

# Introduction to APIs In R

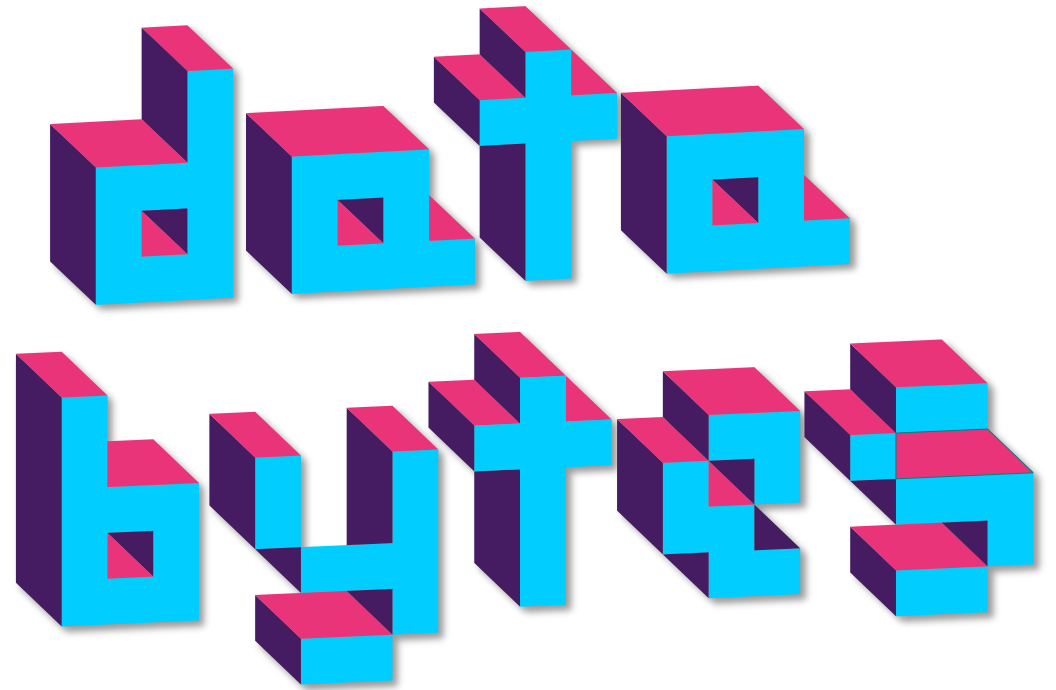
Reina Chano Murray

JHU Data Services

 [github.com/jhu-data-services](https://github.com/jhu-data-services)

 [dataservices.library.jhu.edu](https://dataservices.library.jhu.edu)

 [dataservices@jhu.edu](mailto:dataservices@jhu.edu)

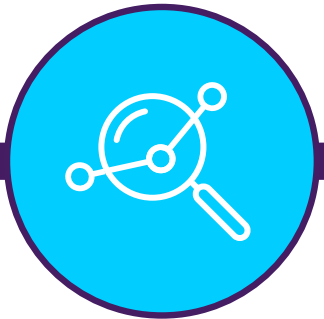


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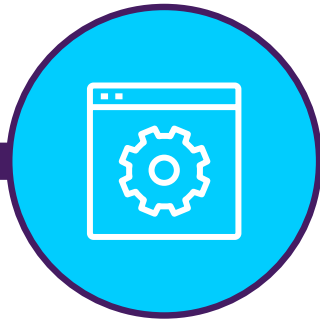


# JHU Data Services

WE HELP FACULTY, RESEARCHERS AND STUDENTS:



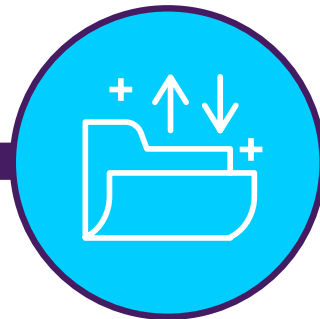
**FIND**



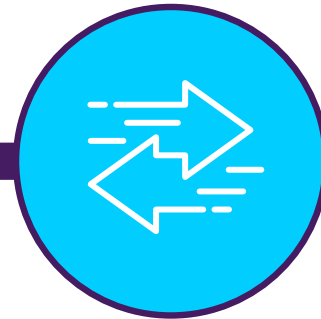
**USE**



**VISUALIZE**



**MANAGE**



**SHARE**



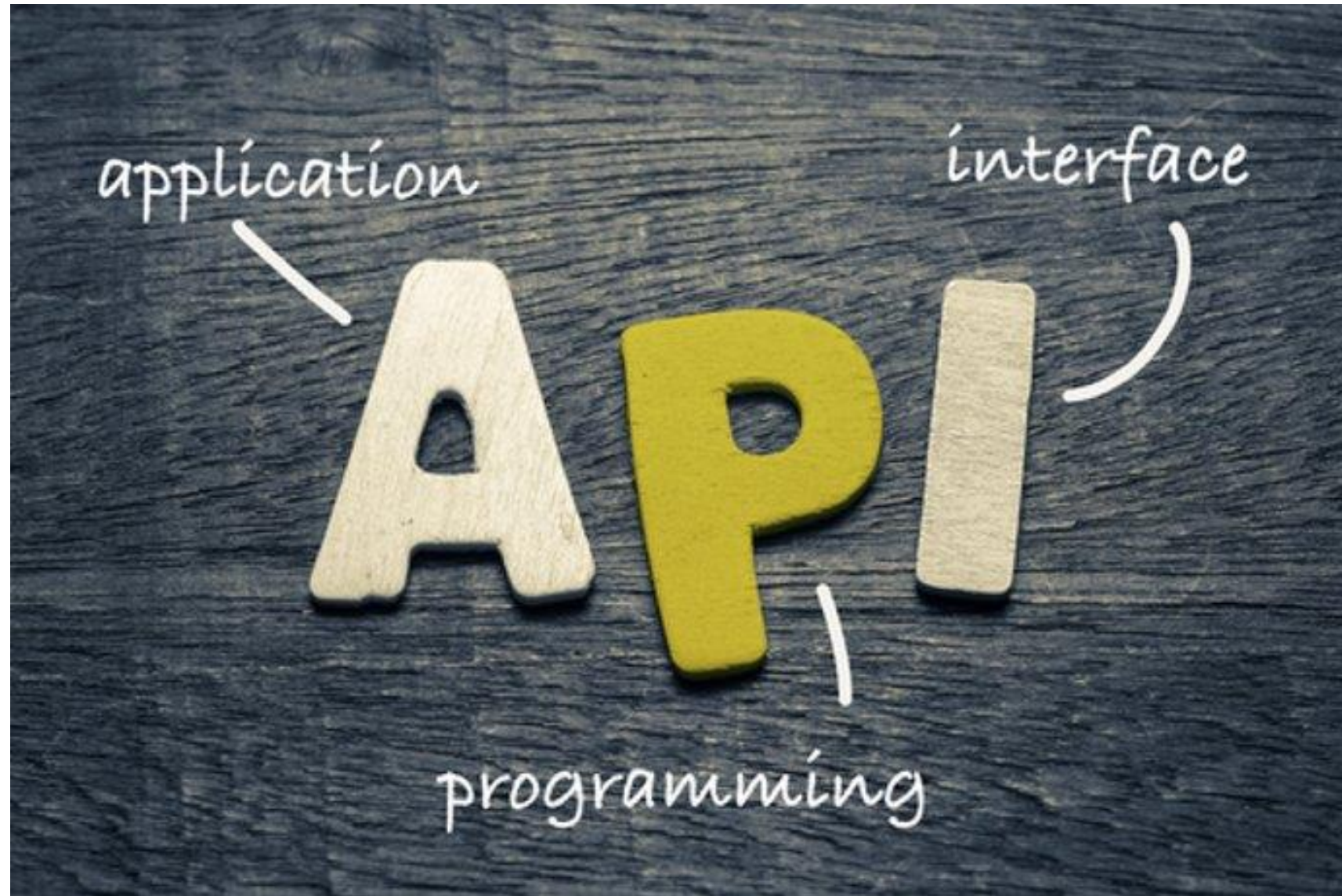
**DATA**

# Agenda

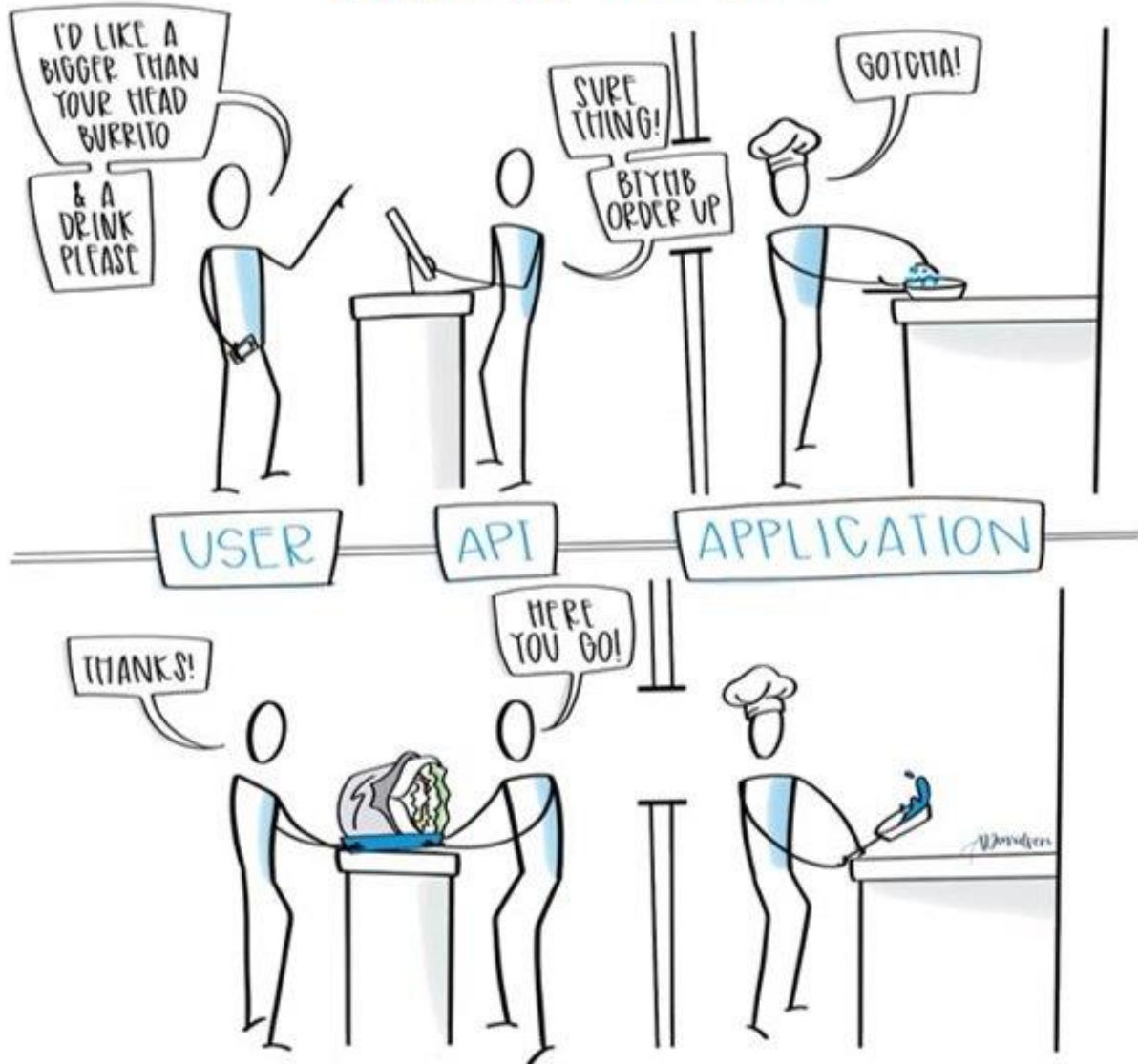
- Introduction to APIs
  - What are they?
  - Why use them?
- Getting started with APIs
  - What you need
- Demonstrations with U.S. Census Bureau APIs



# Introduction to APIs



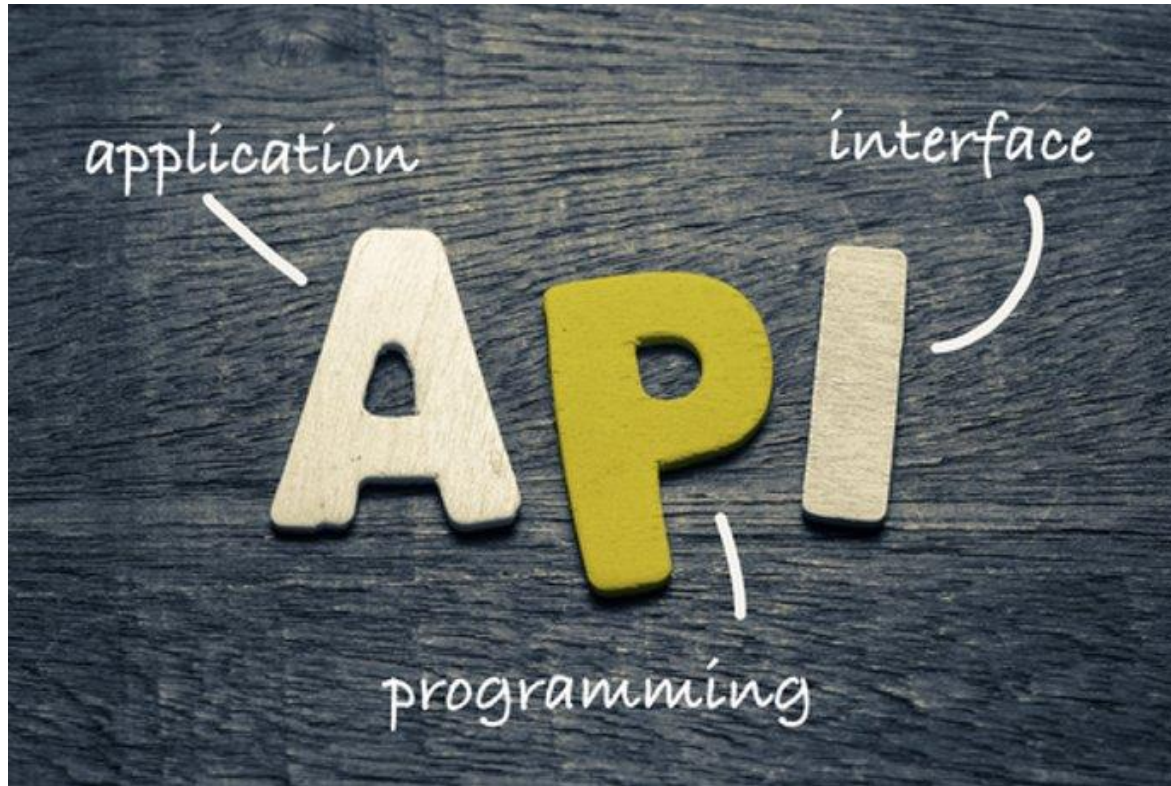
# WHAT IS AN API?



## Ordering a Meal

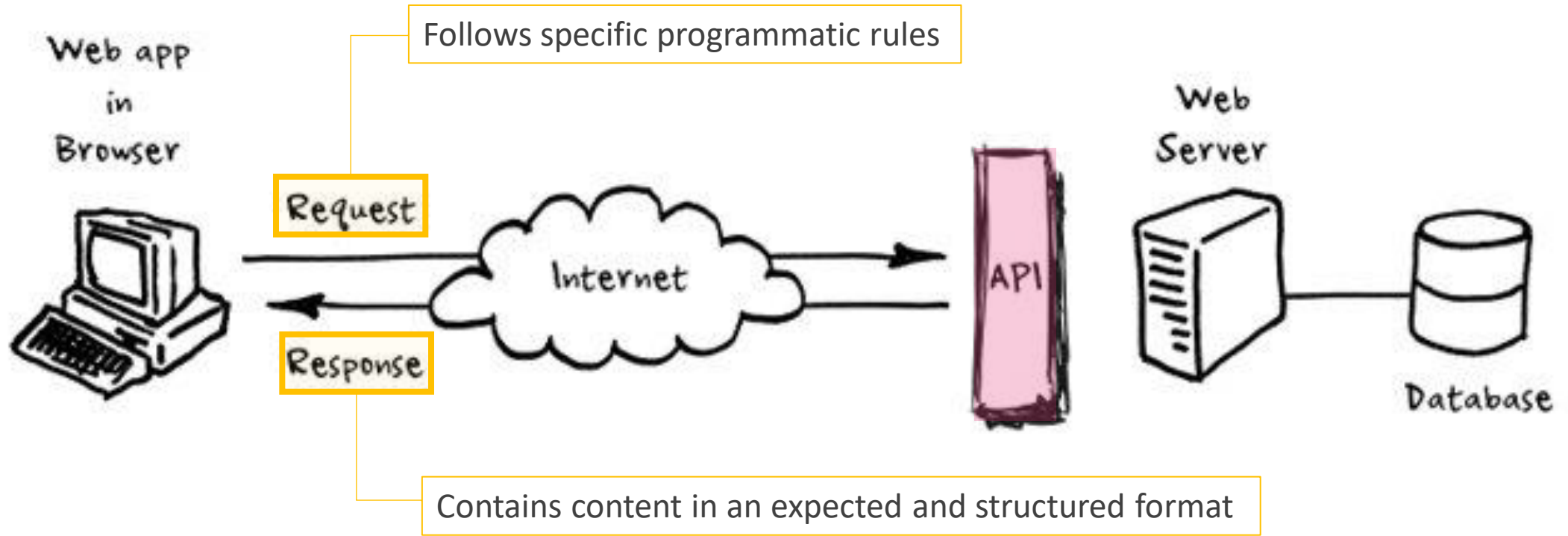
- Customer makes an order
- Server takes down order, processes it, and passes it to cook
- Cook acknowledges order
- Cook makes the order and gives it to the server
- Server gives the customer their order



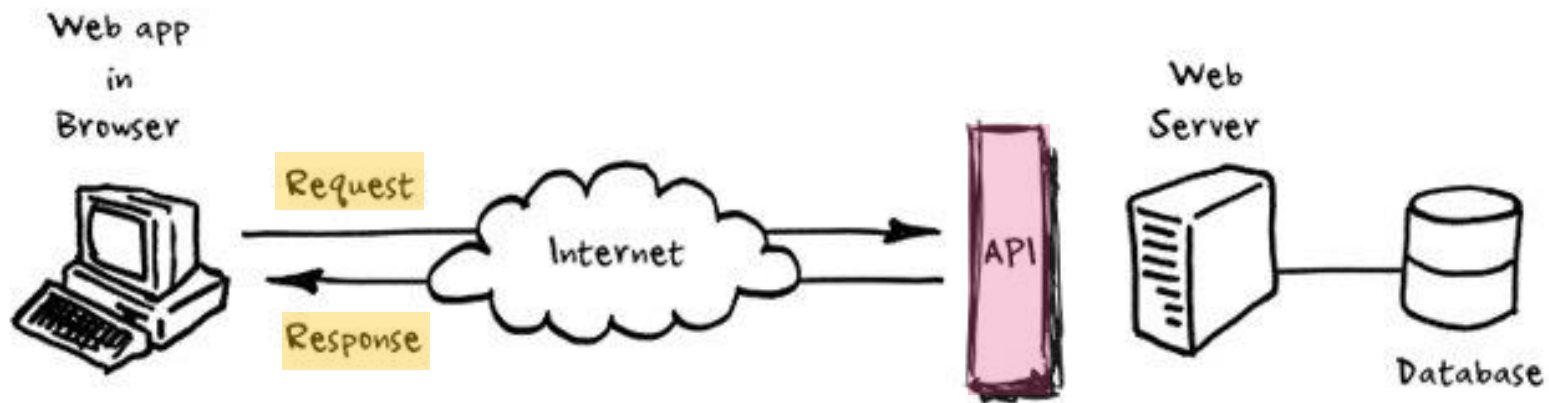


## APIs

- 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

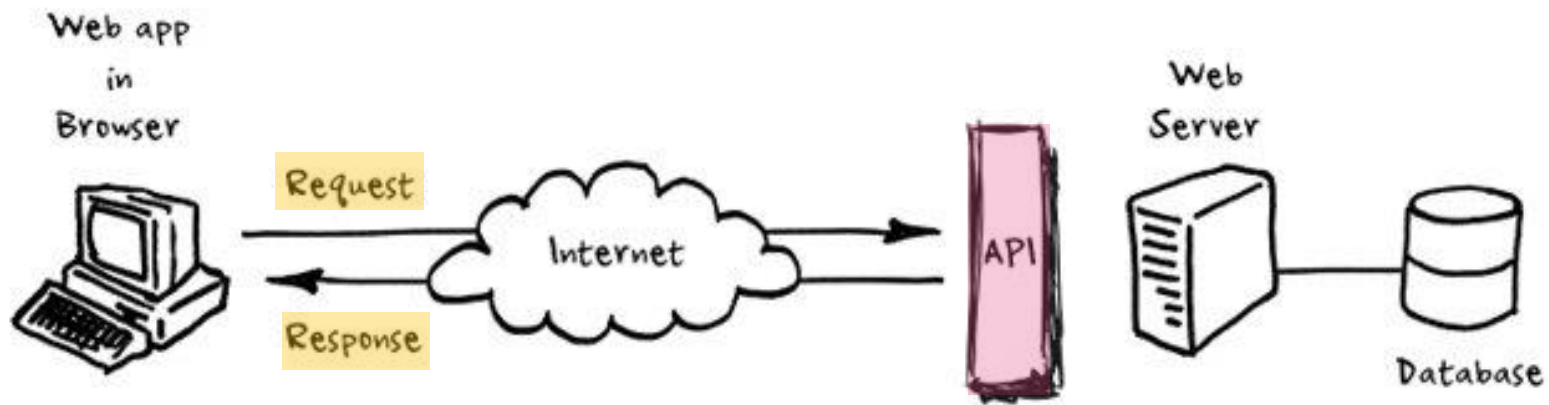






## APIs

- 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

# Why Use an API?

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	84,795
White; Asian	18,510	9,815	62,975
White; Native Hawaiian and Other Pacific Islander	1,449	1,599	7,025
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	4,322
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"))
```

# APIs for Research

- **Get clean and curated data directly from a source**
  - Data pulled from an API is usually formatted to be immediately usable (or can be formatted with some data 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 download datasets from a website, managing the data in a file management system, and loading it into the software you are using for analysis.

# Working with an API





1 Explore the documentation for the API

2 Make your **request**

3 Review **response**

1

## Explore the documentation for the API

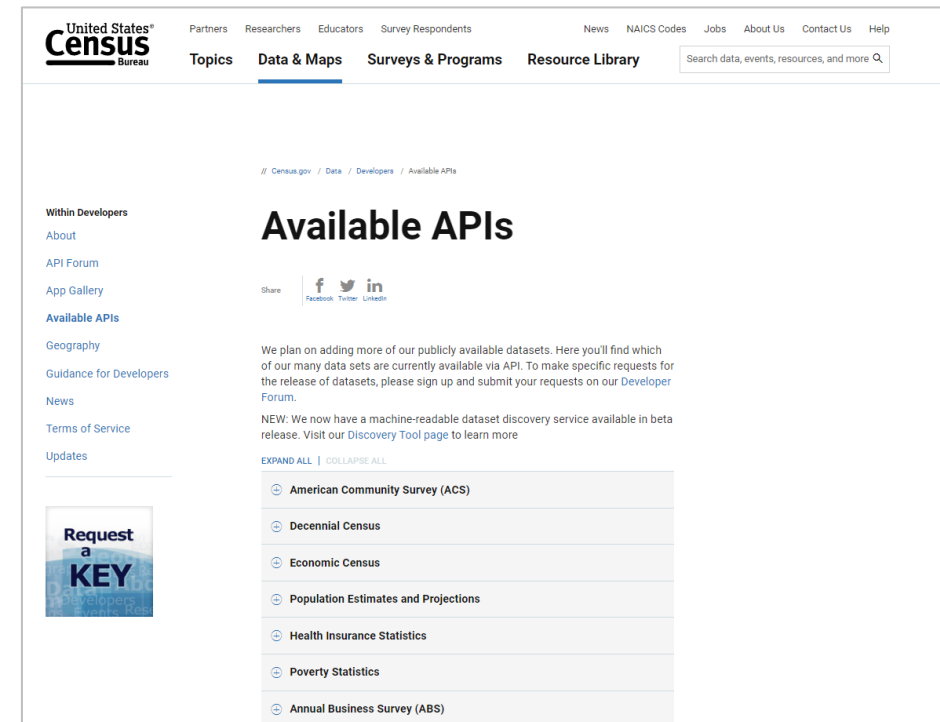
- Do they supply an API that does what you're looking for?
- Review the process for getting access to the API:
  - Do you need to apply / create an account?
  - Applying for an **API key** – unique identifier to authenticate your particular requests
  - Query limits (if any)

2

## Make your request

3

## Review response



The screenshot displays the 'Available APIs' page from the United States Census Bureau. The page features a navigation bar at the top with links for 'Partners', 'Researchers', 'Educators', 'Survey Respondents', 'News', 'NAICS Codes', 'Jobs', 'About Us', 'Contact Us', and 'Help'. Below the navigation bar, there are tabs for 'Topics', 'Data & Maps', 'Surveys & Programs', and 'Resource Library'. The main content area is titled 'Available APIs' and includes a sidebar on the left with links for 'Within Developers', 'About', 'API Forum', 'App Gallery', 'Available APIs', 'Geography', 'Guidance for Developers', 'News', 'Terms of Service', and 'Updates'. The main content area contains a section for 'Available APIs' with a list of APIs: American Community Survey (ACS), Decennial Census, Economic Census, Population Estimates and Projections, Health Insurance Statistics, Poverty Statistics, and Annual Business Survey (ABS). A 'Request a KEY' button is visible in the sidebar.

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**

- Prepare the URL
- Query the API

3

## Review **response**

- Get the response
- Convert response to a dataframe

# US Census Data API

- <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 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)

# Creating Queries in a 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)



1. Start with the host name



# Creating Queries in a 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>)

# Creating Queries in a 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 Browser

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

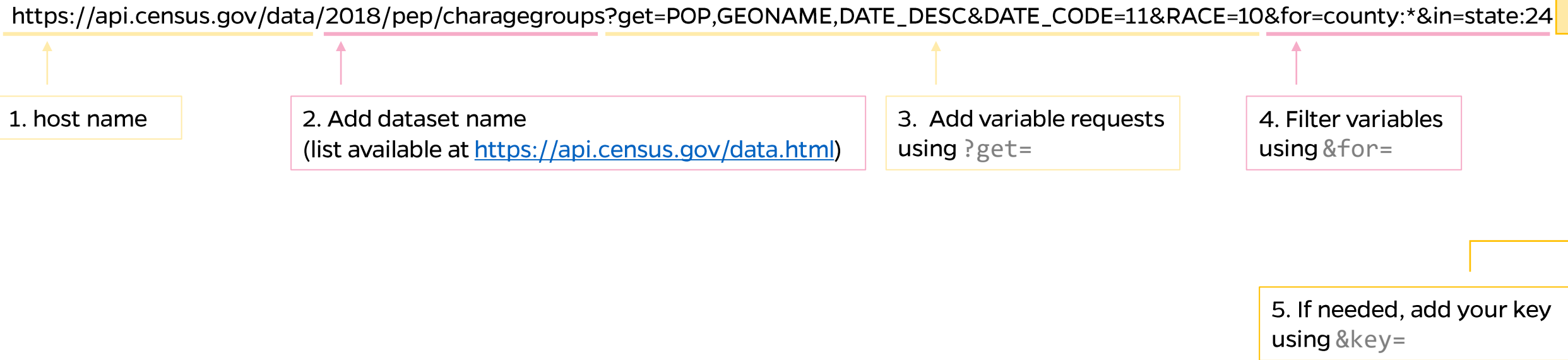
1. host name

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

3. Add variable requests  
using ?get=

4. Filter variables  
using &for=

# Creating Queries in a Browser



[Click here to see RESULT](#)

# Creating Queries in a 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)

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=

- 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
- 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)

# Demonstrations



# Demo 1

- Install and load [RJSONIO](#) – a package that converts data to and from JSON format
- Structure mimics creating API queries in a browser
- Works – but tedious. You need to make sure you understand the structure of your data well, and convert JSON to R objects.

# Demo 2

- [tidycensus](#): an integrated package that allows users to access decennial census and ACS data as tidyverse-ready data frames.
- [tidyverse](#): collection of R packages designed for data science.  
(come to our other R workshops to learn more about this collection)



## R packages for data science

The tidyverse is an opinionated collection of R packages designed for data science. All packages share an underlying design philosophy, grammar, and data structures.

Install the complete tidyverse with:

```
install.packages("tidyverse")
```

# Demo 3

- [censusapi](#): R wrapper for US Census Data API.
- Covers more datasets than tidycensus.
- Returns data frames of census data **and metadata** for Decennial, ACS, Small Area Health Insurance Estimates, Small Area Income and Poverty Estimates, Population Estimates and Projections, etc.

# Fall 2022 Data Bytes Schedule

*All sessions are on Mondays from 12 to 1 pm.*

**Finding Maps and Map Data**

Sept 12<sup>th</sup>

**Choosing a Python IDE**

Sept 19<sup>th</sup>

**Creating Infographics in  
Business Analyst**

Sept 26<sup>th</sup>

**Debugging your Python Code**

Oct 3<sup>rd</sup>

**Speeding up your Python Code**

Oct 10<sup>th</sup>

**Introduction to Leaflet**

Oct 17<sup>th</sup>

**Advanced StoryMaps  
Tips and Tricks**

Oct 24<sup>th</sup>

**Introduction to APIs in R**

Oct 31<sup>st</sup> 

**GIS and Maps  
Programming**

More info at:

[bit.ly/data-bytes](https://bit.ly/data-bytes)

**Thank you  
for attending!**

Please complete  
our survey at:

[bit.ly/data-bytes-  
survey](https://bit.ly/data-bytes-survey)

# Questions?