Harnessing the Power of Open Data on the Web (& mocking/testing!!)

@sckottie

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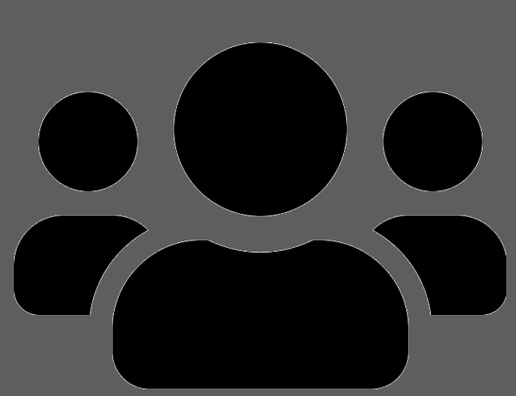
scotttalks.info/jsm18

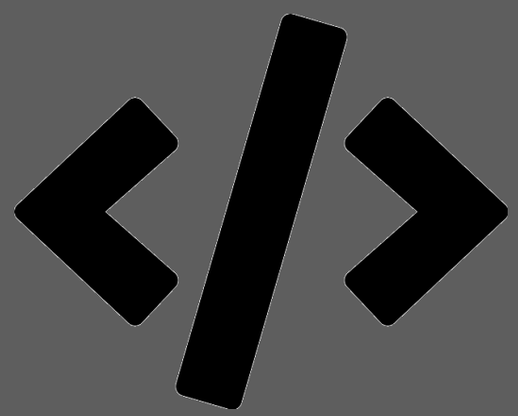
rOpenSci

ropensci.org

rOpenSci Does



Community



Software

Peer Review

ORIGINS

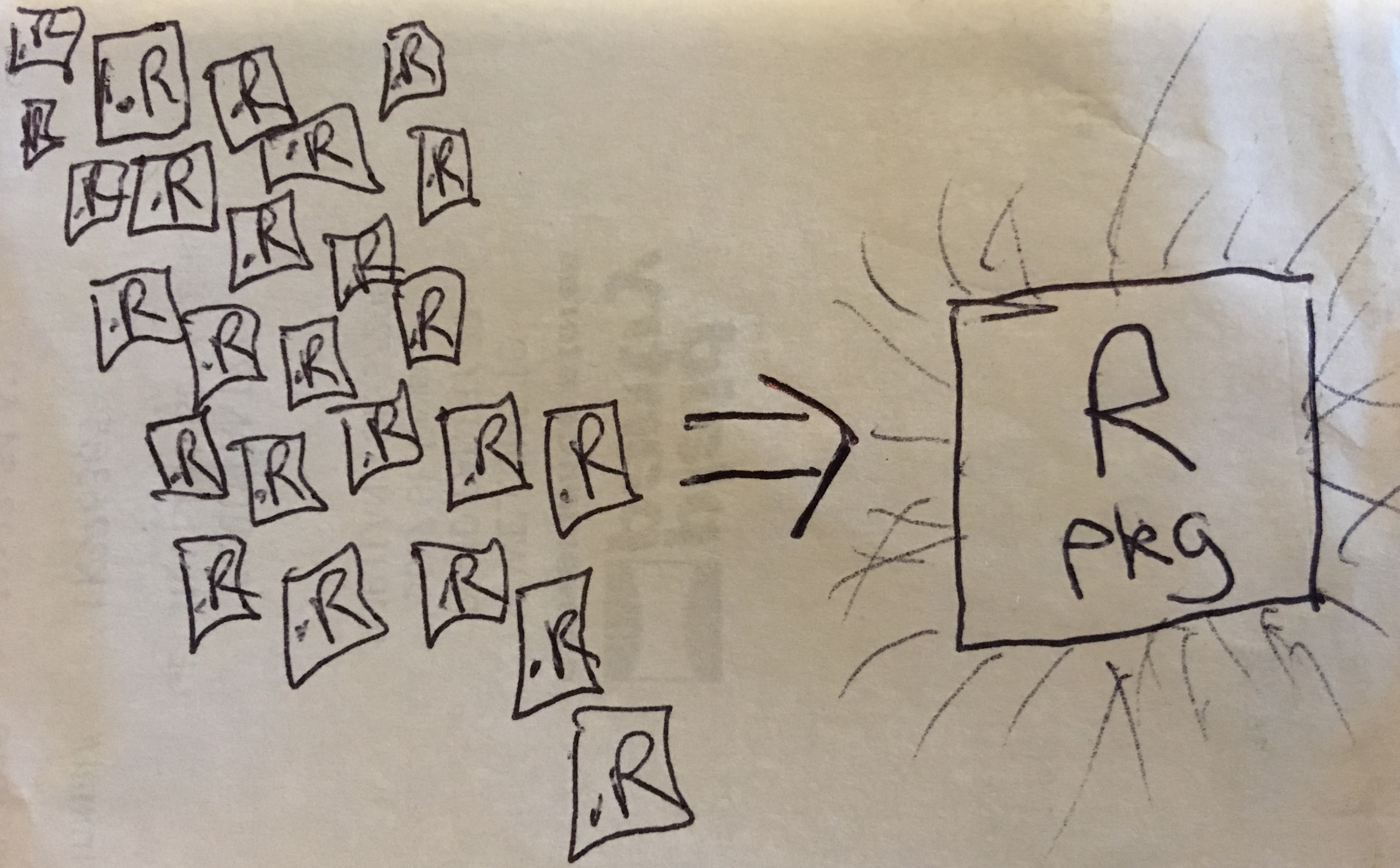
an unsolved problem in 2011:

Getting data from the web

make R pkgs for specific data sources

At first embracing a niche seems like smaller impact

But …


R
pkg

make R pkgs for specific data sources

Reduces redundant code

Fewer chances for mistakes

Central community where these pkgs exist (i.e., ropensci)

many niche packages together do great good

& very general purpose pkgs

magick
pdftools
spelling
ssh
sys
tesseract
writexl
jqr

drake
eml
assertr
skimr
Rselenium
crul
geojsonio
plotly

rOpenSci: numbers

6 staff
2 Bioconductor pkgs
192 CRAN pkgs
287 total pkgs
~70K commits
~500 code contributors
LOTS! of community members
> 500 citations in peer-reviewed lit
1 awesome peer review software system

HTTP Requests

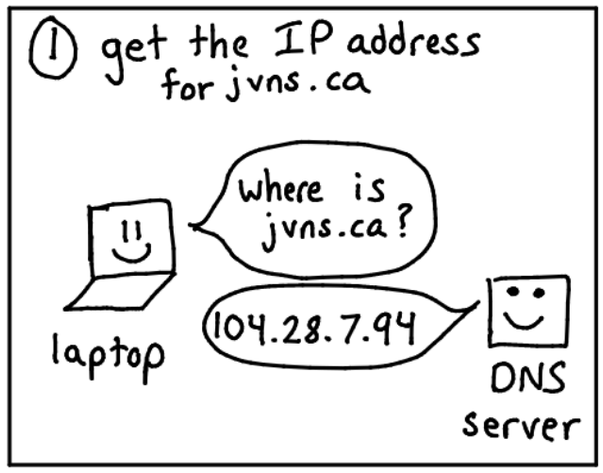
Julia Evans

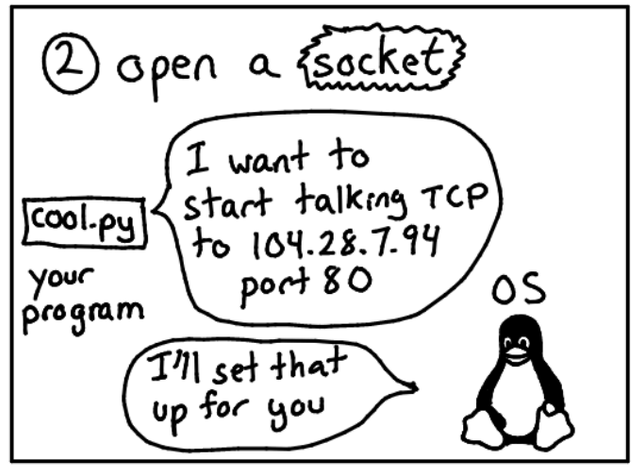
jvns.ca/networking-zine.pdf

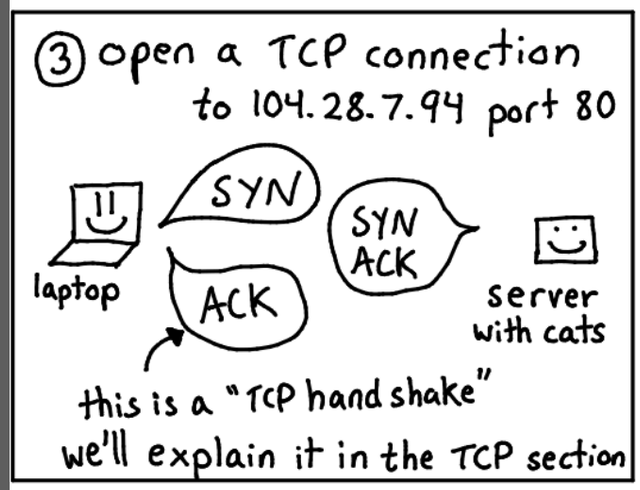
steps to get a cat picture

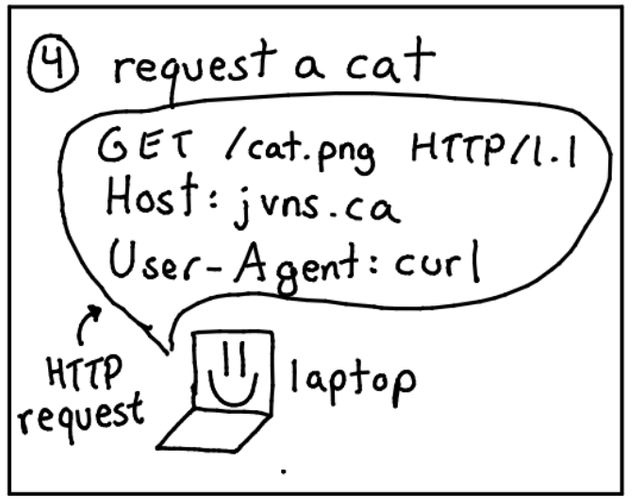
from jvns.ca/cat.png

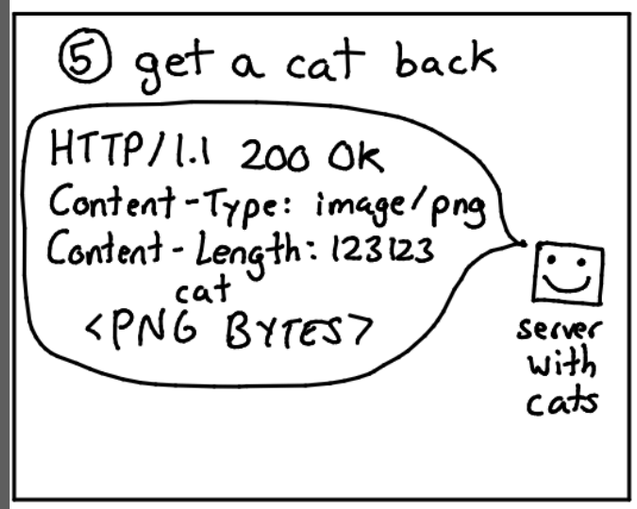
When you download an image, there are a LOT of networking moving pieces. Here are the basic steps we'll explain in the next few pages.

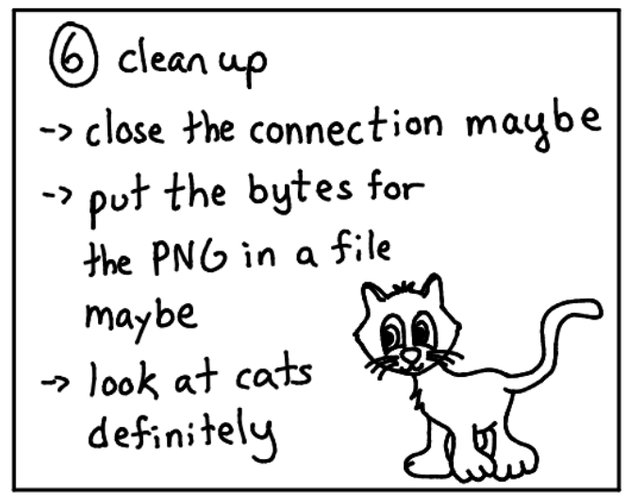












HTTP Requests: Problems

- Internet access required
- Internet speeds vary, **A LOT**
- Firewalls
- Proxies
- Power outages
- on and on

HTTP Requests: Development

When developing software, you:

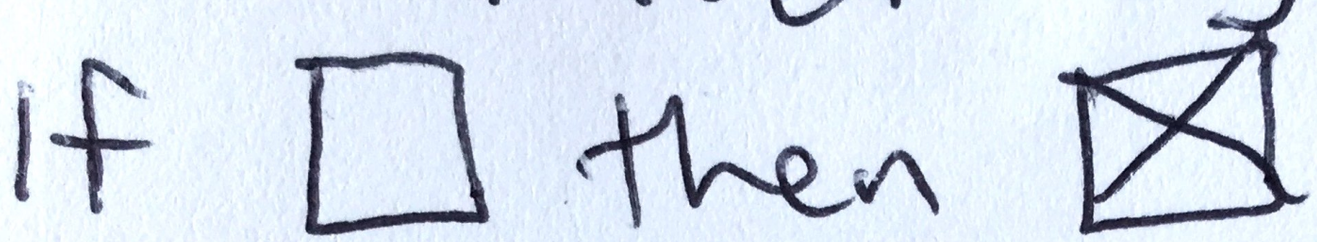
- Want to test functionality of the code
- Not whether:
  - the internet is up or down
  - fast or slow
  - remote server is up or down, misbehaving, etc.

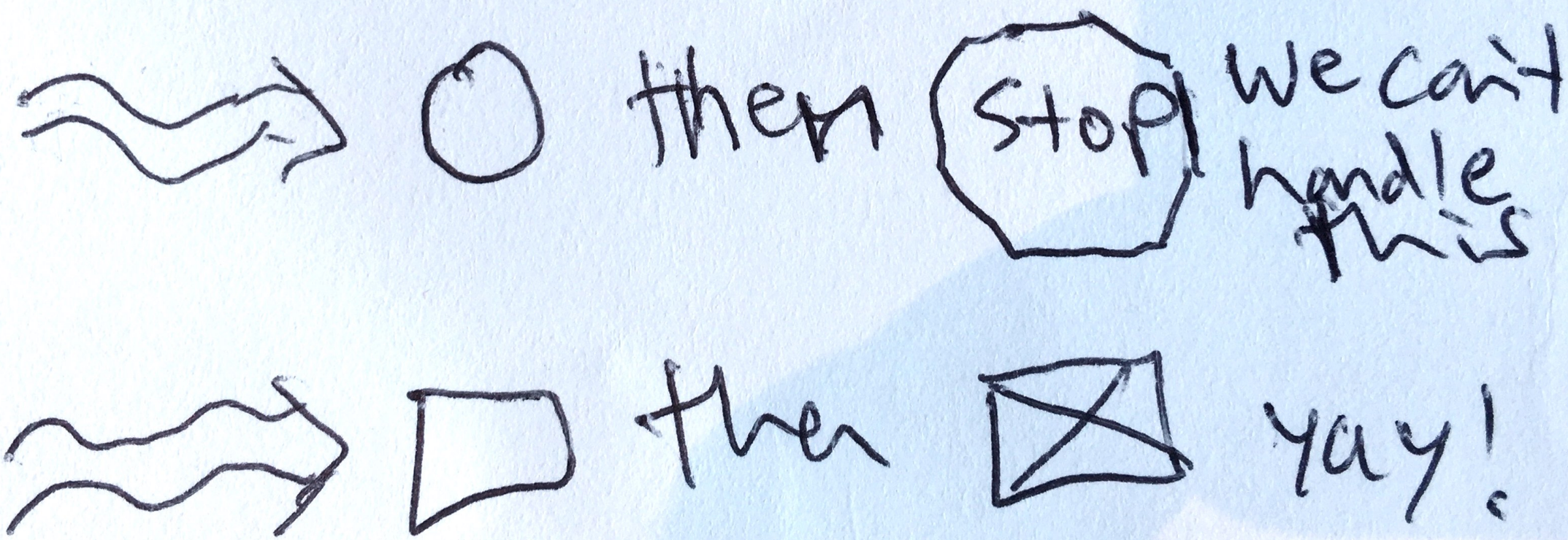
HTTP Requests: Solutions

Mocking

Record/replay

Mocking





Record / Replay

Recording ON

HTTP Request

set stub

do real request

cache real request/response

return real response

Same Request

matches stub

Return Cached Response

¡!

Why?

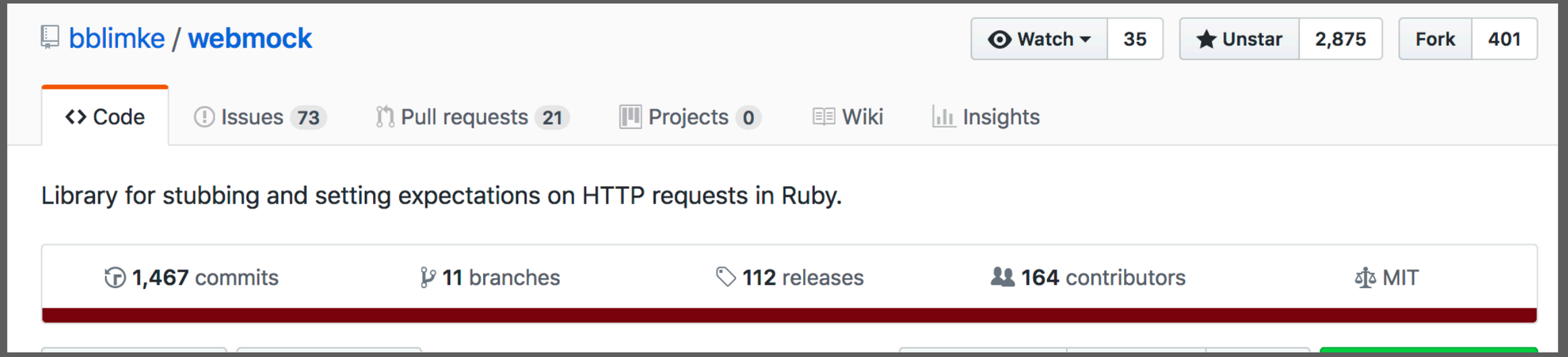
- Mocking:
  - No or slow internet access
  - Simulate situations that are hard to create/re-create (e.g. errors)
    - Return unusual responses
- Record/replay (e.g. for unit tests)
  - Package development cycle increases!
  - Less usage of data providers servers
  - Actually test your software, not internet connections/etc.

Mocking HTTP Requests

Stubbing and setting expectations on HTTP requests

Mocking HTTP Requests

Ported from Ruby's webmock



Mocking HTTP Requests

Ported from Ruby's webmock

Take advantage of prior art!
Build on hard-earned knowledge

```
commit 40dae6303aaa20309c95f81b7046bf7b46af1c0d
Author: Bartosz Blimke <bartosz@new-bamboo.co.uk>
Date:   Fri Nov 6 10:37:54 2009 +0000
```

webmockr R package

github.com/ropensci/webmockr

webmockr

- Hooks into an http package. When mocking is enabled, *webmockr* handles the request instead of the http package

- Set stubs - stubs are what's matched against: HTTP method, URL, query parameters, headers

- Optionally set what you'd like returned: status code, body, headers

- Optionally force a timeout or other error to occur

webmockr

- Adapters:
  - crul - github.com/ropensci/crul ✅ (on CRAN)

```
install.packages("webmockr")
```

  - httr - github.com/r-lib/httr ✅ (try it!)

```
remotes::install_github("ropensci/webmockr@adapter-httr")
```

  - curl - github.com/jeroen/curl (try it, but a ways to go)

```
remotes::install_github("ropensci/webmockr@adapter-curl")
```

webmockr

```
# before mocking is turned on
library(crul)
HttpClient$new(url = "https://httpbin.org")$get('get')
#> <crul response>
#>   url: https://httpbin.org/get
#>   request_headers:
#>     User-Agent: libcurl/7.54.0 r-curl/3.2 crul/0.6.0
#>     Accept-Encoding: gzip, deflate
#>     Accept: application/json, text/xml, application/xml, */*
#>   response_headers:
#>     status: HTTP/1.1 200 OK
#>     connection: keep-alive
#>     server: gunicorn/19.9.0
#>     date: Fri, 27 Jul 2018 18:59:09 GMT
#>     content-type: application/json
#>     content-length: 325
#>     access-control-allow-origin: *
#>     access-control-allow-credentials: true
#>     via: 1.1 vegur
#>   status: 200
```

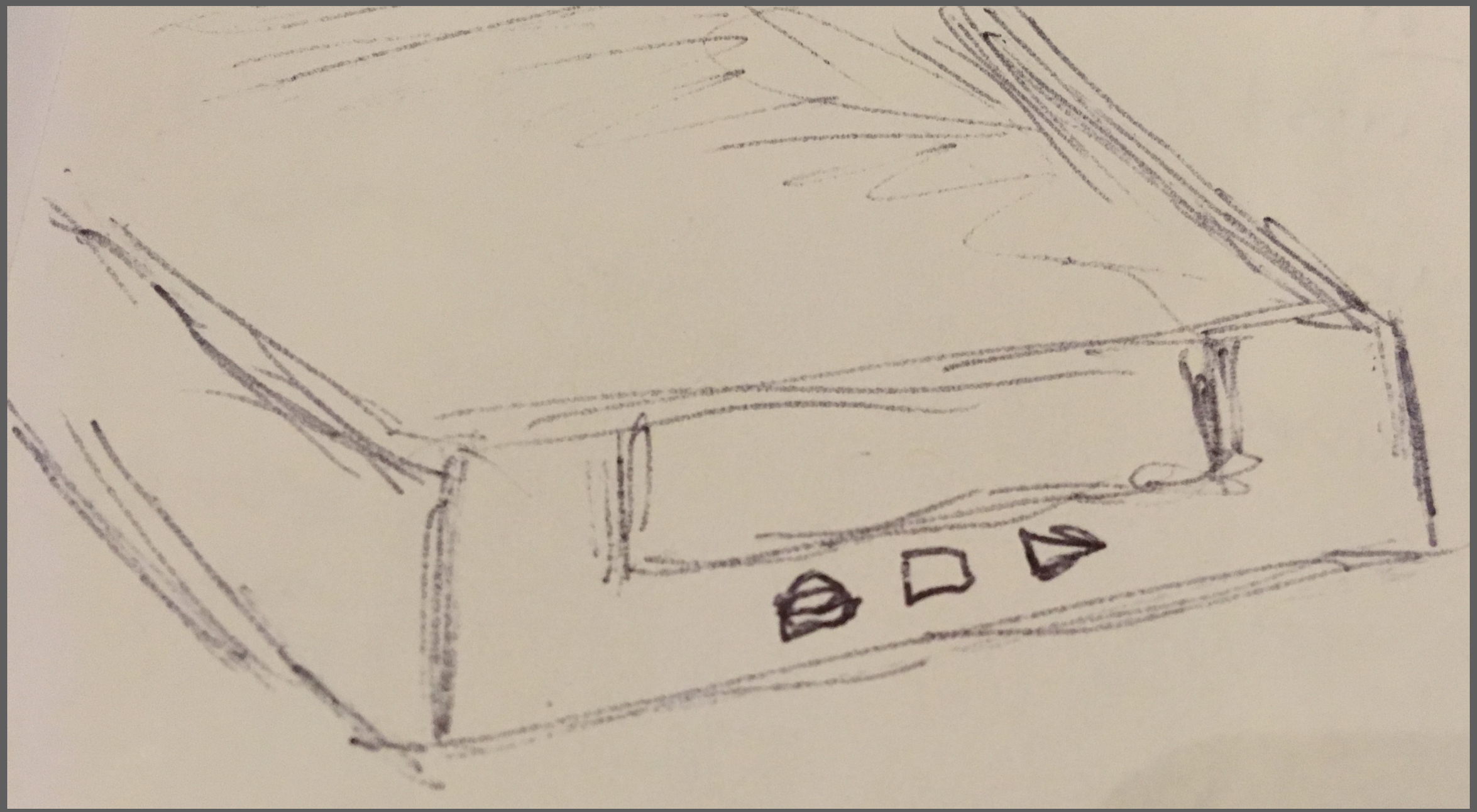
webmockr

```
# load webmockr, enable
library(webmockr)
webmockr::enable()

# errors now
HttpClient$new(url = "https://httpbin.org")$get('get')
#> Error: Real HTTP connections are disabled.
#> Unregistered request:
#>   GET https://httpbin.org/get   with headers {Accept-Encoding: gzip, deflate,
#>
#> You can stub this request with the following snippet:
#>
#>    stub_request('get', uri = 'https://httpbin.org/get') %>%
#>      wi_th(
#>        headers = list('Accept-Encoding' = 'gzip, deflate', 'Accept' = 'application/json')
#>      )
#> ============================================================
```

webmockr

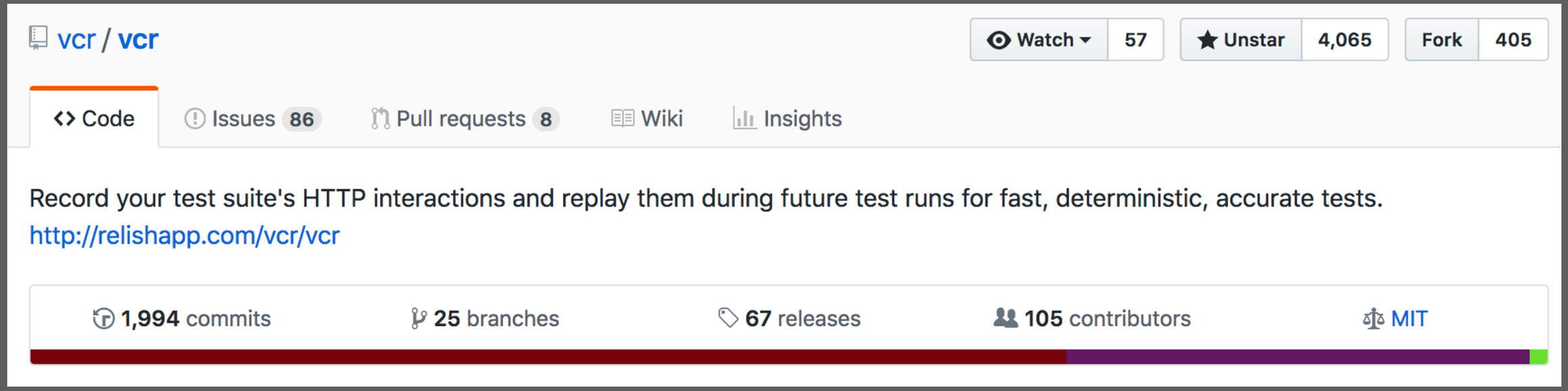
```
# stub registry is empty
stub_registry()
#> <webmockr stub registry>
#>  Registered Stubs

# set stub
stub_request("get", "https://httpbin.org/get") %>%
  wi_th(
    query = list(hello = "world")) %>%
    to_return(status = 418)
# stub registry now not empty
stub_registry()
#> <webmockr stub registry>
#>  Registered Stubs
#>    get: https://httpbin.org/get?hello=world   | to_return:   with status 418

# get mocked request
con <- HttpClient$new(url = "https://httpbin.org")
con$get('get', query = list(hello = "world"))
#> <crul response>
#>   url: https://httpbin.org/get?hello=world
#>   request_headers:
#>     User-Agent: libcurl/7.54.0 r-curl/3.2 crul/0.6.0
#>     Accept-Encoding: gzip, deflate
#>     Accept: application/json, text/xml, application/xml, */*
#>   response_headers:
#>   params:
#>     hello: world
#>   status: 418
```

let’s talk about vcr’s!



Record/Replay HTTP Requests

Ported from Ruby's vcr



Record/Replay HTTP Requests

Ported from Ruby's vcr

Take advantage of prior art!

Build on hard-earned knowledge

Ports in Other Languages

- Betamax (Python)
- VCR.py (Python)
- Betamax (Go)
- DVR (Go)
- Go VCR (Go)
- Betamax (Clojure)
- vcr-clj (Clojure)
- scotch (C#/.NET)
- Betamax.NET (C#/.NET)
- ExVCR (Elixir)
- HAVCR (Haskell)
- Mimic (PHP/Kohana)
- PHP-VCR (PHP)
- Nock-VCR (JavaScript/Node)
- Sepia (JavaScript/Node)
- VCR.js (JavaScript)
- yakbak (JavaScript/Node)
- NSURLConnectionVCR (Objective-C)
- VCRURLConnection (Objective-C)
- DVR (Swift)
- VHS (Erlang)
- Betamax (Java)
- http_replayer (Rust)
- OkReplay (Java/Android)
- vcr (R)

vcr R package

github.com/ropensci/vcr

Record/Replay HTTP requests

- *webmockr* does not cache
- *vcr*, which does cache, leverages *webmockr* for the matching
- *vcr* can be used to:
    - Cache individual/one off HTTP requests
    - Unit tests in packages/projects

```
commit 6690a23c0723ce2f0a3ed9e9ad785ea2142e032e
Author: Scott Chamberlain <myrmecocystus@gmail.com>
Date:   Tue Dec 9 09:33:09 2014 -0800
```

Ouch!

3 years & 5 months to 1st CRAN version

```
commit 417094bebd24b1c0130c94cb44721a298e9b5eae (tag: v0.1.0)
Author: Scott Chamberlain <myrmecocystus@gmail.com>
Date:   Wed May 9 11:15:49 2018 -0700
```

vcr

- Adapters:
  - crul - github.com/ropensci/crul ✅ (on CRAN)

```
install.packages("vcr")
```

  - httr - github.com/r-lib/httr ✅ (on GitHub)

```
remotes::install_github(“ropensci/vcr@httr-integration“)
```

  - curl - github.com/jeroen/curl (not ready yet 😞)

vcr

- Hooks into an http package (e.g., *crul*) by using *webmockr*. When *vcr* is enabled, real requests are allowed, and *vcr* caches real responses

- *vcr* works no matter how many layers down the HTTP request is made

vcr: requirements

- DESCRIPTION file: add *vcr* to Suggests (don't need to include *webmockr*)
- Add *vcr::vcr_configure()* call in tests/ dir
- Wherever needed, wrap requests that make HTTP requests in *vcr::use_cassette()*

vcr: setup

basic setup

```
# tests/testthat/helper-packagename.R
library("vcr")
vcr_configure(dir = "../fixtures")
```

secure strings

```
# tests/testthat/helper-packagename.R
library("vcr")
vcr_configure(
    dir = "../fixtures",
    filter_sensitive_data = list("<<rredlist_api_token>>" = Sys.getenv('IUCN_REDLIST_KEY'))
)
```

vcr: usage

```
# tests/testthat/test-rl_history.R
vcr::use_cassette("rl_history", {
  aa <- rl_history('Loxodonta africana')

  expect_is(aa, "list")
  expect_is(aa$name, "character")
  expect_is(aa$result, "data.frame")
  expect_true(any(grepl("Vulnerable", aa$result$category, ignore.case = TRUE)))
})
```

vcr: cassette

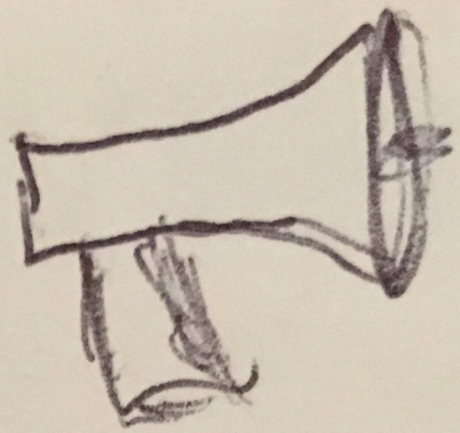
```
# tests/fixtures/rl_history.yml
http_interactions:
- request:
    method: get
    uri: http://apiv3.iucnredlist.org/api/v3/species/history/name/Loxodonta%20africana?token=<<rredlist_api_token>>
    body:
      encoding: ''
      string: ''
    headers:
      User-Agent: r-curl/3.2 crul/0.5.2 rOpenSci(rredlist/0.4.1.9120)
      Accept-Encoding: gzip, deflate
      Accept: application/json, text/xml, application/xml, */*
  response:
    status:
      status_code: '200'
      message: OK
      explanation: Request fulfilled, document follows
    headers:
      status: HTTP/1.1 200 OK
      server: nginx/1.1.19
      date: Thu, 17 May 2018 18:36:03 GMT
      content-type: application/json; charset=utf-8
      content-length: '400'
      connection: keep-alive
      x-powered-by: Sails <sailsjs.org>
      vary: Accept-Encoding
    body:
      encoding: UTF-8
      string: '{"name":"Loxodonta africana","result":[{"year":"2008","code":"VU","category":"Vulnerable"},
              {"year":"2004","code":"VU","category":"Vulnerable"},{"year":"1996","code":"EN","category":"Endangered"},
              {"year":"1994","code":"V","category":"Vulnerable"},{"year":"1990","code":"V","category":"Vulnerable"},
              {"year":"1988","code":"V","category":"Vulnerable"},{"year":"1986","code":"V","category":"Vulnerable"}]}'
  recorded_at: 2018-05-17 18:36:03 GMT
recorded_with: vcr/0.1.0, webmockr/0.2.6, crul/0.5.2
```

src/

github.com/ropensci/vcr

github.com/ropensci/webmockr

talk to us



forum

discuss.ropensci.org

submit/review package

onboarding.ropensci.org