

# REST APIs with plumber: : CHEAT SHEET



## Introduction to REST APIs

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

### HTTP



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

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

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

Annotations: Path, HTTP Method, Headers, HTTP Version, Message body

### RESPONSE

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

Annotations: HTTP Version, Status code, Reason phrase, Headers, 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
#* Echo back the input
#* @param msg The message to echo
#* @get /echo
function(msg = "") {
  list(
    msg = paste0(
      "The message is: '", msg, "'"
    )
  )
}
```

Annotations: Plumber comments begin with #\*, @decorators define API characteristics, HTTP Method, /<path> is used to define the location of the endpoint

## 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
function(req, res) {
  print(req$HTTP_USER_AGENT)
  forward()
}

#* Convert request body to uppercase
#* @preempt log
#* @parser json
#* @post /uppercase
#* @serializer json
function(req, res) {
  toupper(req$body)
}
```

Annotations: Identify as filter, Forward request, Endpoint description, Parser, HTTP Method, Filter name, Opt out of the log filter, Endpoint path, Serializer

## Running Plumber APIs

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

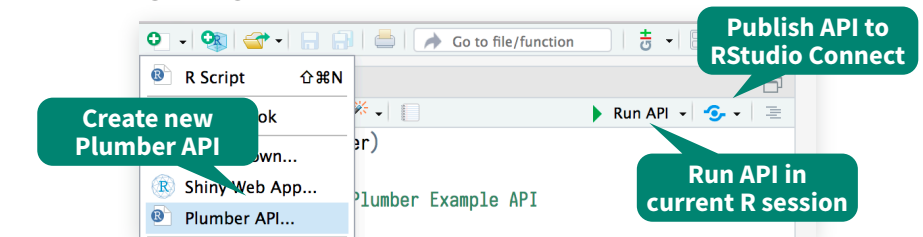
```
library(plumber)

plumb("plumber.R") %>%
  pr_run(port = 5762)
```

Annotations: Path to API definition, Specify API port

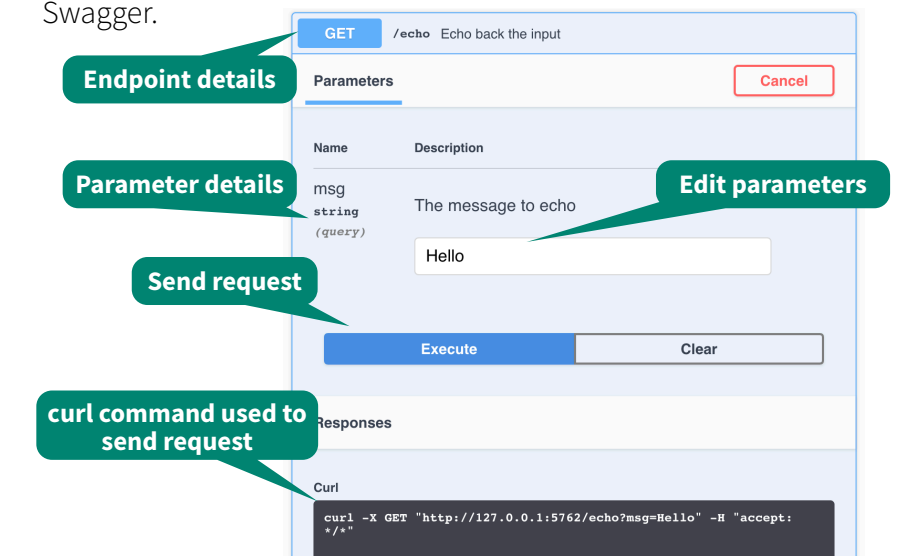
This runs the API on the host machine supported by the current R session.

### IDE INTEGRATION



## 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.



## 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] "{\n  \"msg\": [\n    \"The message is: 'Hello'\\n\"]\n}"
```

# Programmatic Plumber

## Tidy Plumber

Plumber is exceptionally customizable. In addition to using special comments to create APIs, APIs can be created entirely programmatically. 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.

```
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)
            })
}
```

Use @plumber tag

Function that accepts and modifies a plumber router

“Tidy” functions for building out Plumber API

## 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.

```
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
    })
}
```

Function that receives and modifies the existing specification

Return the updated specification

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

## ASYNCR PLUMBER

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

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

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

Set the execution plan

Slow calculation

## 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()`.

```
library(plumber)

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

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

Create an initial router

Mount one router into another

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()`.

```
library(plumber)

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

Identify the package name and API name

Run the example API

Optionally open the file for editing

# 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 RStudio Connect, which supports push button publishing from the RStudio IDE.

Run API

Publish API...

Manage Accounts...