

# Getting Started with APIs in R

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<https://bit.ly/3MBht0O>

# What we'll use today

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- Rstudio (Posit)
- Packages:
  - `httr`
  - `jsonlite`
  - `censusapi`
- US Census Bureau API Key

# Agenda

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- What is an API?
- Why use APIs?
- Getting started (the general workflow)
- Explore the US Census API (creating queries in a web browser)
- Demos:
  - Using `httr` and `jsonlite`
  - Using `censusapi`

# What is an API?

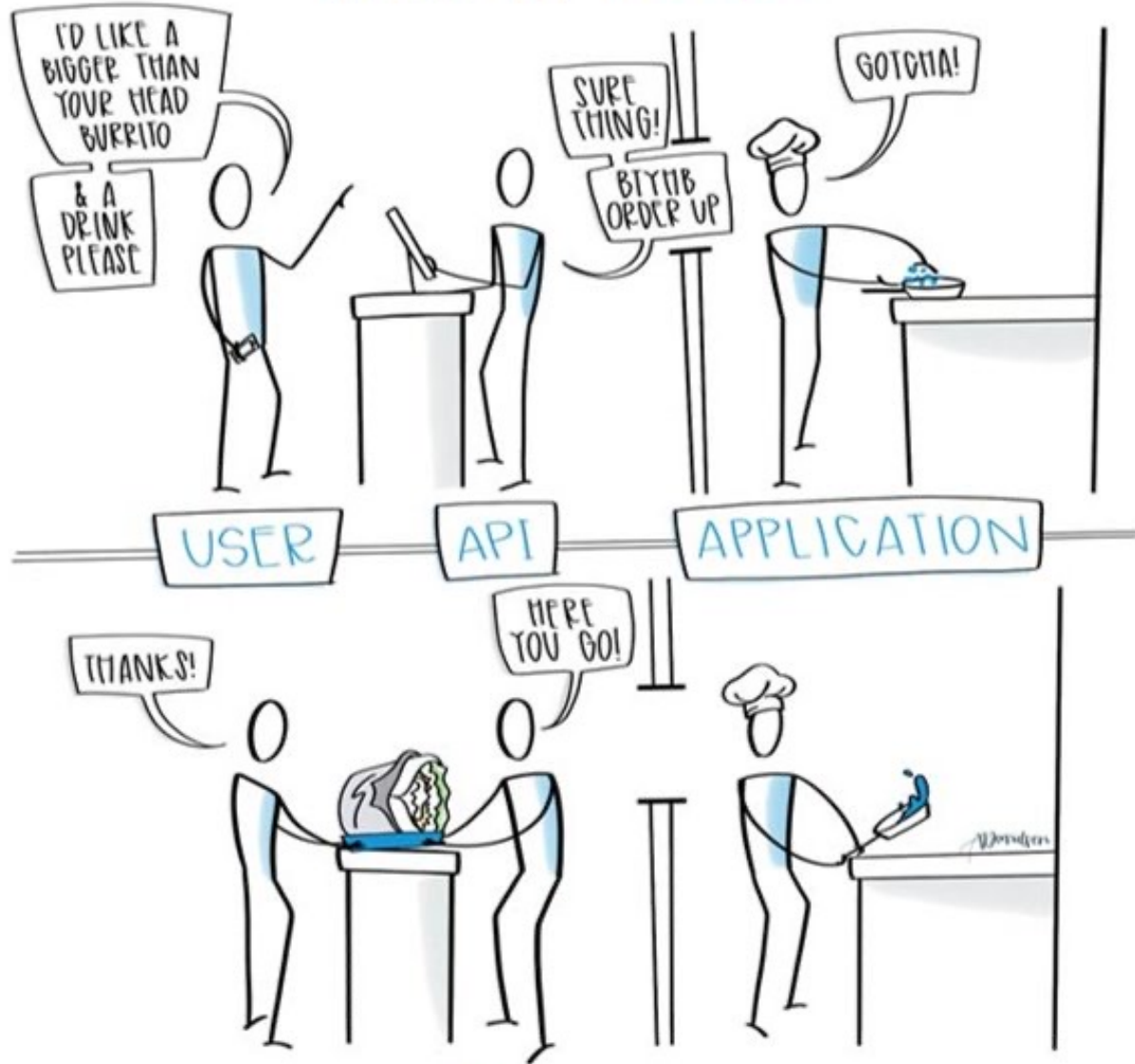
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application

interface

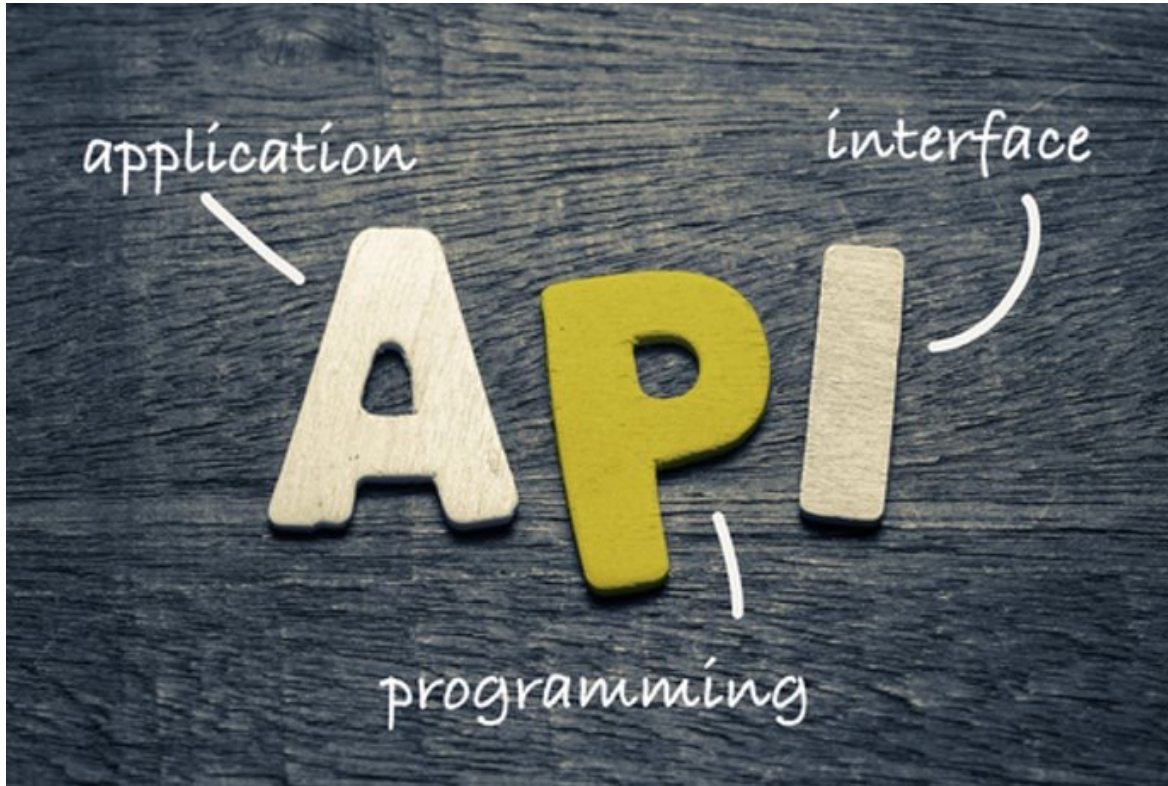
API

# WHAT IS AN API?



## Ordering a Meal

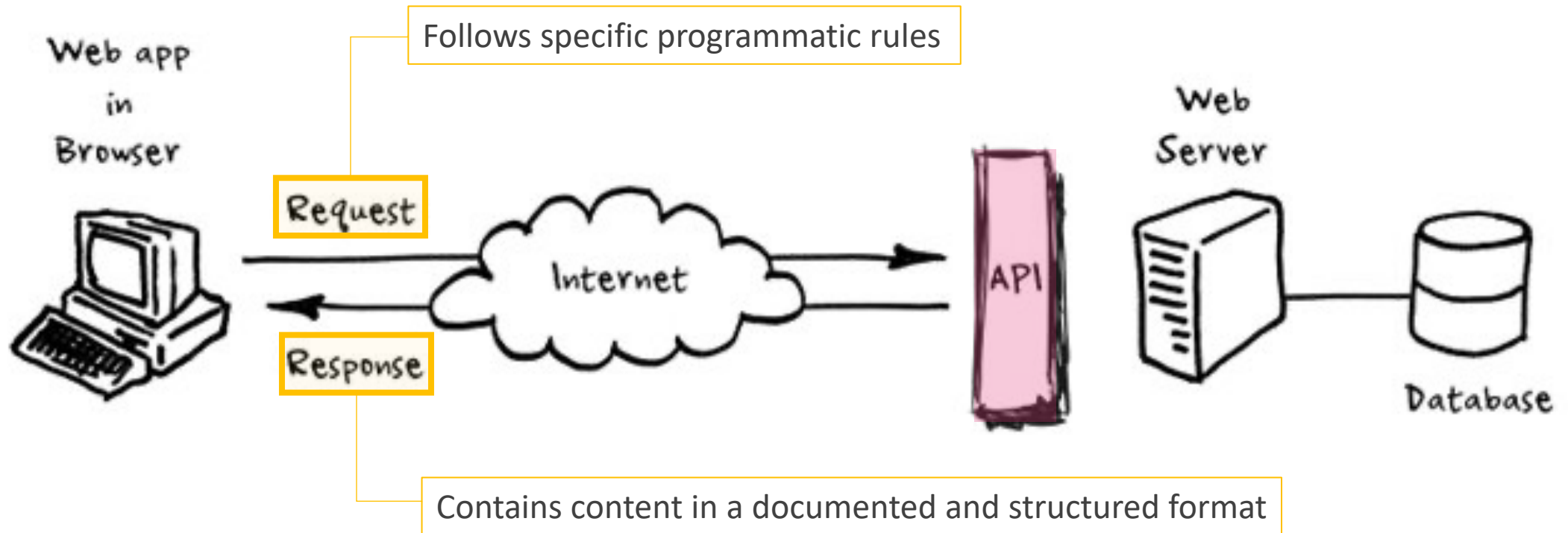
- Customer makes an order
- Server takes down order, processes it, and passes it to cook
- Cook acknowledges order
- Cook makes the order, gives it to the server
- Server gives the customer their order



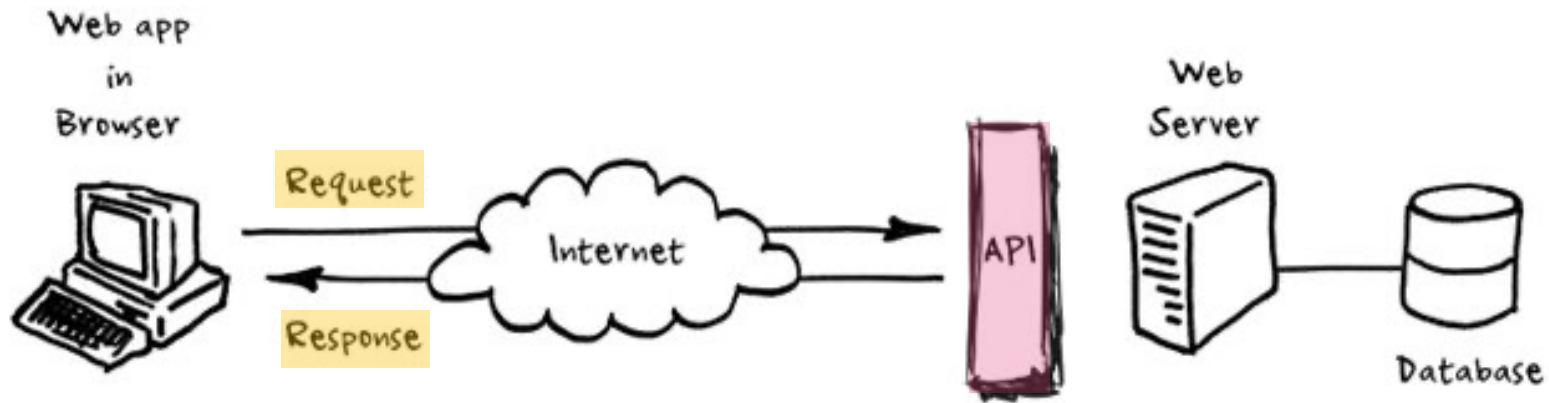
## APIs

- User (client) makes a **request**
- API takes down request, processes it, and passes it to the application
- Application acknowledges request
- Application processes request and signals API
- API returns a **response** to user



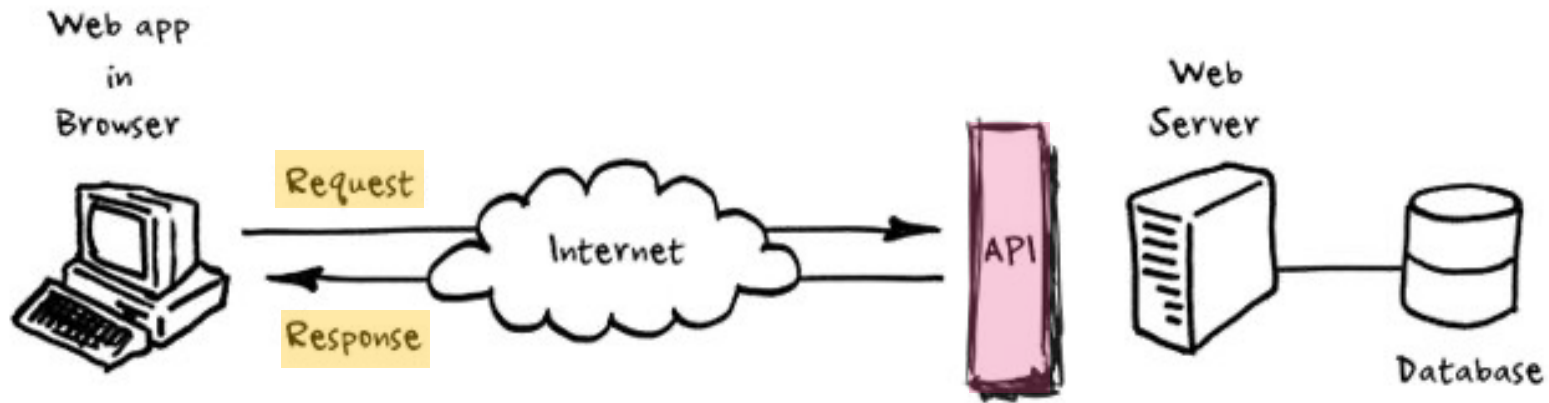






## APIs

- Is **NOT** the database or the server – it is the code that governs the access point(s) for the server
- APIs cover a broad category that includes all interfaces that facilitate communication between computer applications
- We're talking about **Web APIs** – APIs that expose an application's data and functionality over the internet, allowing two computers (the client and the server) to interact with each other to **request** and **provide** data.



### 4 main types of web APIs

1. Open / public APIs – no restrictions to access\*
2. Partner APIs – requires specific rights and/or licenses
3. Internal APIs – designed for internal use within an organization
4. Composite APIs – combines different data and service APIs

\* May need to create an account or request an API key

# Why use an API?

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Search



Advanced Search

All

**Tables**

Maps

Pages

[Microdata](#) [Help](#) [FAQ](#) [Feedback](#)

0 Filters ?



5154 Results



View: 10 | 25 | 50

[Download Table Data](#)

Find a Filter

Search

123 Codes >

Geography >

Surveys >

Topics >

Years >

Decennial Census

**P1 | RACE**

[View All 11 Products](#)

American Community Survey

**S0101 | AGE AND SEX**

[View All 22 Products](#)

American Community Survey

**DP05 | ACS DEMOGRAPHIC AND HOUSING ESTIMATES**

[View All 23 Products](#)

American Community Survey

**S1901 | INCOME IN THE PAST 12 MONTHS (IN 2021 INFLATION-ADJUSTED DOLLARS)**

[View All 22 Products](#)

American Community Survey

**DP03 | SELECTED ECONOMIC CHARACTERISTICS**

[View All 25 Products](#)

Decennial Census

**P2 | HISPANIC OR LATINO, AND NOT HISPANIC OR LATINO BY RACE**

[View All 11 Products](#)

American Community Survey

**DP03 | SELECTED SOCIAL CHARACTERISTICS IN THE HOUSEHOLD**

Decennial Census

**P1 | RACE**

2020: DEC Redistricting Data (PL 94-171) | Universe: Total population



Notes

Geos

Years

Topics

Surveys

Codes

Hide

Transpose

Restore

Excel

CSV

ZIP

Print

More Data

Map

Label	Alabama	Alaska	Arizona
▼ Total:	5,024,279	733,391	7,151,502
▼ Population of one race:	4,767,326	643,867	6,154,696
White alone	3,220,452	435,392	4,322,337
Black or African American alone	1,296,162	21,898	339,150
American Indian and Alaska Native alone	33,625	111,575	319,512
Asian alone	76,660	44,032	257,430
Native Hawaiian and Other Pacific Islander alone	2,984	12,698	16,397
Some Other Race alone	137,443	18,272	899,870
▼ Population of two or more races:	256,953	89,524	996,806
▼ Population of two races:	243,473	81,221	948,897
White; Black or African American	45,429	5,987	60,610
White; American Indian and Alaska Native	79,559	38,129	84,790
White; Asian	18,510	9,815	62,970
White; Native Hawaiian and Other Pacific Islander	1,449	1,599	7,020
White; Some Other Race	80,617	17,735	687,137
Black or African American; American Indian and Alaska Native	6,301	2,039	7,977
Black or African American; Asian	2,049	547	4,320
Black or African American; Native Hawaiian and Other Pacific Islander	492	319	864
Black or African American; Some Other Race	5,421	948	11,926
American Indian and Alaska Native; Asian	266	1,215	1,492

```
# read in csv
```

```
acsDat1 <- read.csv("acsst5y2017_20210119.csv", header=T, na.strings=c("", "NA"))
```

# Why Use an API

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## Get data directly from the source

- Data pulled from an API is usually formatted to be usable with some cleaning
- Get access to **most recent, up-to-date data**

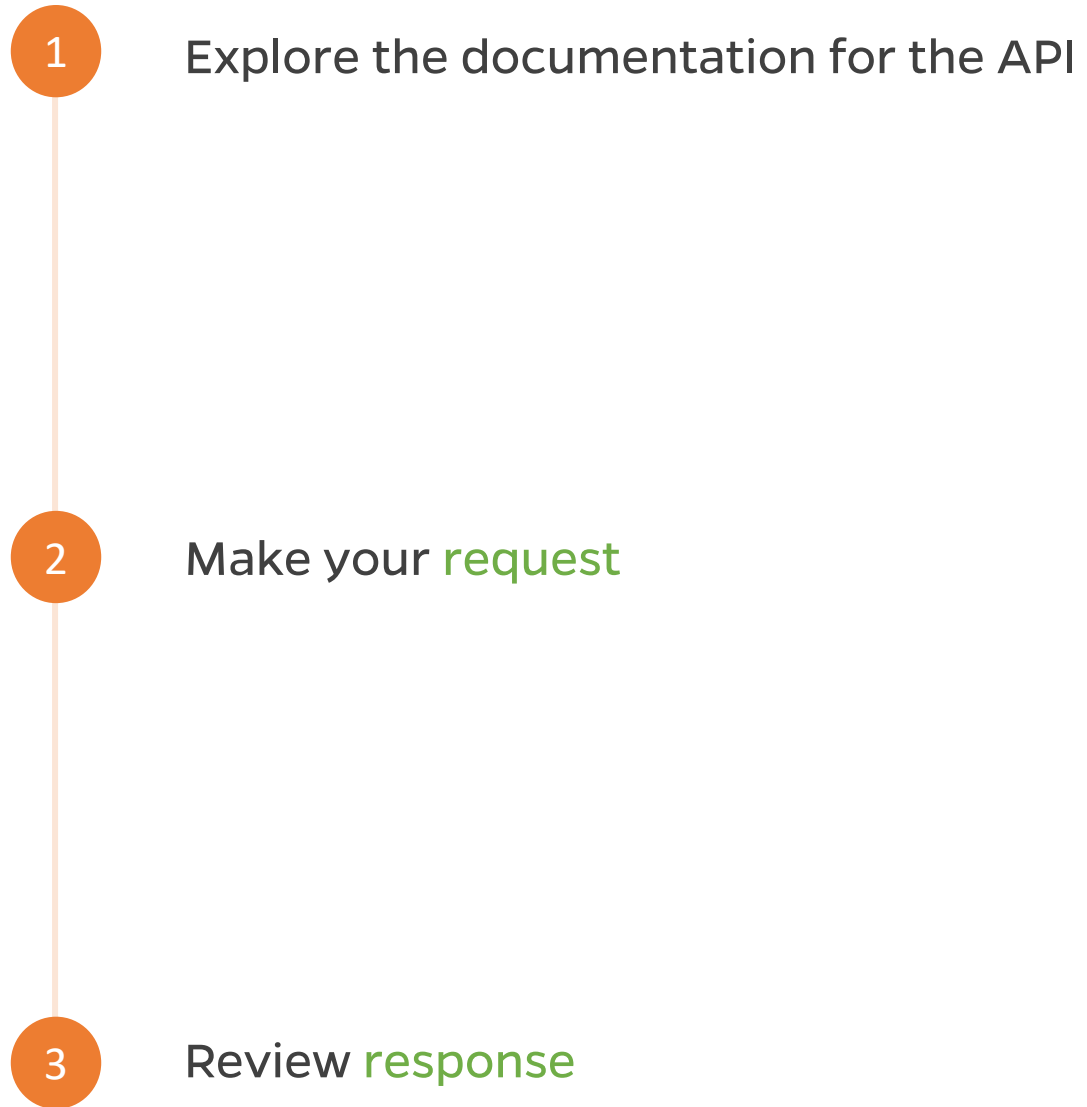
## Integrate and automate your data collection workflow

- APIs can let you forgo the process of manually downloading datasets from a website, managing the data in a file management system, and loading it into the software you are using for analysis.

# Getting Started

A thick, hand-drawn style orange line that spans the width of the title text below it.

The general workflow





1

## Explore the documentation for the API

- Do they supply an API that does what you're looking for?
- Review the process for getting access to the API:
  - Do you need to apply / create an account?
  - Applying for an **API key** – unique identifier to authenticate your particular requests
  - Query limits (if any)

2

## Make your request

3

## Review response

United States<sup>®</sup>  
Census Bureau

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Search data, events, resources, and more Q

// Census.gov / Data / Developers / Available APIs

**Available APIs**

Share f t in  
Facebook Twitter LinkedIn

We plan on adding more of our publicly available datasets. Here you'll find which of our many data sets are currently available via API. To make specific requests for the release of datasets, please sign up and submit your requests on our [Developer Forum](#).

NEW: We now have a machine-readable dataset discovery service available in beta release. Visit our [Discovery Tool](#) page to learn more

EXPAND ALL | COLLAPSE ALL

- ⊖ American Community Survey (ACS)
- ⊖ Decennial Census
- ⊖ Economic Census
- ⊖ Population Estimates and Projections
- ⊖ Health Insurance Statistics
- ⊖ Poverty Statistics
- ⊖ Annual Business Survey (ABS)

**Request a KEY**

<https://www.census.gov/data/developers/data-sets.html>

1

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  - Query limits (if any)

2

## Make your **request**

- Identify the URI/URL (uniform resource identifier/locator)
- Prepare your query
- Send a **GET request** to the API

3

## Review **response**

- Parse through and clean response
- Convert response to a dataframe

# Explore the US Census API

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# US Census Data API

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- <https://www.census.gov/data/developers/guidance.html>
- Available data
  - American Community Survey (ACS), Economic Indicators Time Series, Decennial Census, Economic Census, County Business Patterns and Nonemployer Statistics, Population Estimates and Projections, International Trade, etc...
- Query small quantities of data (up to 50 variables in a single query, and up to 500 queries per IP address per day)
  - To make more than 500 queries per IP address per day, request an **API key**

# Creating Queries in a Web Browser

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[https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE\\_DESC&DATE\\_CODE=11&RACE=10&for=county:\\*&in=state:24](https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE_DESC&DATE_CODE=11&RACE=10&for=county:*&in=state:24)

# Creating Queries in a Web Browser

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[https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE\\_DESC&DATE\\_CODE=11&RACE=10&for=county:\\*&in=state:24](https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE_DESC&DATE_CODE=11&RACE=10&for=county:*&in=state:24)



1. Start with the host name

# Creating Queries in a Web Browser

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[https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE\\_DESC&DATE\\_CODE=11&RACE=10&for=county:\\*&in=state:24](https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE_DESC&DATE_CODE=11&RACE=10&for=county:*&in=state:24)

↑  
1. host name

2. Add dataset name  
(list available at <https://api.census.gov/data.html>)



# Creating Queries in a Web Browser

---

`https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE_DESC&DATE_CODE=11&RACE=10&for=county:*&in=state:24`

1. host name

2. Add dataset name  
(list available at <https://api.census.gov/data.html>)

3. Add variable requests  
using ?get=

# Creating Queries in a Web Browser

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1. host name

2. Add dataset name  
(list available at <https://api.census.gov/data.html>)

3. Add variable requests  
using ?get=

4. Filter variables  
using &for=

# Creating Queries in a Web Browser

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[https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE\\_DESC&DATE\\_CODE=11&RACE=10&for=county:\\*&in=state:24](https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE_DESC&DATE_CODE=11&RACE=10&for=county:*&in=state:24)

1. host name

2. Add dataset name  
(list available at <https://api.census.gov/data.html>)

3. Add variable requests  
using ?get=

4. Filter variables  
using &for=

5. If needed, add your  
key using &key=

[Click here to see RESULT](#)

# Creating Queries in a Web Browser

[https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE\\_DESC&DATE\\_CODE=11&RACE=10&for=county:\\*&in=state:24](https://api.census.gov/data/2018/pep/charagegroups?get=POP,GEONAME,DATE_DESC&DATE_CODE=11&RACE=10&for=county:*&in=state:24)

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- Making queries in your browser is a good way to practice and get comfortable with the variables and filters available in the Census Data API
- Works best on Chrome or Firefox
  - Use an extension like JSON Formatter, JSON Viewer, or JSONView to make JSON easier to read in your browser
- In web browser, right-click and select “Save As” to save results as a csv
- Sample queries:

[https://www.census.gov/data/developers/guidance/api-user-guide.Example\\_API\\_Queries.html](https://www.census.gov/data/developers/guidance/api-user-guide.Example_API_Queries.html)

# Demo 1

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Using `httr` and `jsonlite`

# Demo 2

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Using `censusapi`

# censusapi

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- [Link](#)
- R wrapper for US Census Data API.
- Covers more datasets than **tidycensus** (another R package for US Census data)
- Returns data frames of census data AND **metadata**



# Other Demos

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- rjsonio demo:
  - [RJSONIO](#) – a package that converts data to and from JSON format
  - Similar to using httr and jsonlite
- tidycensus demo:
  - [Tidycensus](#) - an integrated package that allows users to access decennial census and ACS data as tidyverse-ready data frames.
  - Offers access to less datasets than censusapi:

*The main intent of the tidycensus package is to return population characteristics of the United States in tidy format allowing for integration with simple feature geometries. Its intent is not, and has never been, to wrap the universe of APIs and datasets available from the US Census Bureau.*
  - [Walkthrough](#)

# Thank you!

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