'{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'

...this is a string
r.text
# => '{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'

r.json()
# => {'id': 86, 'type': 'general', 'setup': 'Did you hear about the
bread factory burning down?', 'punchline': 'They say the business is
toast.'}
```

```
import requests
r = requests.get(
    'https://official-joke-api.appspot.com/random_joke'
)
This is raw bytes data...
r.content
# => b'{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'

...this is a string
r.text
# => '{"id":86,"type":"general","setup":"Did you hear about the bread
factory burning down?","punchline":"They say the business is toast."}'

r.json()
# => {'id': 86, 'type': 'general', 'setup': 'Did you hear about the
bread factory burning down?', 'punchline': 'They say the business is
toast.'}
...and this is a dictionary
```

# Exploring an API

# What's an API?

Now, let's play with APIs!  
*API Resource Sheet*

# What's an API?

- API = Application Programming Interface
  - A way for applications (computer programs) to talk to each other
  - Exposes an interface that's not usually user-friendly, but *is* programmer-friendly so that other programs can hook into it.

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# What's an API?

- API = Application Programming Interface
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  - Exposes an interface that's not usually user-friendly, but *is* programmer-friendly so that other programs can hook into it.
- For example, the random jokes API: <https://official-joke-api.appspot.com/>

Now, let's play with APIs!  
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