REST APIs with plumber :: **CHEATSHEET**

Introduction to REST APIs

Web APIs use **HTTP** to communicate between **client** and **server**.

HTTP

```
        request
  ?  ───────────→  HTTP  ←───────────  ?
client    response              server
```

HTTP is built around a **request** and a **response**. A **client** makes a request to a **server**, which handles the request and provides a response. Requests and responses are specially formatted text containing details and data about the exchange between client and server.

REQUEST

HTTP Method · **Path**

```
curl -v "http://httpbin.org/get"
```
HTTP Version

```
#> GET / get HTTP/1.1
#> Host: httpbin.org        ← Headers
#> User-Agent: curl/7.55.1
#> Accept: */*
#>
#  Request Body            ← Message body
```

RESPONSE

HTTP Version · **Status code** · **Reason phrase**

```
#< HTTP/1.1 200 OK
#< Connection: keep-alive
#< Date: Thu, 02 Aug 2018 18:22:22 GMT   ← Headers
#
#  Response Body            ← Message body
```

Plumber: Build APIs with R

Plumber uses special comments to turn any arbitrary R code into API endpoints. The example below defines a function that takes the **msg** argument and returns it embedded in additional text.

```
library(plumber)

#* @apiTitle Plumber Example API         ← @ decorators define API characteristics

#* Echo back the input
#* @param msg The message to echo
#* @get /echo                            ← /<path> is used to define the location of the endpoint
function(msg = "") {                     ← HTTP Method
    list(
        msg = paste0(
            "The message is: '", msg, "'")
    )
}
```
Plumber comments begin with #*

Plumber pipeline

Plumber endpoints contain R code that is executed in response to an HTTP request. Incoming requests pass through a set of mechanisms before a response is returned to the client.

FILTERS

Filters can forward requests (after potentially mutating them), throw errors, or return a response without forwarding the request. Filters are defined similarly to endpoints using the **@filter [name]** tag. By default, filters apply to all endpoints. Endpoints can opt out of filters using the **@preempt** tag.

PARSER

Parsers determine how Plumber parses the incoming request body. By default Plumber parses the request body as JavaScript Object Notation (JSON). Other parsers, including custom parsers, are identified using the **@parser [parser name]** tag. All registered parsers can be viewed with **registered_parsers()**.

ENDPOINT

Endpoints define the R code that is executed in response to incoming requests. These endpoints correspond to HTTP methods and respond to incoming requests that match the defined method.

METHODS

- **@get** - request a resource
- **@post** - send data in body
- **@put** - store / update data
- **@delete** - delete resource
- **@head** - no request body
- **@options** - describe options
- **@patch** - partial changes
- **@use** - use all methods

SERIALIZER

Serializers determine how Plumber returns results to the client. By default Plumber serializes the R object returned into JavaScript Object Notation (JSON). Other serializers, including custom serializers, are identified using the **@serializer [serializer name]** tag. All registered serializers can be viewed with **registered_serializers()**.

```
library(plumber)

#* @filter log                       ← Identify as filter · Filter name
function(req, res) {
    print(req$HTTP_USER_AGENT)       ← Forward
    forward()
}

#* Convert request body to uppercase  ← Endpoint description
#* @preempt log                       ← Opt out of the log
#* @parser json                       ← Parser
#* @post /uppercase                   ← Endpoint path
#* @serializer json                   ← Serializer
function(req, res) {                  ← HTTP Method
    toupper(req$body)
}
```

Running Plumber APIs

Plumber APIs can be run programmatically from within an R session.

```
library(plumber)

plumb("plumber.R") %>%         ← Path to API definition
    pr_run(port = 5762)        ← Specify API port
```
Publish API to Posit Connect · **Run API in current R session**

This runs the API on the host machine supported by the current R session.

IDE INTEGRATION

Create new Plumber API

Plumber API... · Shiny Web App...

Run API ▸ ⚙ ·

Plumber Example API

Documentation

Plumber APIs automatically generate an OpenAPI specification file. This specification file can be interpreted to generate a dynamic user-interface for the API. The default interface is generated via Swagger.

Endpoint details · GET /echo Echo back the input

Parameter details
Name · msg · string (query)
Description · The message to echo · Hello

Send request · Execute · Clear

Edit parameters · Cancel

curl command used to send request
```
curl -X GET "http://127.0.0.1:5762/echo?msg=Hello" -H "accept: */*"
```
Responses · Curl

Interact with the API

Once the API is running, it can be interacted with using any HTTP client. Note that using **httr** requires using a separate R session from the one serving the API.

```
(resp <- httr::GET("localhost:5762/echo?msg=Hello"))
#> Response [http://localhost:5762/echo?msg=Hello]
#>   Date: 2018-08-07 20:06
#>   Status: 200
#>   Content-Type: application/json
#>   Size: 35 B
httr::content(resp, as = "text")
#> [1] "{\"msg\":[\"The message is: 'Hello'\"]}"
```

posit

Programmatic Plumber

Tidy Plumber

Plumber is exceptionally customizable. In addition to using special comments to create APIs, APIs can be created entirely programatically. This exposes additional features and functionality. Plumber has a convenient "tidy" interface that allows API routers to be built piece by piece. The following example is part of a standard `plumber.R` file.

Use @plumber tag

Function that accepts and modifies a plumber router

"Tidy" functions for building out Plumber API

```r
library(plumber)

#* @plumber
function(pr) {
  pr %>%
    pr_get(path = "/echo",
      handler = function(msg = "") {
        list(msg = paste0(
          "The message is: '",
          msg,
          "'"))
      }) %>%
    pr_get(path = "/plot",
      handler = function() {
        rand <- rnorm(100)
        hist(rand)
      },
      serializer = serializer_png()) %>%
    pr_post(path = "/sum",
      handler = function(a, b) {
        as.numeric(a) + as.numeric(b)
      })
}
```

OpenAPI

Plumber automatically creates an OpenAPI specification file based on Plumber comments. This file can be further modified using `pr_set_api_spec()` with either a function that modifies the existing specification or a path to a `.yaml` or `.json` specification file.

Function that receives and modifies the existing specification

Return the updated specification

```r
library(plumber)

#* @param msg The message to echo
#* @get /echo
function(msg = "") {
  list(
    msg = paste0(
      "The message is: '", msg, "'")
  )
}

#* @plumber
function(pr) {
  pr %>%
    pr_set_api_spec(function(spec) {
      spec$paths[["/echo"]]$get$summary <-
        "Echo back the input"
      spec
    })
}
```

By default, Swagger is used to interpret the OpenAPI specification file and generate the user interface for the API. Other interpreters can be used to adjust the look and feel of the user interface via `pr_set_docs()`.


Advanced Plumber

REQUEST and RESPONSE

Plumber provides access to special `req` and `res` objects that can be passed to Plumber functions. These objects provide access to the request submitted by the client and the response that will be sent to the client. Each object has several components, the most helpful of which are outlined below:

Name	Example	Description
req		
req$pr	plumber::pr()	The Plumber router processing the request
req$body	list(a=1)	Typically the same as **argsBody**
req$argsBody	list(a=1)	The parsed body output
req$argsPath	list(c=3)	The values of the path arguments
req$argsQuery	list(e=5)	The parsed output from **req$QUERY_STRING**
req$cookies	list(cook = "a")	A list of cookies
req$REQUEST_METHOD	"GET"	The method used for the HTTP request
req$PATH_INFO	"/"	The path of the incoming HTTP request
req$HTTP_*	"HTTP_USER_AGENT"	All of the HTTP headers sent with the request
req$bodyRaw	charToRaw("a=1")	The **raw()** contents of the request body
res		
res$headers	list(header = "abc")	HTTP headers to include in the response
res$setHeader()	setHeader("foo", "bar")	Sets an HTTP header
res$setCookie()	setCookie("foo", "bar")	Sets an HTTP cookie on the client
res$removeCookie	removeCookie("foo")	Removes an HTTP cookie
res$body	"{"a":[1]}"	Serialized output
res$status	200	The response HTTP status code
res$toResponse()	toResponse()	A list of status, headers, and body

---
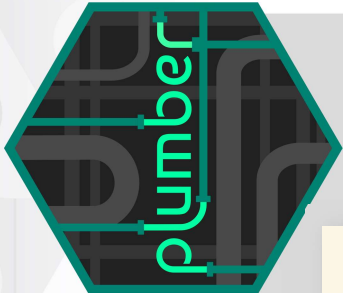
ASYNC PLUMBER

Plumber supports asynchronous execution via the **future** R package. This pattern allows Plumber to concurrently process multiple requests.

Set the execution plan

Slow calculation

```r
library(plumber)
future::plan("multisession")

#* @get /slow
function() {
  promises::future_promise({
    slow_calc()
  })
}
```

MOUNTING ROUTERS

Plumber routers can be combined by mounting routers into other routers. This can be beneficial when building routers that involve several different endpoints and you want to break each component out into a separate router. These separate routers can even be separate files loaded using `plumb()`.

Create an initial router

Mount one router into another

```r
library(plumber)

route <- pr() %>%
  pr_get("/foo", function() "foo")

#* @plumber
function(pr) {
  pr %>%
    pr_mount("/bar", route)
}
```

In the above example, the final route is `/bar/foo`.

RUNNING EXAMPLES

Some packages, like the Plumber package itself, may include example Plumber APIs. Available APIs can be viewed using `available_apis()`. These example APIs can be run with `plumb_api()` combined with `pr_run()`.

Identify the package name and API name

Optionally open the file for editing

Run the example API

```r
library(plumber)

plumb_api(package = "plumber",
  name = "01-append",
  edit = TRUE) %>%
  pr_run()
```

Deploying Plumber APIs

Once Plumber APIs have been developed, they often need to be deployed somewhere to be useful. Plumber APIs can be deployed in a variety of different ways. One of the easiest way to deploy Plumber APIs is using Posit Connect, which supports push button publishing from the RStudio IDE.

▶ Run API ▾
Publish API...
Manage Accounts...

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