

Navigating APIs with R: An Introductory Overview

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Plan for today

- Overview of APIs
- What are REST APIs
- Use cases applicable to data science
- How to use an API with R

A bit about me

👋, PhD microbial ecology



5 years industry experience in Switzerland – bioinformatics

2 years at Agroscope in IT department

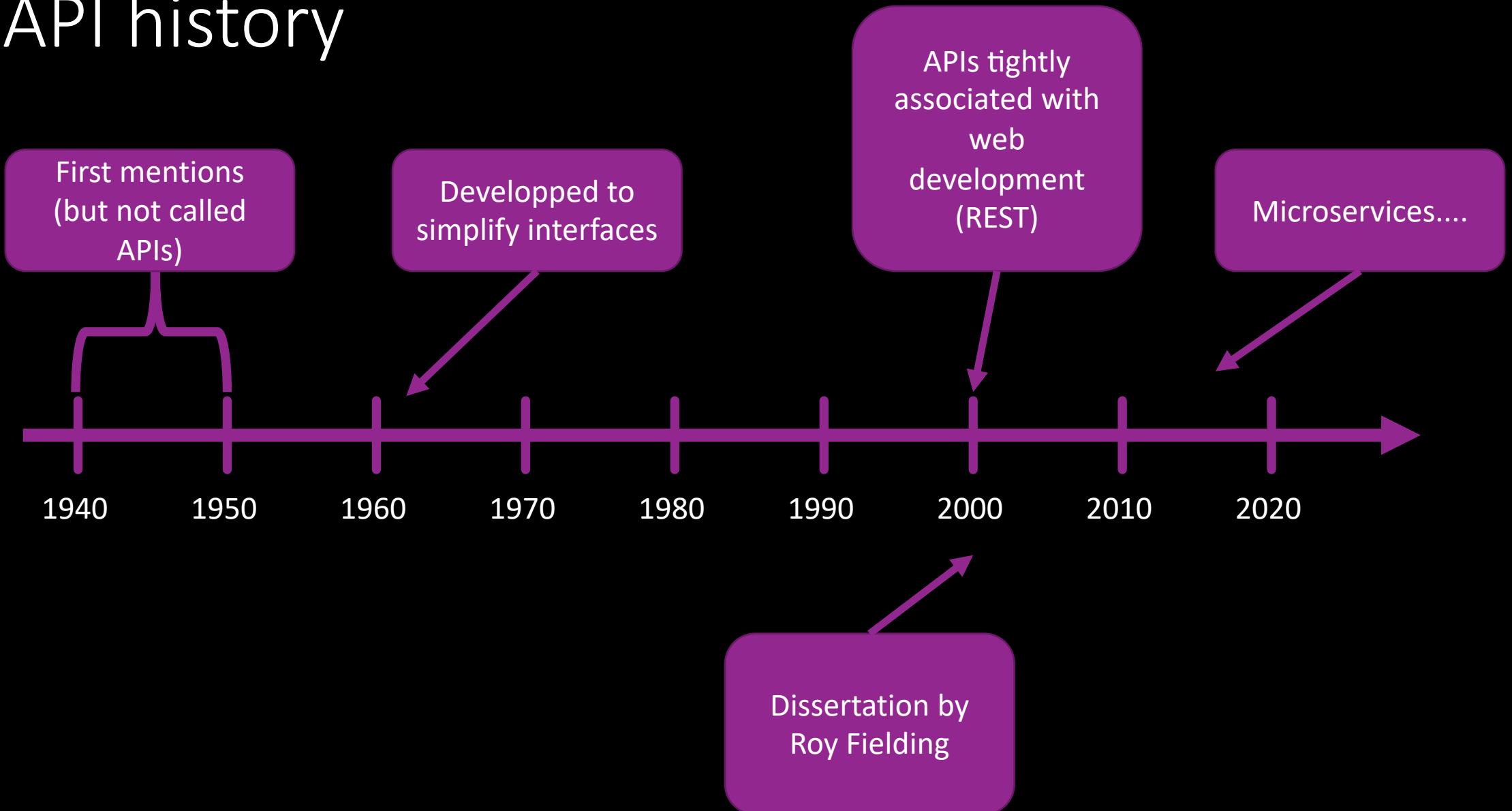
Freetime: hiking, skiing, rOpenSci

What is an API?

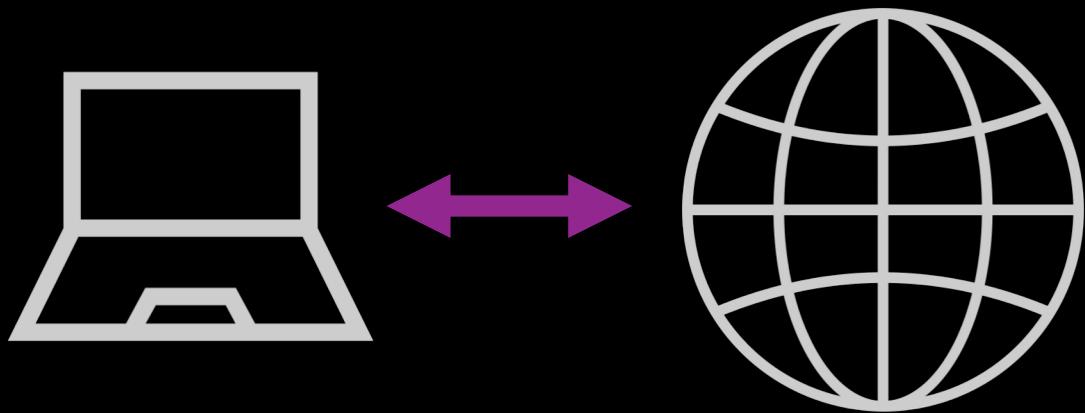
- Application Programmatic Interface.
- What does application programmatic interface mean?
 - Not intended to be directly used by a human, but by a program or software

API makes accessible (often “exposes”) certain parts (e.g. functionality, data, services, etc.) that can be used by others. Idea is that you do not need to understand the internals to be able to use or extract info.

API history

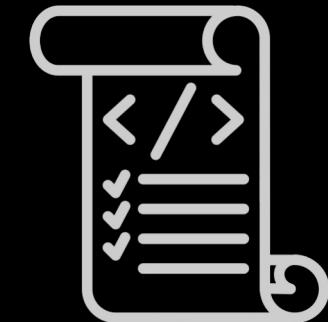


What can I use an API for?



Getting and sending data

Programmatically
controlling
software

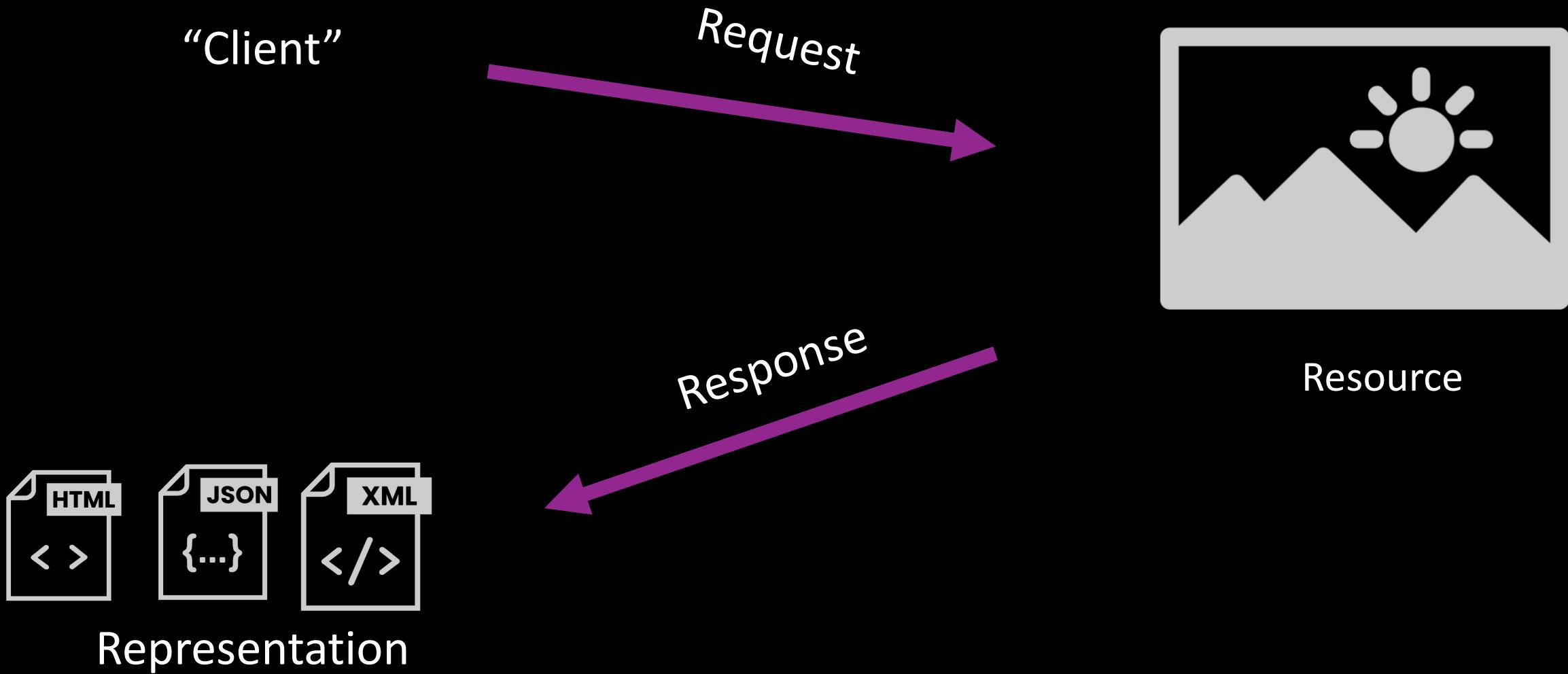




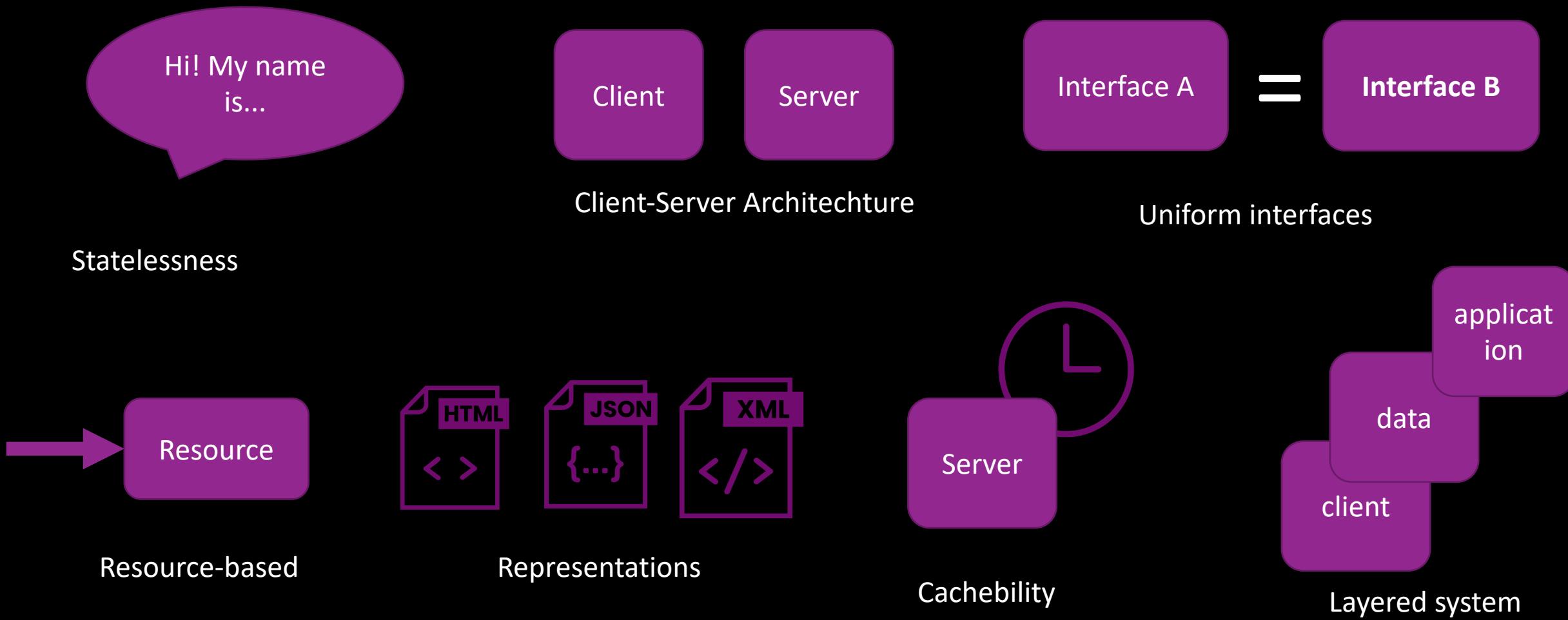
What is a REST API?

- **Representational State Transfer**
Application Programmatic Interface
- This is generally the common meaning
of API nowadays
- Adhere to a structured set of principles

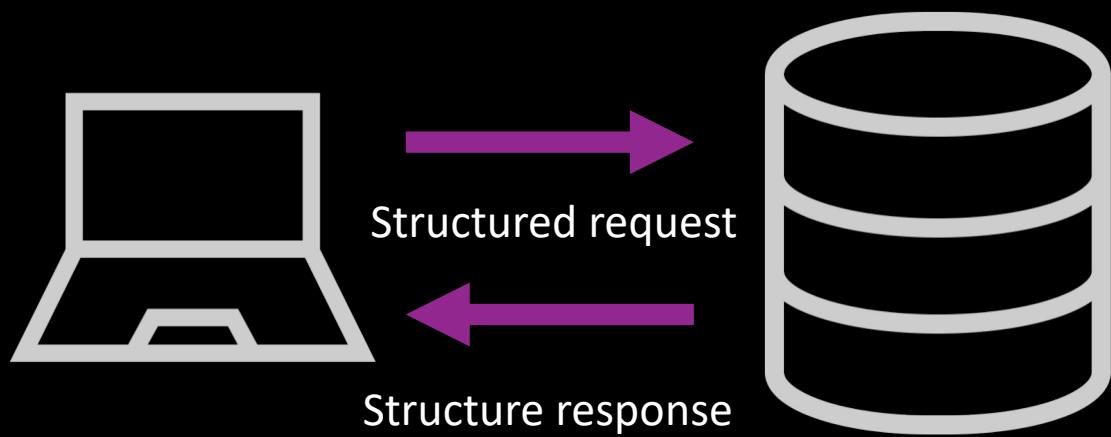
Representational State transfer? Concept



REST principles

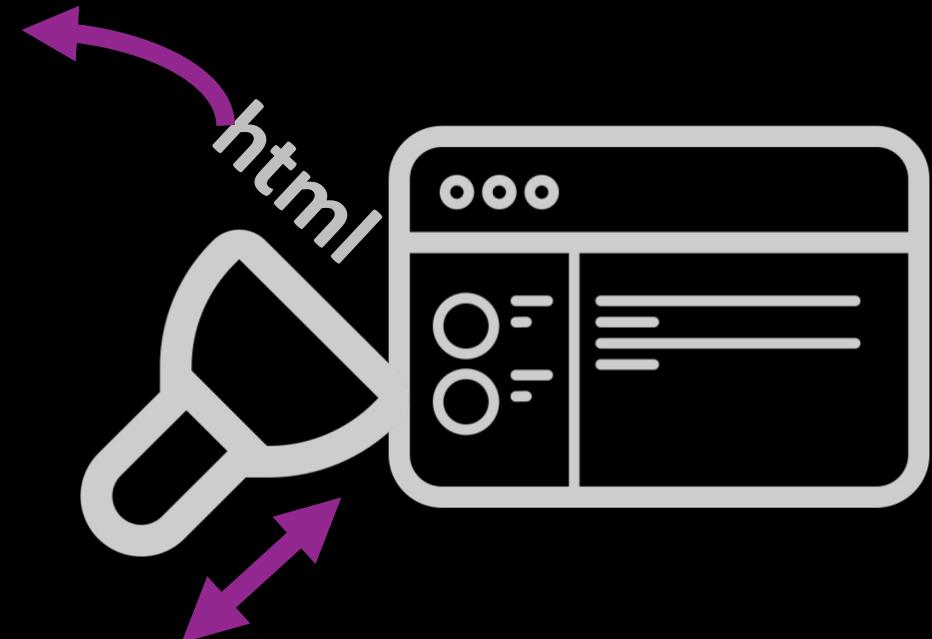


REST API



Structured data exchange

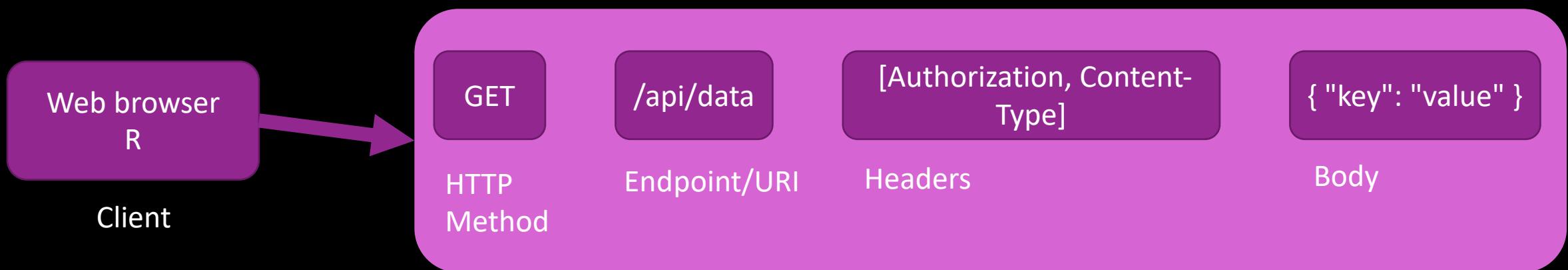
Web scraping



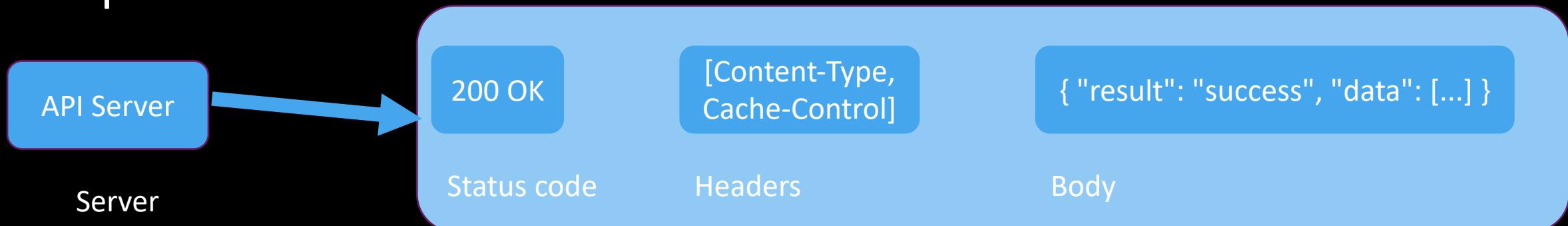
Direct extraction
Html parsing

What is a request / response?

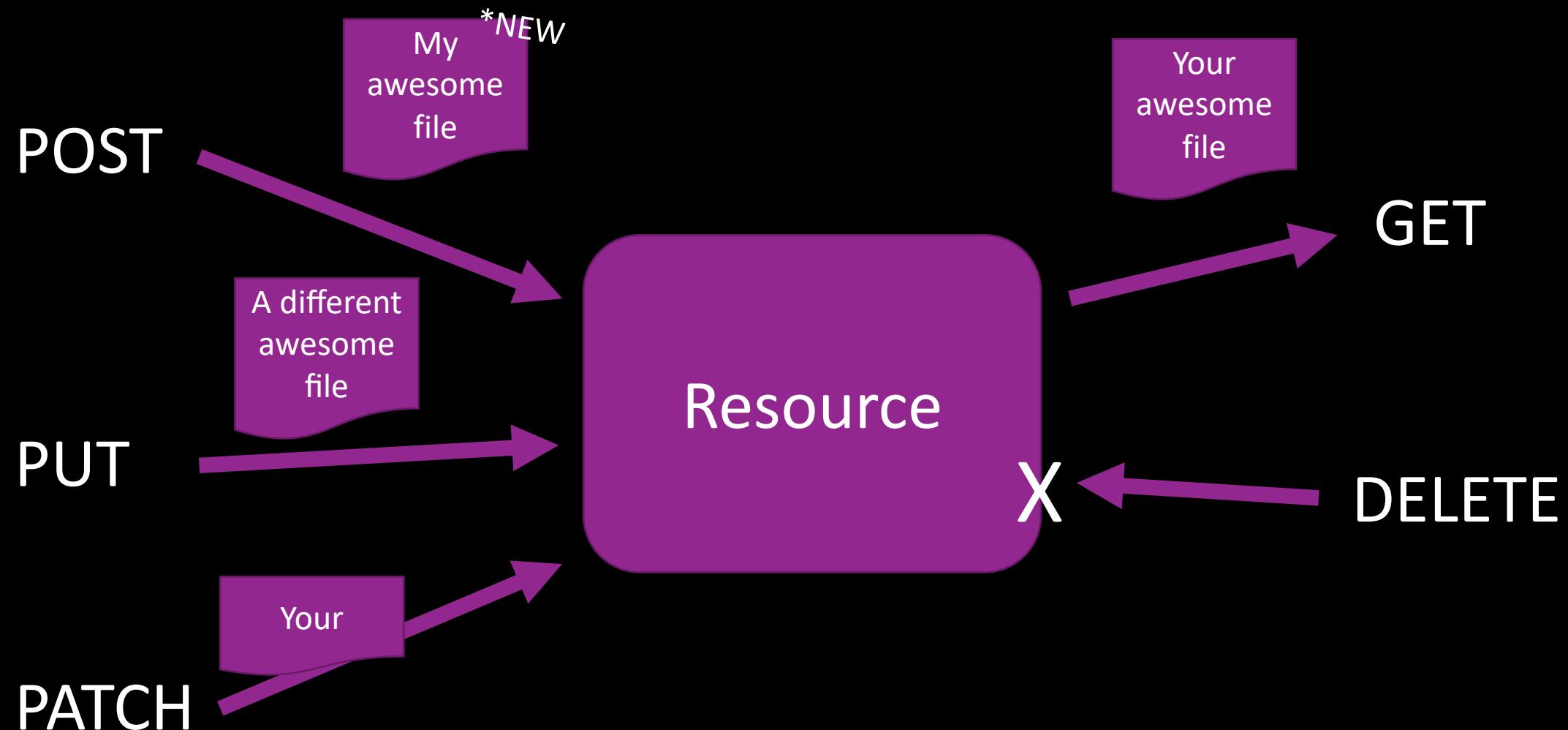
Request



Response



HTTP verbs used in APIs



Why JSON?

```
{ "key": "value" }
```

```
{ "result": "success", "data": [...] }
```

```
{
  "name": "Daniel Müller",
  "age": 30,
  "email": "daniel.mueller@example.com",
  "address": {
    "street": "123 Dorfstrasse",
    "city": "Oberhof",
    "zip": "5062"
  },
  "skills": ["R", "Python", "RESTful APIs"],
  "isStudent": false,
  "grades": null
}
```

- Human readable and Lightweight
- Language Agnostic and Interoperable
- Native support in Javascript and Web Development

So.....using APIs in R

What are the options for manipulating APIs in R?

- (non exhaustive list) many different options, curl, crul, httr, httr2, Rcurl, using system calls from R, etc..
- Today we will mostly use httr2 in our demos.

What about security for users while using APIs?

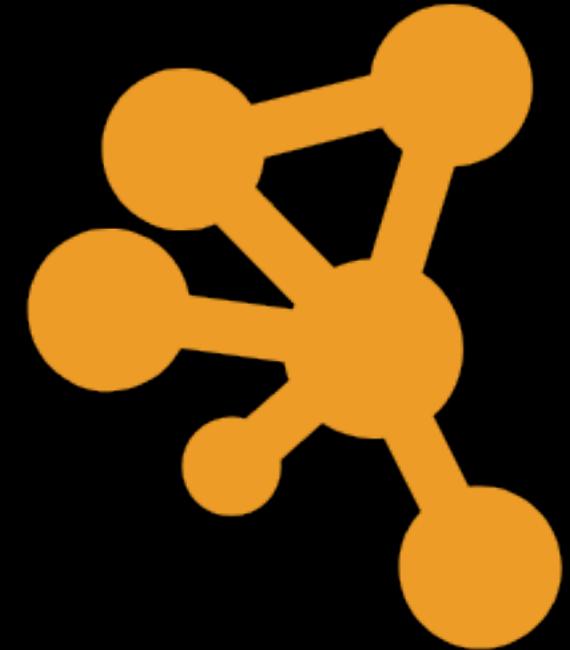
- How to manage secrets – do not store passwords or tokens in scripts/packages.
 - Lots of good advice by Hadley Wickam in a httr vignette entitled [Managing secrets](#), starts with storing in .Renviron file
 - also {secret}, {getPass}, {keyring}, {cyphr}
- Sensitive data – use only HTTPS
- Data privacy, understand where your data are headed...

R Demos

- Use cases for APIs that I am familiar with:
 - Traditional web APIs: examples: Github, DeepL
 - Software with GUI that could be automated: {RCy3} for Cytoscape

Cytoscape

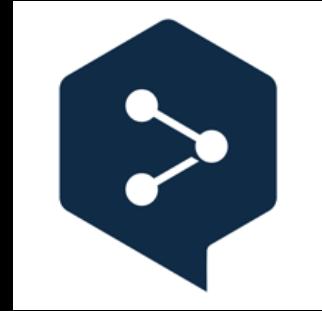
- Open source Software that is used for visualizing networks
- Can use desktop software with graphical user interface
- Also REST API available and Python and R packages that wrap the REST API
 - In R this is {RCy3}



A large amount of development has gone into providing automation possibilities in Cytoscape

Agroscope use cases

- DeepL
 - Note: this is outside of the Confederation's DeepL pro account (which makes sure that the texts translated are not saved).
 - Use case: IT ticketing system, preparation for input into NLP
- Firecrest
 - API for the Swiss National Supercomputer Center
 - Allows us to transfer data from our research network
 - There is a recommended tool, Globus, but it does not work with the proxy, so this is a great alternative for us.
 - Allows us to launch jobs



Conclusion

-  **First steps:** Today's talk and demos were a basic introduction to APIs and interacting with APIs using R.
-  **Endless possibilities:** APIs are the gateway to a vast world of data and services on the web. Many creative possibilities exist....
-  **Streamlined workflows:** If you've faced limitations workflows , consider APIs as a powerful solution. R provides not only convenient wrappers for APIs but also the flexibility to communicate directly with them.

Questions?

Slides and code available at: https://github.com/jooolia/APIs_with_R_talkTutorial

APIs is R

There are several R packages that have been widely used for dealing with REST APIs. These packages facilitate making HTTP requests, handling responses, and parsing data in R. Here are some popular ones:

1. **httr**:

- **Description:** A versatile package that provides functions for working with URLs, HTTP methods, headers, and other aspects of HTTP.

- **Example:**

```
```R
library(httr)
response <- GET("https://api.example.com/data")
content(response)
````
```

2. **curl**:

- **Description:** Offers a modern and flexible R interface to libcurl, a widely used library for handling HTTP requests.

- **Example:**

```
```R
library(curl)
handle <- new_handle()
response <- curl_fetch_memory("https://api.example.com/data", handle = handle)
````
```

3. **jsonlite**:

- **Description:** A lightweight package for JSON parsing and generation. Useful for handling JSON data often returned by REST APIs.

- **Example:**

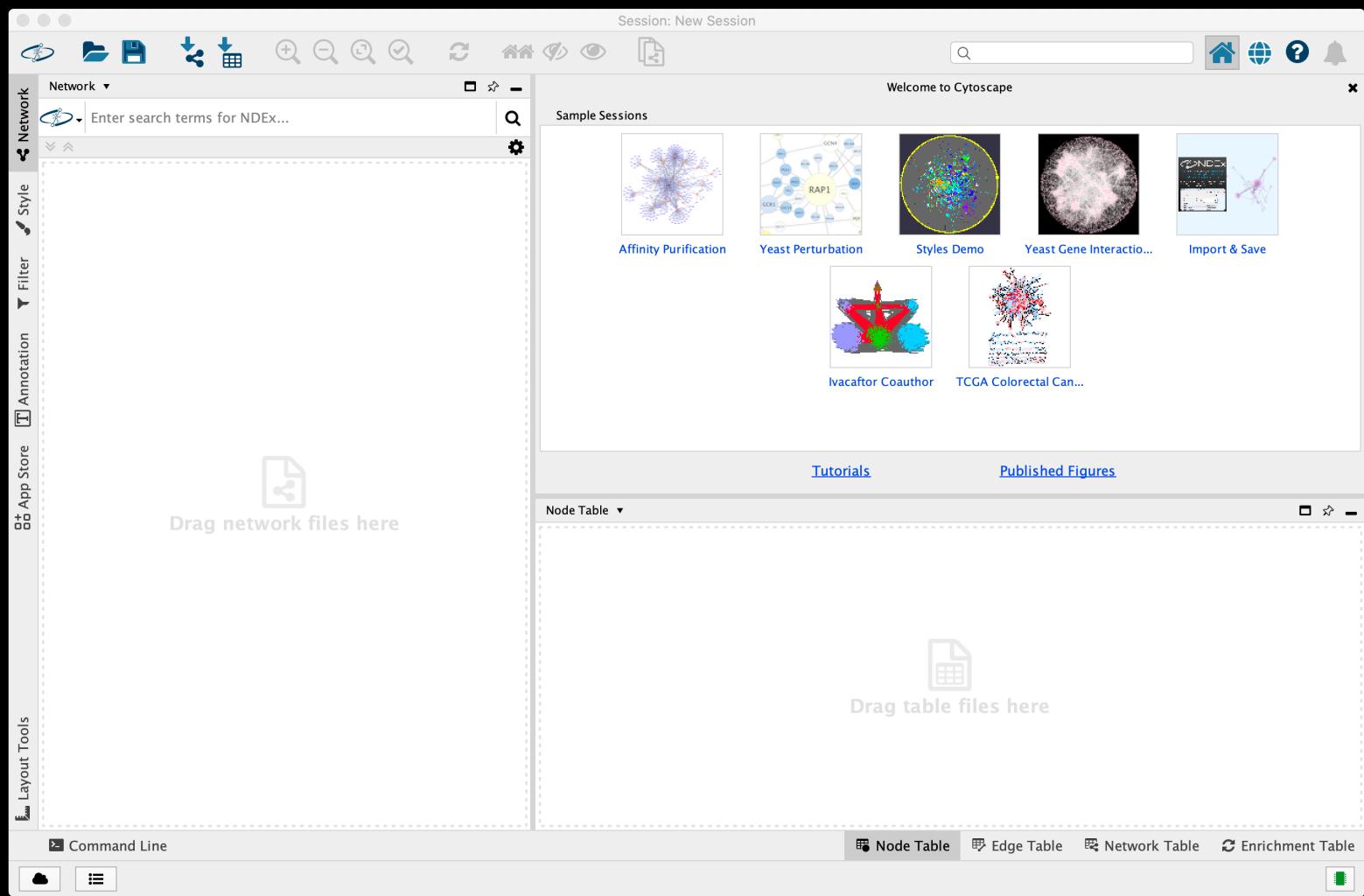
```
```R
library(jsonlite)
data <- fromJSON('{"name": "John", "age": 30}')
````
```

REST vs non-REST API

| | REST API | non-REST API |
|-------------------------|--|---|
| Architectural style | Adheres to principles of REST
Stateless communication primordial | Can follow other architectural designs such as SOAP, GraphQL or others. |
| Communication protocol | Generally HTTP methods
Standard HTTP status codes | can use other protocols |
| Data format | often use JSON or XML for representation
Resources identified by URIs(uniform resource identifiers) | can use XML or JSON or other formats |
| Documentation standards | Standardized conventions available and tools like Swagger or OpenAPI available | Can have own documentation standards.. |
| Endpoint design | Uses resource-based endpoints and standard HTTP methods | can vary.. |

Cytoscape screen shots

- Open Cytoscape



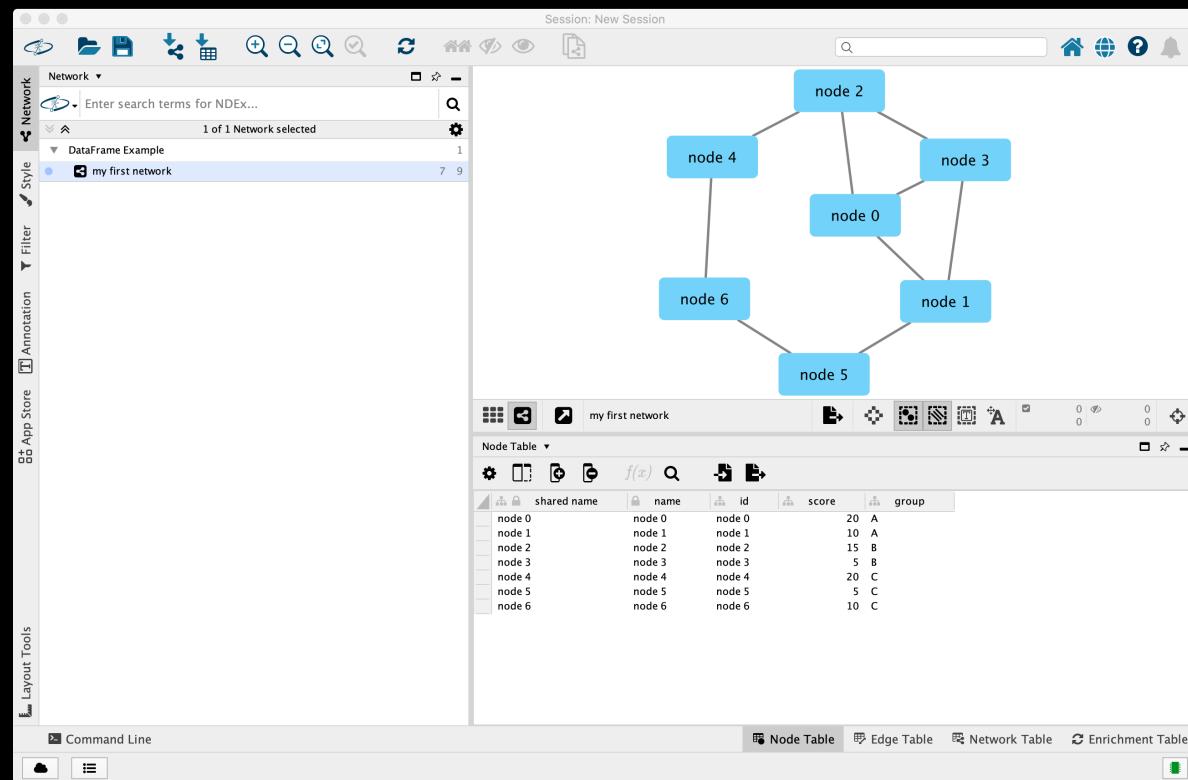
```

nodes <- data.frame(id = c("node 0", "node 1", "node 2", "node 3", "node 4", "node 5", "node 6"),
                     group = c("A", "A", "B", "B", "C", "C", "C"), # categorical strings
                     score = as.integer(c(20, 10, 15, 5, 20, 5, 10)), # integers
                     stringsAsFactors = FALSE)
edges <- data.frame(source = c("node 0", "node 0", "node 2", "node 2", "node 5", "node 4", "node 5", "node 1"),
                     target = c("node 1", "node 2", "node 3", "node 3", "node 4", "node 6", "node 6", "node 1", "node 3"),
                     weight = c(5.1, 3.0, 5.2, 9.9, 3.5, 4.5, 6, 5.3, 3), # numeric
                     stringsAsFactors = FALSE)

simple_graph_ig <- igraph::graph_from_data_frame(edges, vertices = nodes)
plot(simple_graph_ig)

createNetworkFromDataFrames(nodes, edges,
                           title = "my first network",
                           collection = "DataFrame Example")

```



```
style.name = "myStyle"
defaults <- list(NODE_SHAPE = "diamond",
                 NODE_SIZE = 30,
                 EDGE_TRANSPARENCY = 120)
edgeWidth <- mapVisualProperty('edge width','weight','p')
nodeFill <- mapVisualProperty('node fill
color','score','c',c(5,10,20),c('#99CCFF','#FFFFFF','#FF7777'))
nodeLabel <- mapVisualProperty('node label','group','p')

createVisualStyle(style.name, defaults, list(edgeWidth, nodeFill, nodeLabel))
setVisualStyle(style.name)
```

