APIs & Plumber

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Prerequisite software install

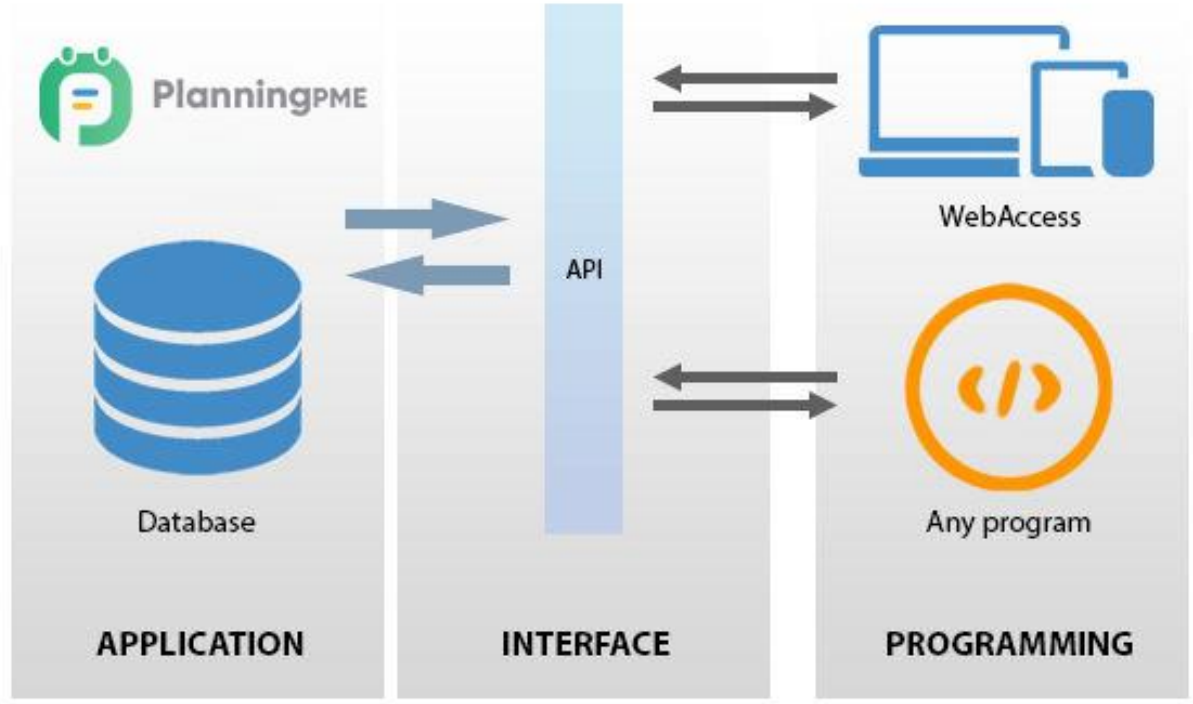
- Download
  - https://github.com/OllyButters/HDS-plumber/archive/refs/heads/main.zip
- RStudio
- R libraries (install.packages)
  - httr
  - jsonlite
  - plumber
  - gapminder
  - png

Session overview

- What is an API, where are they used? (~25 mins)
- Exercise - Two R examples of using existing external APIs. (~15 mins)
- Introduction to plumber. (~15 mins)
- Exercise - Write some plumber code. (~30 mins)
- Final comments. (~5 mins)

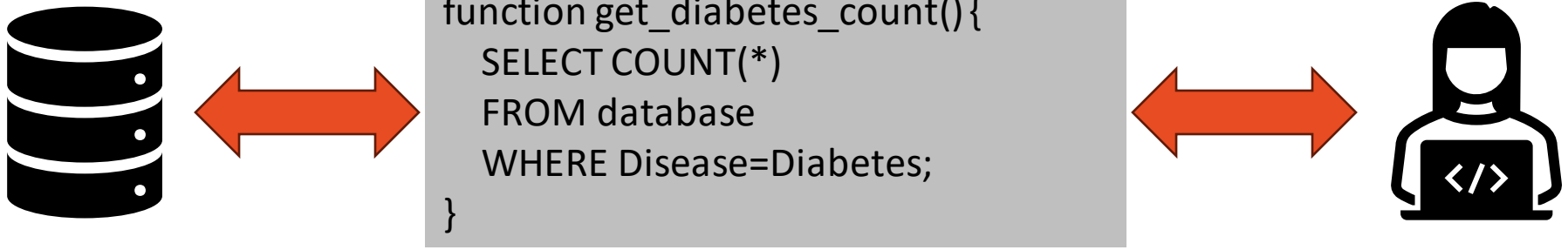
What is an API?

- Application Programming Interface.



https://www.planningpme.com/planningpme-api.htm

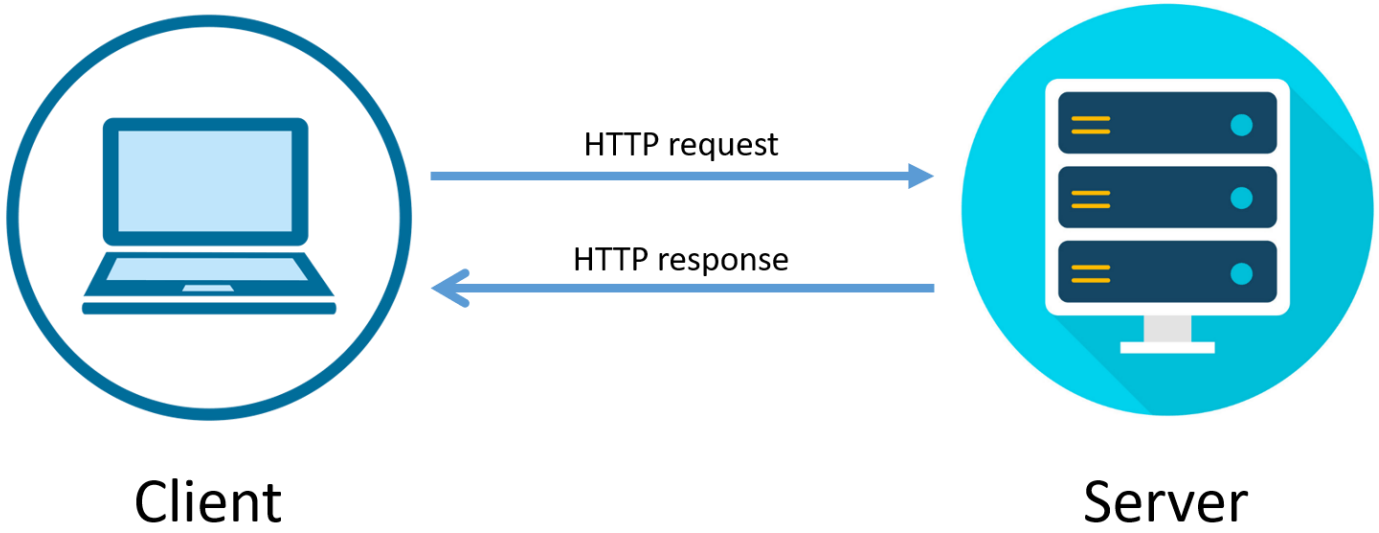
Steps towards an API



```
function get_diabetes_count(){
    SELECT COUNT(*)
    FROM database
    WHERE Disease=Diabetes;
}
```

Name	ID	Disease
John	2345	Diabetes
Jane	7853	Asthma
Judy	1337	Diabetes
Joe	8867	COPD

API messaging

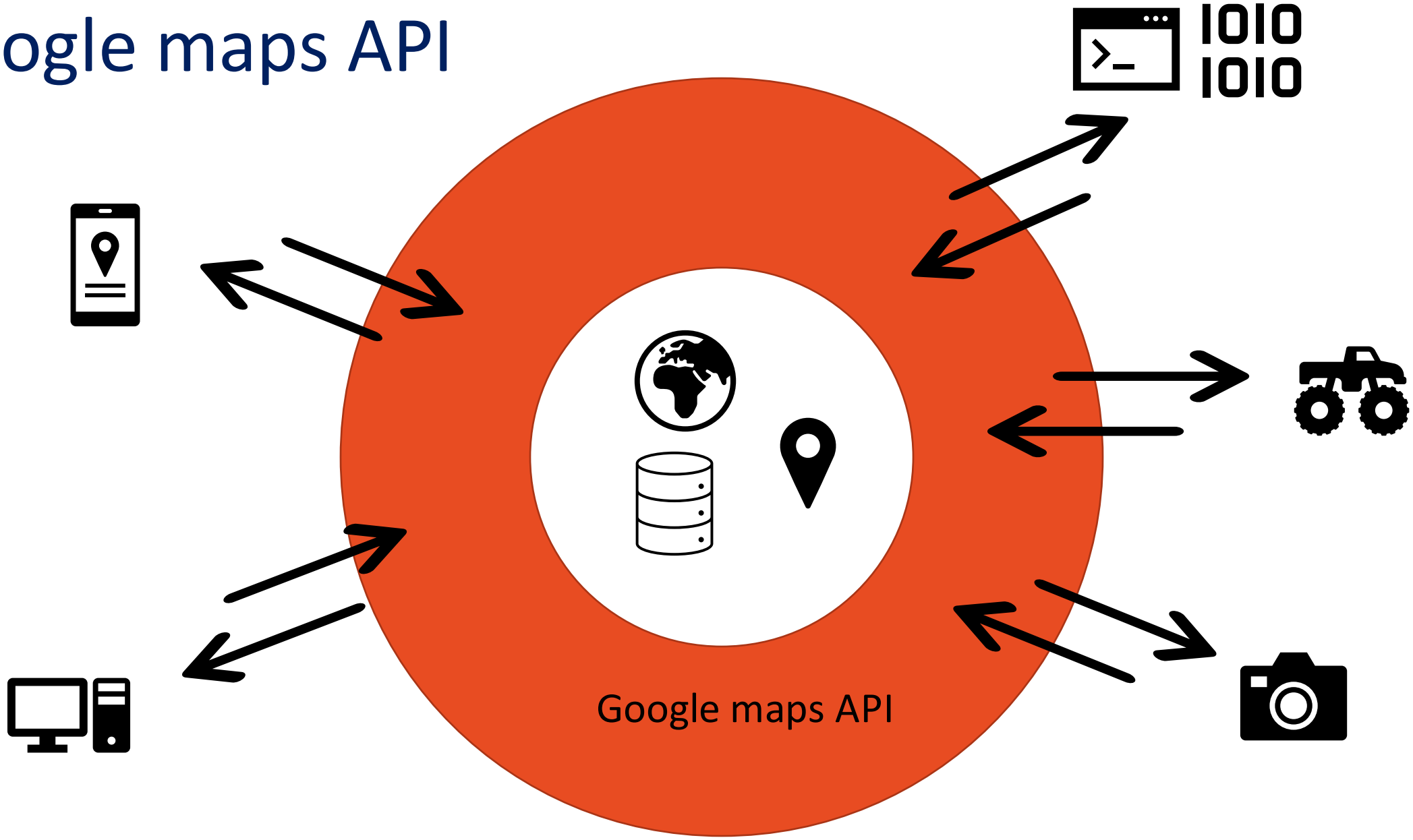


https://bytesofgigabytes.com/networking/how-http-request-and-response-works/

Why bother?

- Easier than connecting to underlying applications.
- Can make subset of data/application available.
- Common language.
- Static interface.

Google maps API



Example APIs

Get data

- Google maps
- Wikidata
- Fitbit
- British library
- Data.parliament.uk

Add data

- Twitter
- Facebook
- Instagram

Book appointments

- GP systems
- Restaurants

Manage services

- Amazon Web Services
- Microsoft Azure

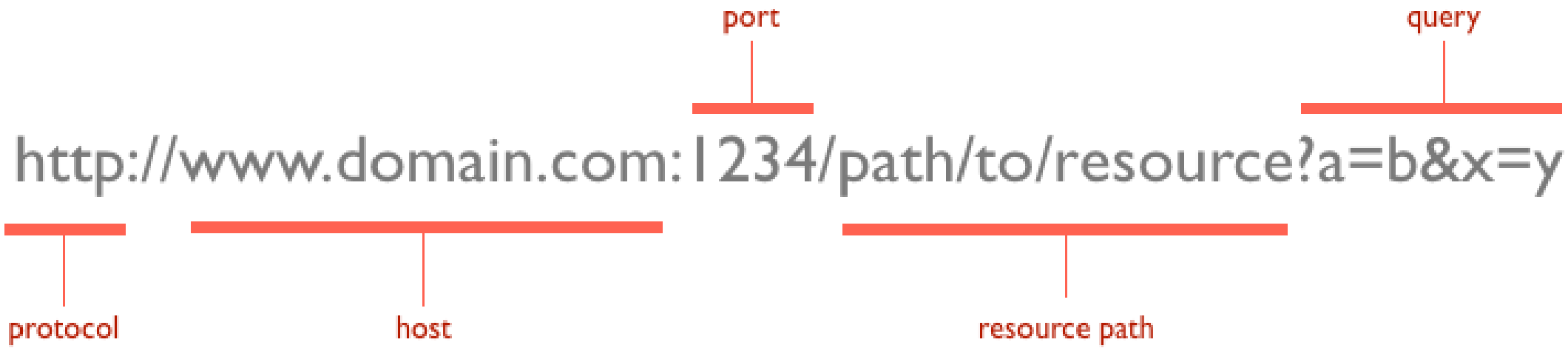
Real world interaction

- Google Nest
- Dishwasher
- Burglar alarm

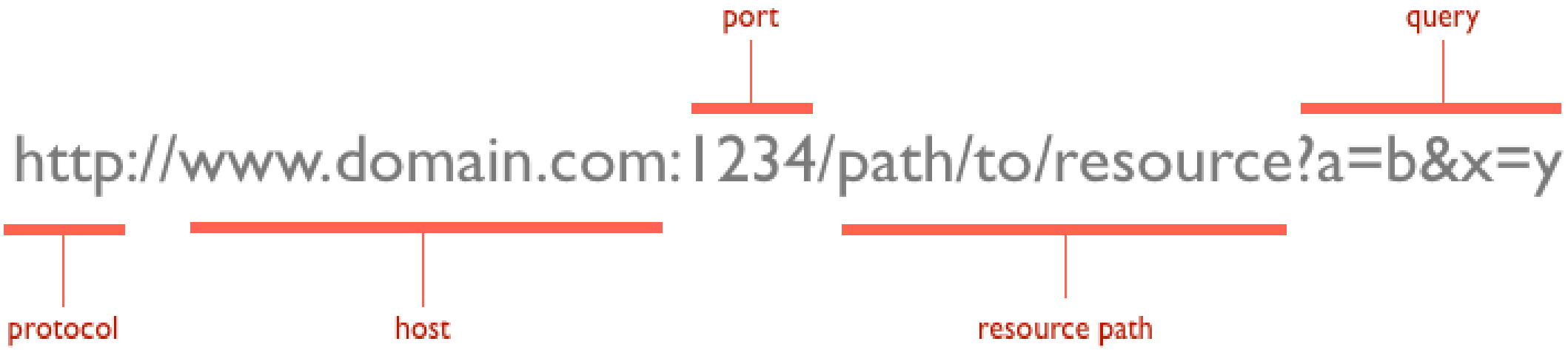
Health data APIs

- Bioportal -> Look up ontologies etc.
- Gov health stats
- NHS Digital -> Loads of APIs to find/get/add data
- Air quality.
- UK government API catalogue
- Urban Observatory
- https://data.police.uk/docs/
- Care Quality Commission -> locations of care homes

Anatomy of a query URL (the request)



Anatomy of a query URL (the request)



Pavement	Liver building	Flat number 3	Kitchen/cupboard/get_mug	colour=red
Road	Liver building	Garage number 2	Park/car	

Response

- Typically get a header and content in the response
- Response codes in header
  - 200 – OK
  - 404 – Not found
  - 500 – Internal server error
- Content is usually JSON or XML

Google maps elevation API call example

Request: https://maps.googleapis.com/maps/api/elevation/json?locations=39.7391536%2C-104.9847034

Response:


```
{
  "results":
    [
      {
        "elevation": 1608.637939453125,
        "location": { "lat": 39.7391536, "lng": -104.9847034 },
        "resolution": 4.771975994110107,
      },
    ],
  "status": "OK",
}
```

• Exercises 1: How many people are in space right now?

1. https://github.com/OllyButters/HDS-plumber/archive/refs/heads/main.zip
2. Open README.md
3. Open exercise_1_api_who_is_in_space_now.R
4. Run the R file a line at a time (Ctrl-Enter) and read the comments as you do.

Exercise 2: Write your own R script to find out what the UK Covid-19 rate is and plot it

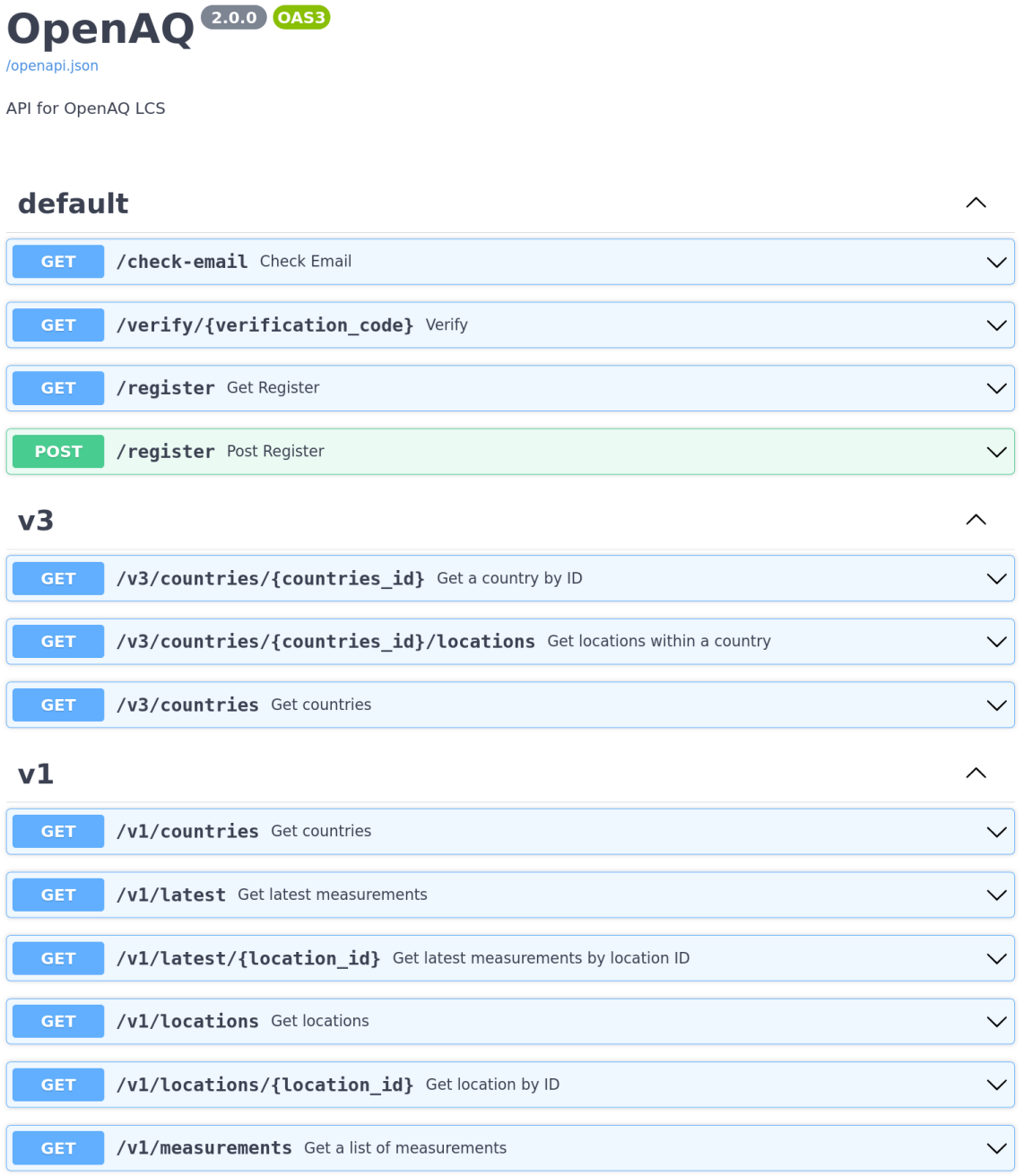
1. Start a new R file called exercise_2_api_covid_rate.R
2. Copy the relevant parts from the first exercise
3. The query URL (the request) is: https://api.coronavirus.data.gov.uk/v1/data?filters=areaType=nation;areaName=england&structure={"date":"date","newCases":"newCasesByPublishDate"
4. Can copy URL from the README.md file.
5. Get the data from the API and plot it.
6. If you get really stuck you can look at exercise_2_api_covid_answer.R

Exercise 1 & 2 summary

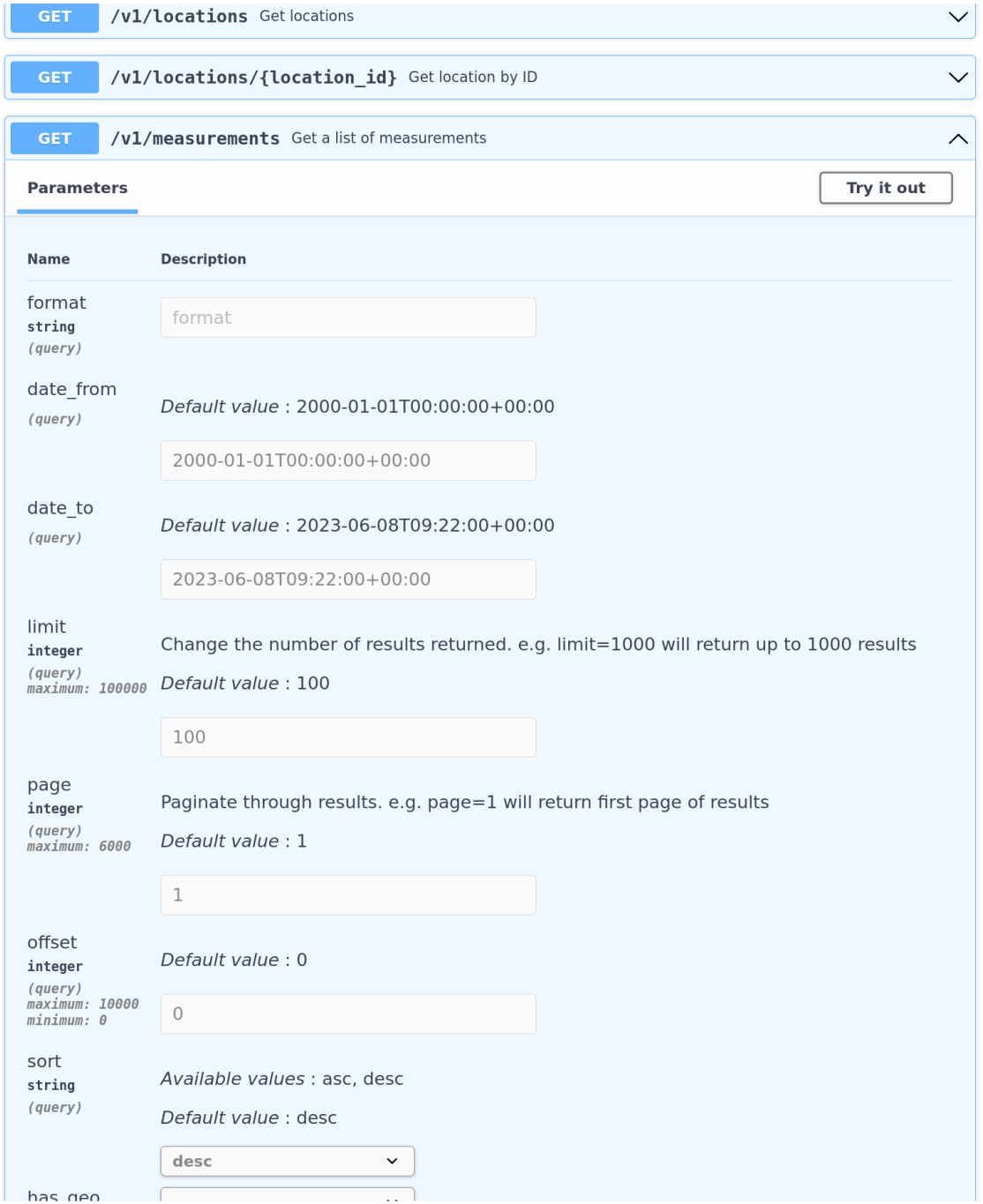
- Used two APIs to get data from remote services.
- Now we are going to build our own APIs and connect to them in a similar way.

Swagger

- Web tool to help explore and use compliant APIs
- https://api.openaq.org/



Swagger


GET /v1/locations Get locations
GET /v1/locations/{location_id} Get location by ID
GET /v1/measurements Get a list of measurements
Parameters
Try it out
Name
Description
format
string
(query)
format
date_from
(query)
Default value : 2000-01-01T00:00:00+00:00
2000-01-01T00:00:00+00:00
date_to
(query)
Default value : 2023-06-08T09:22:00+00:00
2023-06-08T09:22:00+00:00
limit
integer
(query)
maximum: 100000
Change the number of results returned. e.g. limit=1000 will return up to 1000 results
Default value : 100
100
page
integer
(query)
maximum: 6000
Paginate through results. e.g. page=1 will return first page of results
Default value : 1
1
offset
integer
(query)
maximum: 10000
minimum: 0
Default value : 0
0
sort
string
(query)
Available values : asc, desc
Default value : desc
desc

Decorators

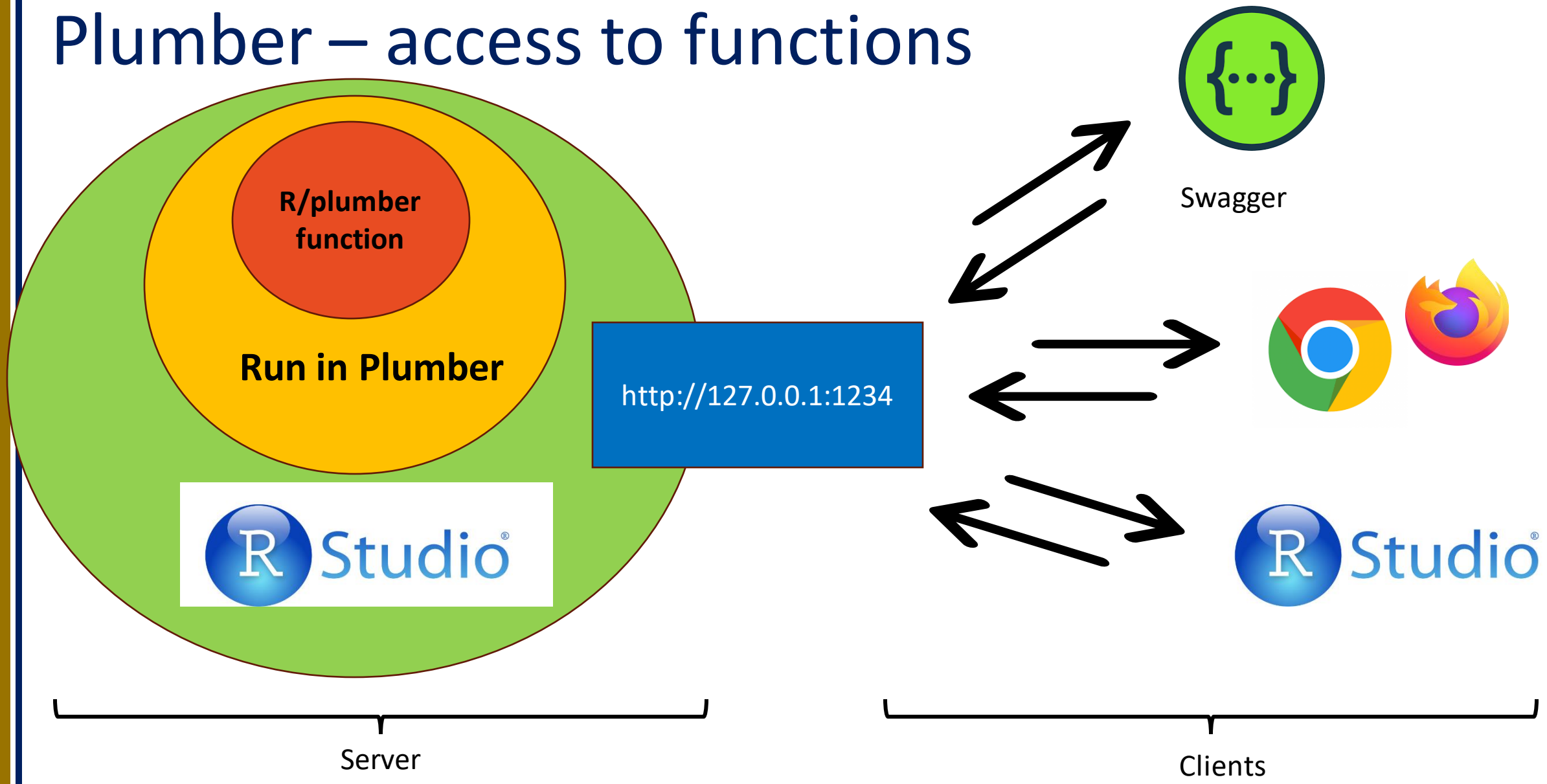
- Decorators let you modify function behaviour without modifying the function code!
- Start with a # so ignored most of the time.
- Common in other languages.

```
#. I am a decorator
my_function <- function()
{
   #do awesome stuff
}
```

Plumber function

```
#* Return the square of a number
#* @param a The number to square
#* @get /square
function(a) {
   as.numeric(a) * as.numeric(a)
}
```

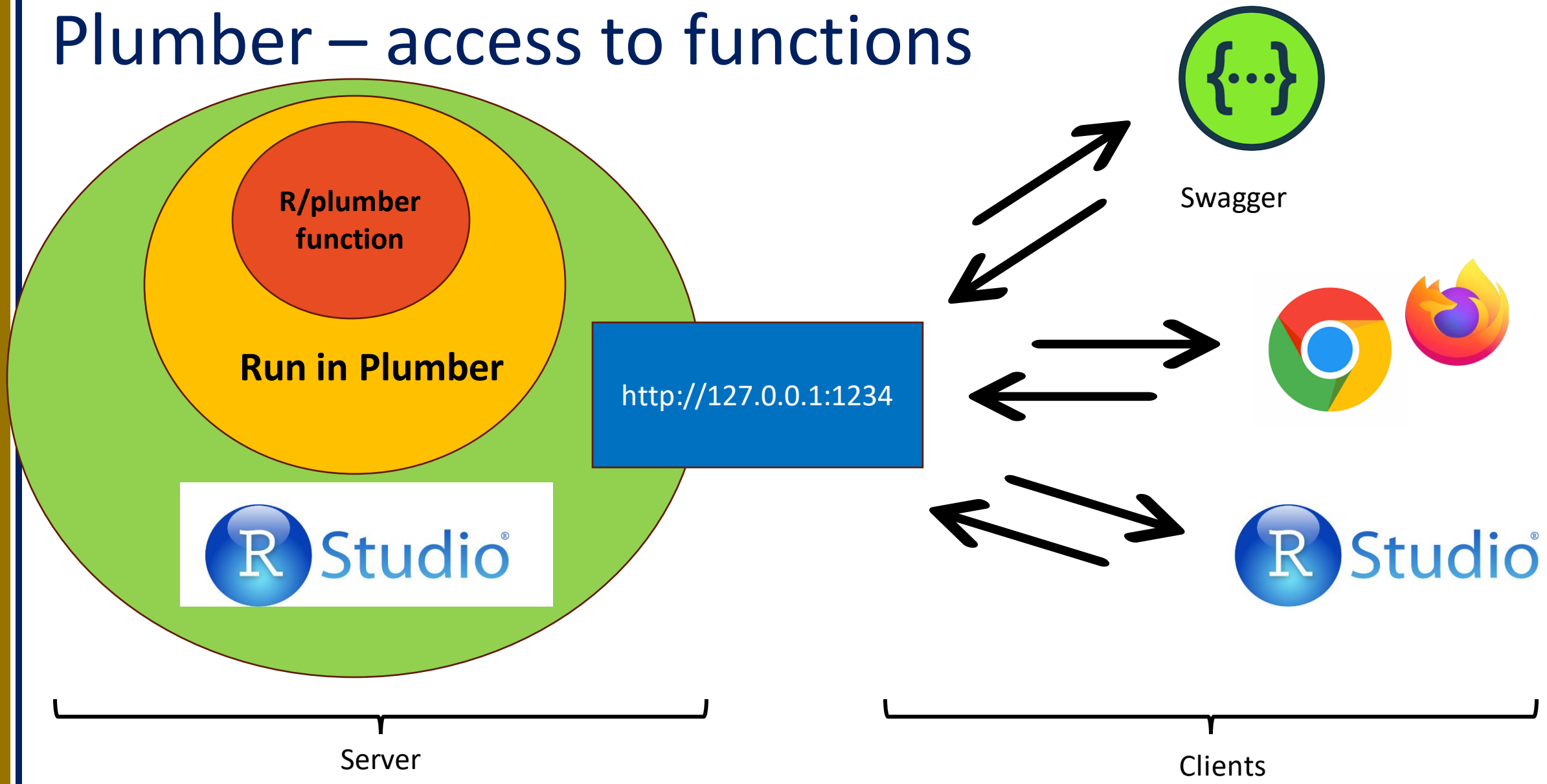
Plumber – access to functions



Exercise 3: Run some plumber code

- Open exercise_3_plumber_example_server.R
- Click on the "Run API" button on the top right of the code.
- This will open a web browser with swagger running in it
- Run example plumber functions (/hello, /square, /plot)
- Open request URLs directly in a web browser
- Open a second RStudio instance (Session > New Session), open exercise_3_plumber_example_client.R, update the port_number variable, run examples.
- More info in the README.md document

Plumber – access to functions



Exercises: write some plumber code

- Exercise 4: Write a plumber function to use gapminder data to show population of the UK in 1982. (Gapminder is a dataset of populations of various countries from 1952 - 2007).
- Exercise 5: Write a plumber function to allow a user to find out the population of any country during any year in gapminder.
- Exercise 6: Write a plumber function to plot the population change of a user defined country.

Additional points

- GET/POST
- Bounds checks
- Security is vital on public APIs
- Good list of public APIs - https://github.com/public-apis/public-apis