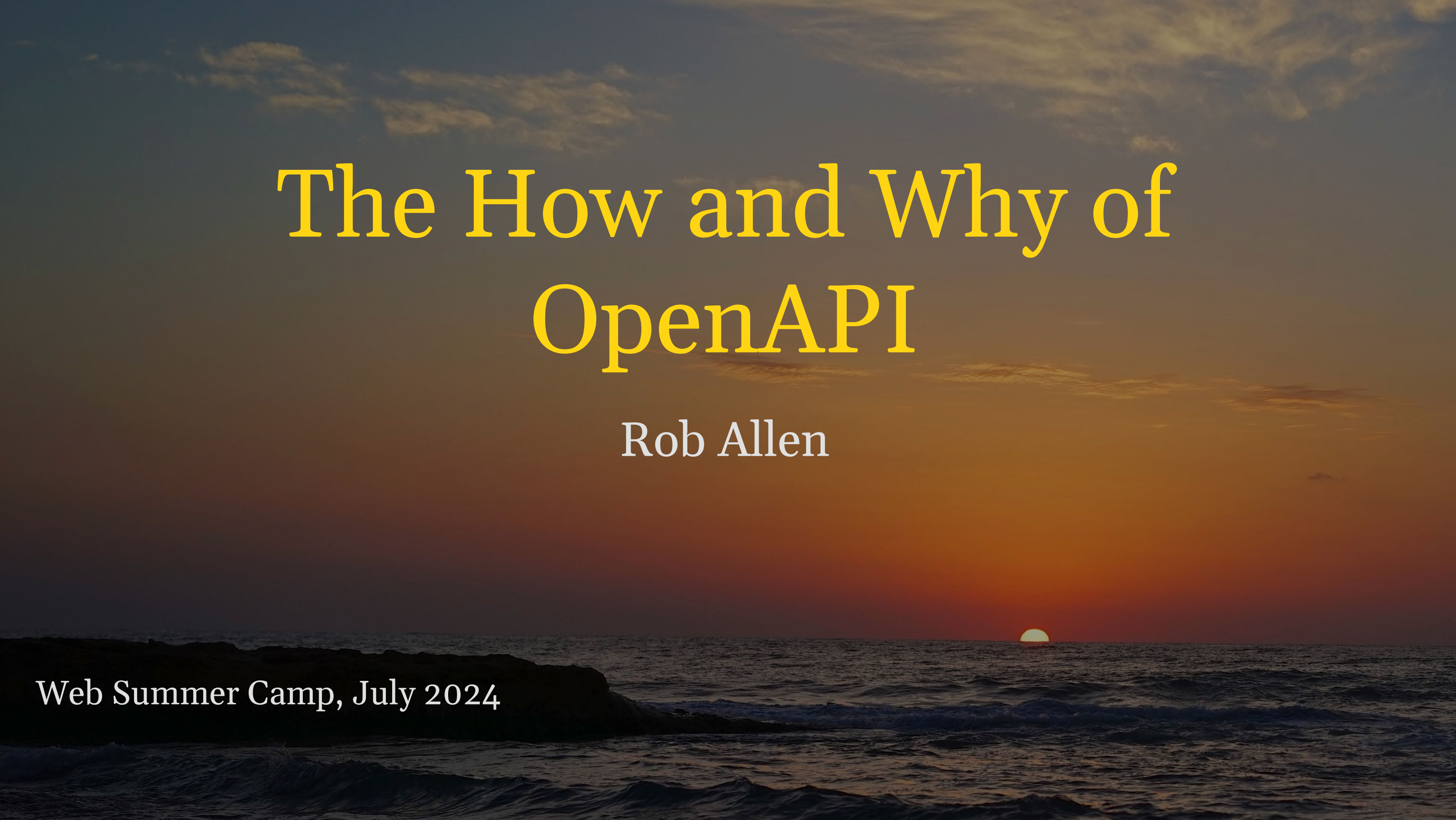


The How and Why of OpenAPI

Rob Allen

Web Summer Camp, July 2024

APIs Power the Internet

APIs Power the Internet

API Descriptions Power APIs

The OpenAPI Specification (OAS) defines a standard, programming language-agnostic interface description for HTTP APIs, which allows both humans and computers to discover and understand the capabilities of a service

https://spec.openapis.org/oas/latest.html

It's about

documentation

It's about

design-first

It's about

communicating changes

It's about
development workflows

It's about

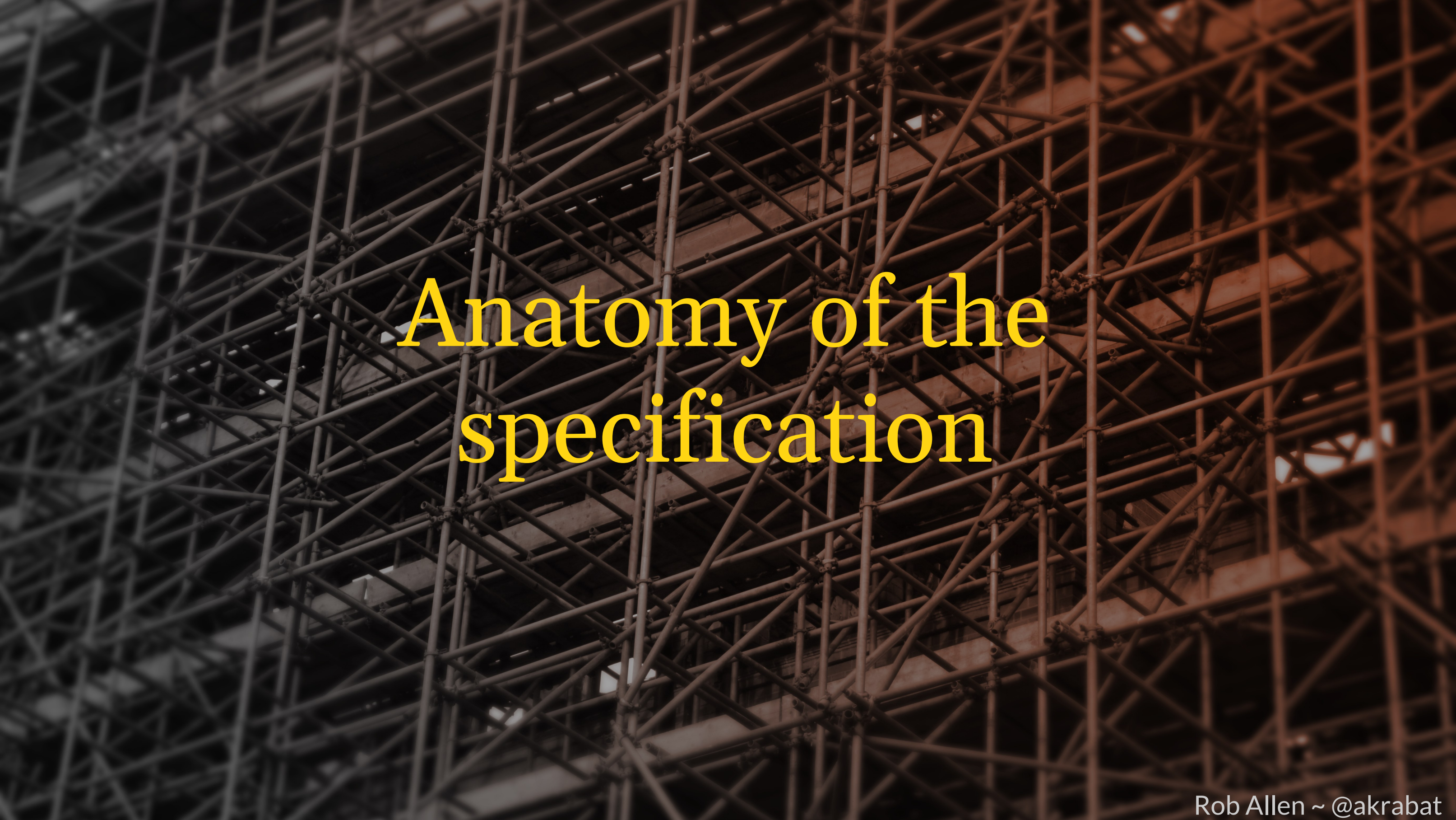
standardisation

It's about

a contract

"Using a consistent API description will help increase adoption of APIs across government by reducing time spent in understanding different APIs.

gov.uk



Anatomy of the specification

openapi.yaml

```yaml
openapi: "3.1.0"
info: # ...
servers: # ...
paths: # ...
webhooks: # ...
components: # ...
security: # ...
tags: # ...
externalDocs: # ...
```

Metadata

```yaml
info:
  title: Rock-Paper-Scissors
  version: "1.0.0"
  description: An implementation of Rock-Paper-Scissors.
  contact:
    name: "Rob Allen"
  license:
    name: The MIT License

servers:
  - url: https://rock-paper-scissors.example.com
    description: "RPS production API"
```

Endpoints

```
paths:
  '/games':
    get:
      # ...
    post:
      # ...
  '/games/{game_id}/moves':
    post:
      # ...
  '/games/{game_id}/judgement':
    get:
      # ...
```

Endpoints

```
paths:
  '/games':
    post:
      operationId: createGame
      summary: Create a new game
      description: Create a new game of Rock-Paper-Scissors.
      requestBody:
        # ...
      responses:
        # ...
```

Endpoints

```yaml
paths:
  '/games':
    post:
      operationId: createGame
      summary: Create a new game
      description: Create a new game of Rock-Paper-Scissors.
      requestBody:
        # ...
      responses:
        # ...
```

Endpoints

```
paths:
  '/games':
    post:
      operationId: createGame
      summary: Create a new game
      description: Create a new game of Rock-Paper-Scissors.
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        # ...
      responses:
        # ...
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Endpoints

```
paths:
  '/games':
    post:
      operationId: createGame
      summary: Create a new game
      description: Create a new game of Rock-Paper-Scissors.
      requestBody:
        # ...
      responses:
        # ...
```

RequestBody

```
requestBody:
  description: Game to add
  required: true
  content:
    application/json:
      schema:
        $ref: '#/components/schemas/NewGameRequest'
```

RequestBody

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requestBody:
  description: Game to add
  required: true
  content:
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RequestBody

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requestBody:
  description: Game to add
  required: true
  content:
    application/json:
      schema:
        $ref: '#/components/schemas/NewGameRequest'
```

Reuse of objects

`$ref` allows us to define once & use in many places

```yaml
components:
  schemas:
    GameId:
      type: string
      format: "uuid"
      examples:
        - "2BC08389-885A-4322-80D0-EF0DE2D7CD37"
    Player:
      type: string
      example: "Lucy"
```

Reuse of objects

`$ref` allows us to define once & use in many places

```
components:
  schemas:
    GameId:
      type: string
      format: "uuid"
      examples:
        - "2BC08389-885A-4322-80D0-EF0DE2D7CD37"
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    GameId:
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      examples:
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Reuse of objects

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components:
  schemas:
    GameId:
      type: string
      format: "uuid"
      examples:
        - "2BC08389-885A-4322-80D0-EF0DE2D7CD37"
    Player:
      type: string
      example: "Lucy"
```

Reuse of objects

`$ref` allows us to define once & use in many places

```
components:
  schemas:
    GameId:
      type: string
      format: "uuid"
      examples:
        - "2BC08389-885A-4322-80D0-EF0DE2D7CD37"
    Player:
      type: string
      example: "Lucy"
```

Build on top of other components

```yaml
schemas:
  NewGameRequest:
    properties:
      player1:
        $ref: '#/components/schemas/Player'
      player2:
        $ref: '#/components/schemas/Player'
    required:
      - player1
      - player2
    examples:
      - '{"player1":"Lucy", "player2":"Dave"}'
```

Build on top of other components

```yaml
schemas:
  NewGameRequest:
    properties:
      player1:
        $ref: '#/components/schemas/Player'
      player2:
        $ref: '#/components/schemas/Player'
    required:
      - player1
      - player2
    examples:
      - '{"player1":"Lucy", "player2":"Dave"}'
```

Build on top of other components

```
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  NewGameRequest:
    properties:
      player1:
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    required:
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      - player2
    examples:
      - '{"player1":"Lucy", "player2":"Dave"}'
```

Build on top of other components

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schemas:
  NewGameRequest:
    properties:
      player1:
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      - player2
    examples:
      - '{"player1":"Lucy", "player2":"Dave"}'
```

Build on top of other components

```
schemas:
  NewGameRequest:
    properties:
      player1:
        $ref: '#/components/schemas/Player'
      player2:
        $ref: '#/components/schemas/Player'
    required:
      - player1
      - player2
    examples:
      - '{"player1":"Lucy", "player2":"Dave"}'
```

RequestBody

```yaml
requestBody:
  description: Game to add
  required: true
  content:
    application/json:
      schema:
        $ref: '#/components/schemas/NewGameRequest'
```

Responses

```
responses:
  '201':
    $ref: '#/components/responses/NewGameResponse'
  '400':
    $ref: '#/components/responses/NewGameError'
  '500':
    $ref: '#/components/responses/InternalServerError'
```

Responses

```
responses:
  '201':
    $ref: '#/components/responses/NewGameResponse'
  '400':
    $ref: '#/components/responses/NewGameError'
  '500':
    $ref: '#/components/responses/InternalServerError'
```

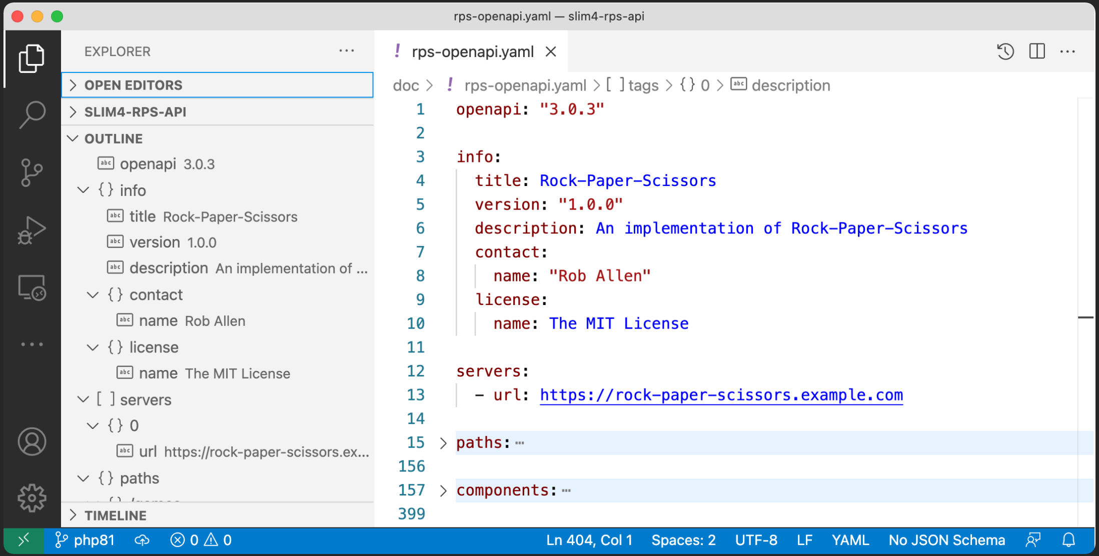
Responses

```
responses:
  '201':
    $ref: '#/components/responses/NewGameResponse'
  '400':
    $ref: '#/components/responses/NewGameError'
  '500':
    $ref: '#/components/responses/InternalServerError'
```

Writing your spec

Editing

It's just text!

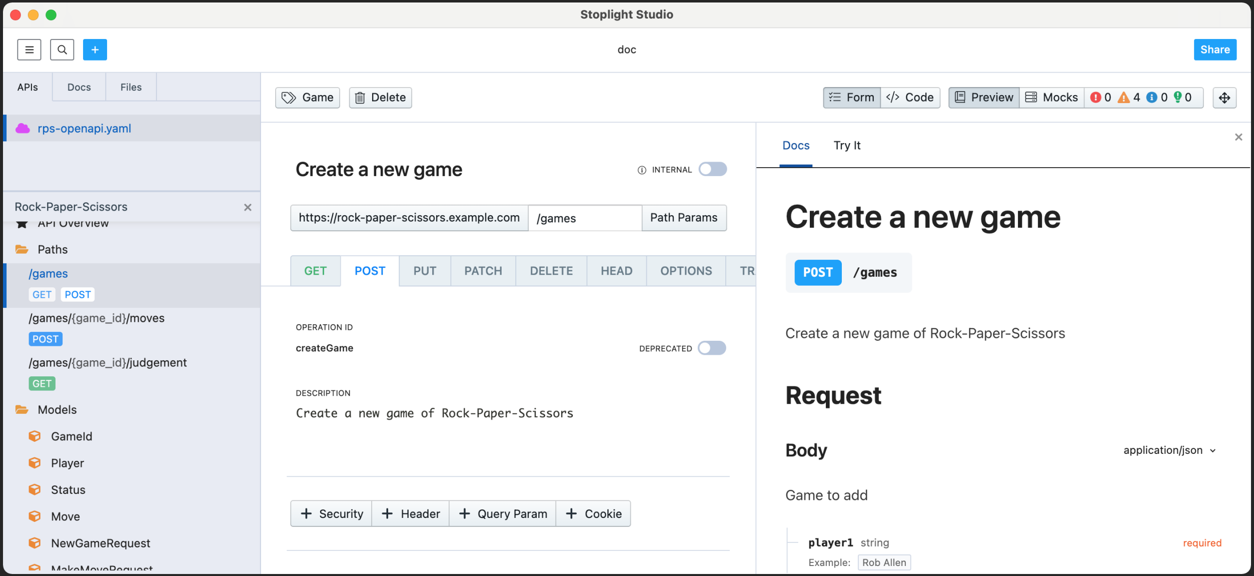


```yaml
openapi: "3.0.3"

info:
  title: Rock-Paper-Scissors
  version: "1.0.0"
  description: An implementation of Rock-Paper-Scissors
  contact:
    name: "Rob Allen"
  license:
    name: The MIT License

servers:
  - url: https://rock-paper-scissors.example.com

paths: …

components: …
```

Rob Allen ~ @akrabat

Editing

GUI tools: Stoplight, OpenAPI-GUI, Swagger Editor



Create a new game

INTERNAL

https://rock-paper-scissors.example.com /games

OPERATION ID
createGame

DEPRECATED

DESCRIPTION
Create a new game of Rock-Paper-Scissors

Create a new game

POST /games

Create a new game of Rock-Paper-Scissors

Request

Body application/json

Game to add

player1 string required
Example: Rob Allen

Linting & validation

CLI tools: Spectral, openapi-spec-validator, etc.

```
$ spectral lint openapi.yaml
No results with a severity of 'error' or higher found!
```

Validation error

```
$ spectral lint openapi.yaml

.../slim4-rps-api/doc/openapi.yaml
3:6  warning  info-contact  Info object must have
  "contact" object.  info

× 1 problem (0 errors, 1 warning, 0 infos, 0 hints)
```

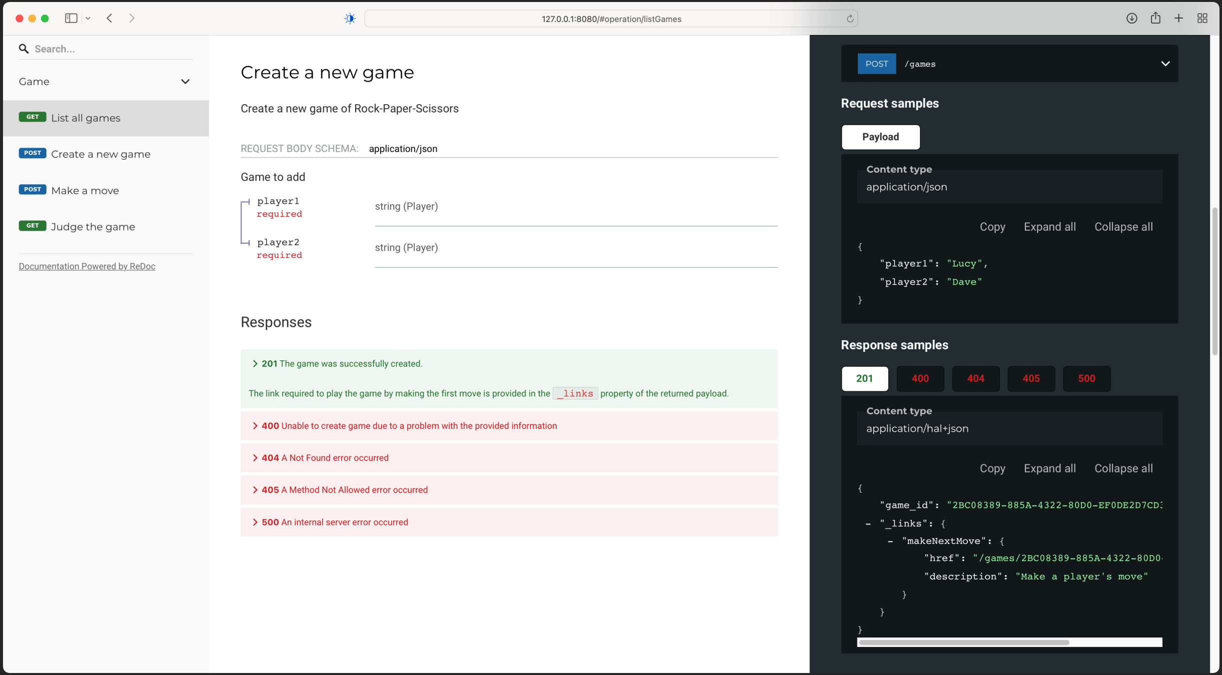
Coding Time!

Write an OpenAPI spec

BOLSILLO
MATERIALES
POESIA
RETRATOS DEL ARTE
MIGUEL SAYAGO
MARY BEARD

Docs

Docs



127.0.0.1:8080/#operation/listGames

Search...

Game

GET List all games

POST Create a new game

POST Make a move

GET Judge the game

Documentation Powered by ReDoc

Create a new game

Create a new game of Rock-Paper-Scissors

REQUEST BODY SCHEMA: application/json

Game to add

player1 required	string (Player)
player2 required	string (Player)

Responses

> 201 The game was successfully created.

The link required to play the game by making the first move is provided in the `_links` property of the returned payload.

> 400 Unable to create game due to a problem with the provided information

> 404 A Not Found error occurred

> 405 A Method Not Allowed error occurred

> 500 An internal server error occurred

POST /games

Request samples

Payload

Content type
application/json

Copy Expand all Collapse all

```
{
    "player1": "Lucy",
    "player2": "Dave"
}
```

Response samples

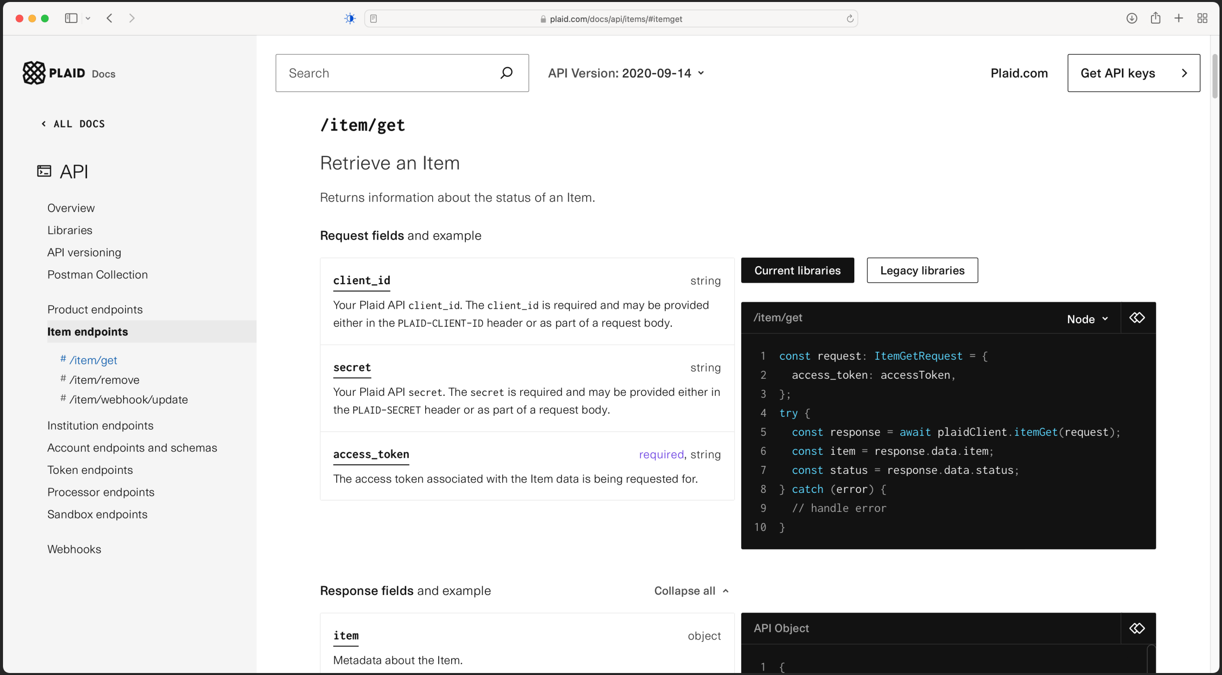
201 400 404 405 500

Content type
application/hal+json

Copy Expand all Collapse all

```
{
    "game_id": "2BC08389-885A-4322-80D0-EF0DE2D7CD3
 -  "_links": {
     -  "makeNextMove": {
            "href": "/games/2BC08389-885A-4322-80D0
            "description": "Make a player's move"
        }
    }
}
```

Docs



plaid.com/docs/api/items/#itemget

PLAID Docs

Search

API Version: 2020-09-14

Plaid.com

Get API keys

‹ ALL DOCS

API

- Overview
- Libraries
- API versioning
- Postman Collection
- Product endpoints
- **Item endpoints**
  - # /item/get
  - # /item/remove
  - # /item/webhook/update
- Institution endpoints
- Account endpoints and schemas
- Token endpoints
- Processor endpoints
- Sandbox endpoints
- Webhooks

/item/get

Retrieve an Item

Returns information about the status of an Item.

Request fields and example

client_id string

Your Plaid API `client_id`. The `client_id` is required and may be provided either in the `PLAID-CLIENT-ID` header or as part of a request body.

secret string

Your Plaid API `secret`. The `secret` is required and may be provided either in the `PLAID-SECRET` header or as part of a request body.

access_token required, string

The access token associated with the Item data is being requested for.

Current libraries | Legacy libraries

/item/get — Node

```
const request: ItemGetRequest = {
  access_token: accessToken,
};
try {
  const response = await plaidClient.itemGet(request);
  const item = response.data.item;
  const status = response.data.status;
} catch (error) {
  // handle error
}
```

Response fields and example — Collapse all

item object

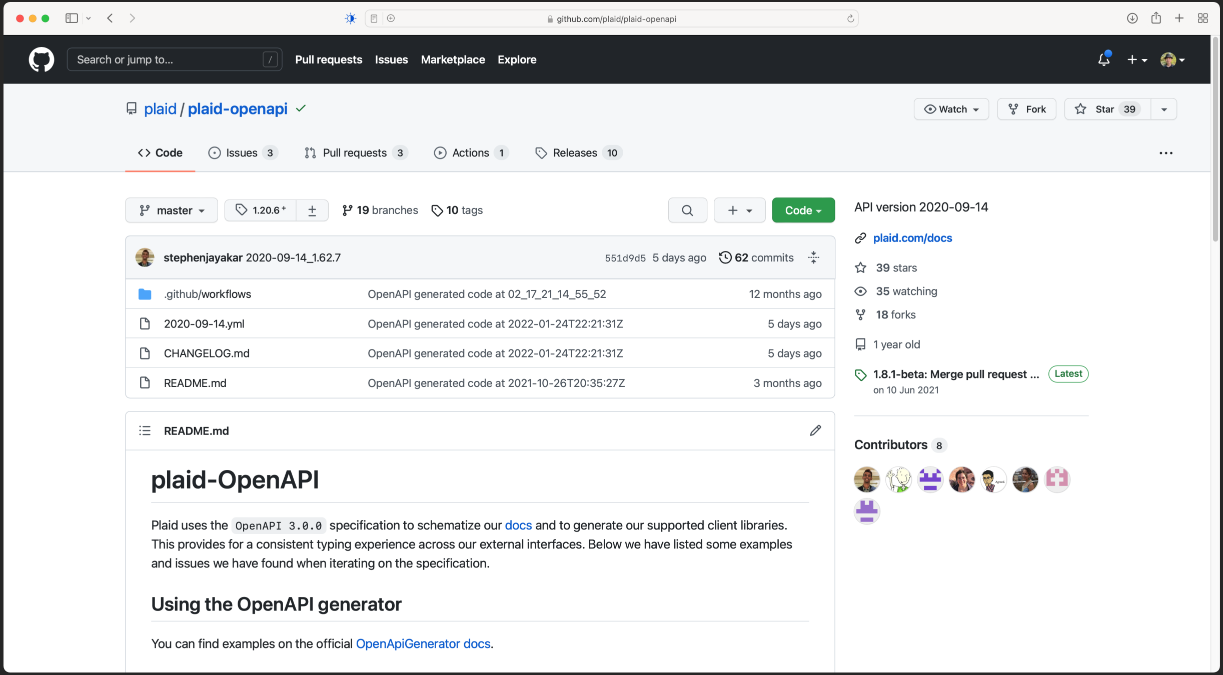
Metadata about the Item.

API Object

```
{
```

Rob Allen ~ @akrabat

Docs



stephenjayakar 2020-09-14_1.62.7 551d9d5 5 days ago 62 commits

.github/workflows	OpenAPI generated code at 02_17_21_14_55_52	12 months ago
2020-09-14.yml	OpenAPI generated code at 2022-01-24T22:21:31Z	5 days ago
CHANGELOG.md	OpenAPI generated code at 2022-01-24T22:21:31Z	5 days ago
README.md	OpenAPI generated code at 2021-10-26T20:35:27Z	3 months ago

API version 2020-09-14

plaid.com/docs

39 stars

35 watching

18 forks

1 year old

1.8.1-beta: Merge pull request ... Latest
on 10 Jun 2021

Contributors 8

README.md

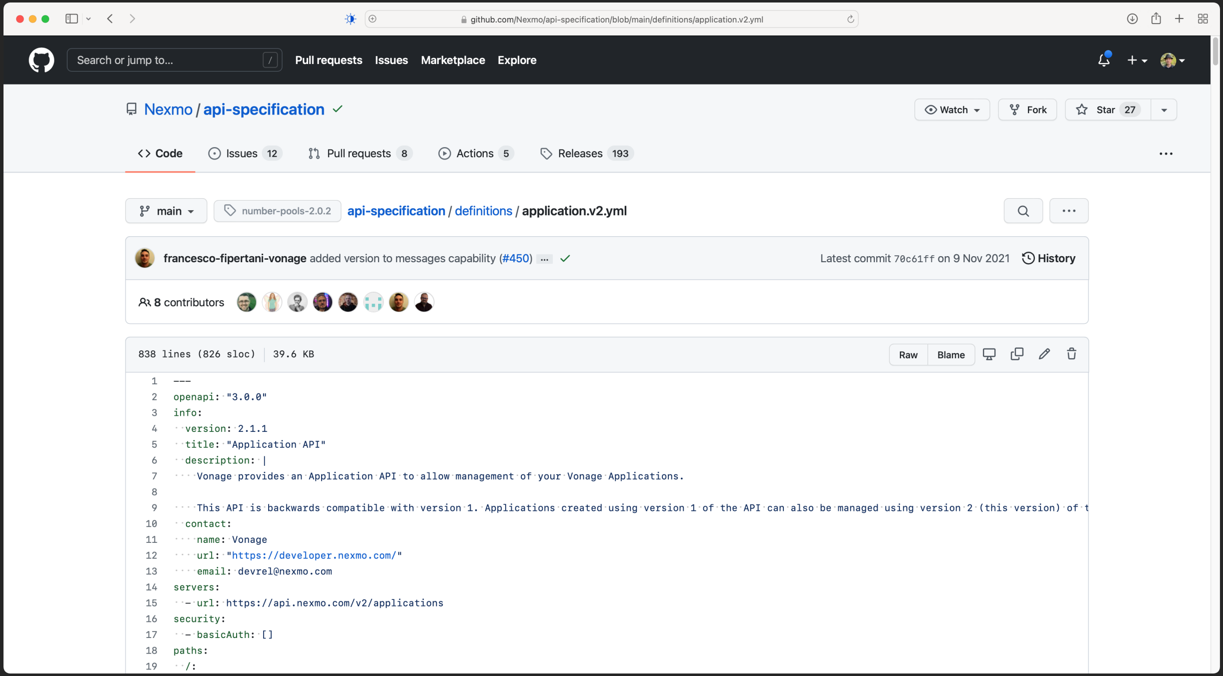
plaid-OpenAPI

Plaid uses the `OpenAPI 3.0.0` specification to schematize our docs and to generate our supported client libraries. This provides for a consistent typing experience across our external interfaces. Below we have listed some examples and issues we have found when iterating on the specification.

Using the OpenAPI generator

You can find examples on the official OpenApiGenerator docs.

Docs



github.com/Nexmo/api-specification/blob/main/definitions/application.v2.yml

Nexmo / api-specification

main · number-pools-2.0.2 · api-specification / definitions / application.v2.yml

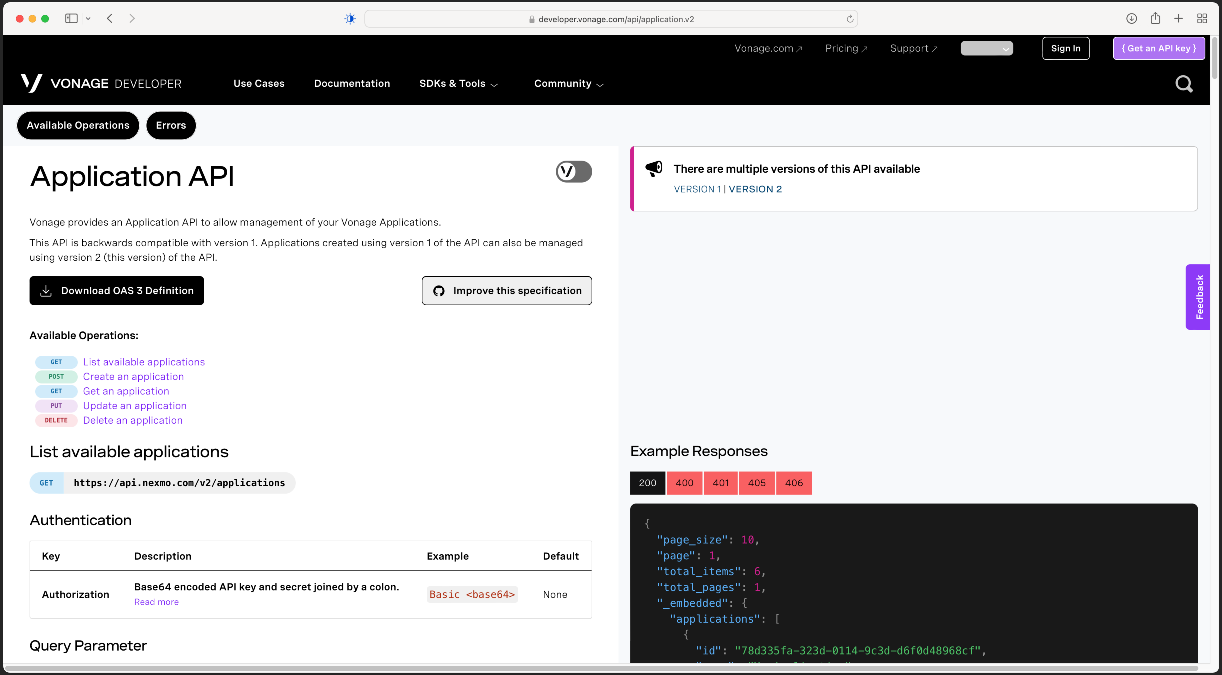
francesco-fipertani-vonage added version to messages capability (#450) … Latest commit 70c61ff on 9 Nov 2021 History

8 contributors

838 lines (826 sloc) | 39.6 KB

```yaml
---
openapi: "3.0.0"
info:
  version: 2.1.1
  title: "Application API"
  description: |
    Vonage provides an Application API to allow management of your Vonage Applications.

    This API is backwards compatible with version 1. Applications created using version 1 of the API can also be managed using version 2 (this version) of t
  contact:
    name: Vonage
    url: "https://developer.nexmo.com/"
    email: devrel@nexmo.com
servers:
  - url: https://api.nexmo.com/v2/applications
security:
  - basicAuth: []
paths:
  /:
```

Docs



developer.vonage.com/api/application.v2

Vonage.com ↗ Pricing ↗ Support ↗ Sign In { Get an API key }

VONAGE DEVELOPER Use Cases Documentation SDKs & Tools Community

Available Operations Errors

Application API

Vonage provides an Application API to allow management of your Vonage Applications.

This API is backwards compatible with version 1. Applications created using version 1 of the API can also be managed using version 2 (this version) of the API.

Download OAS 3 Definition

Improve this specification

Available Operations:

- GET List available applications
- POST Create an application
- GET Get an application
- PUT Update an application
- DELETE Delete an application

List available applications

GET `https://api.nexmo.com/v2/applications`

Authentication

Key	Description	Example	Default
Authorization	Base64 encoded API key and secret joined by a colon. Read more	`Basic <base64>`	None

Query Parameter

There are multiple versions of this API available

VERSION 1 | VERSION 2

Example Responses

200 400 401 405 406

```
{
  "page_size": 10,
  "page": 1,
  "total_items": 6,
  "total_pages": 1,
  "_embedded": {
    "applications": [
      {
        "id": "78d335fa-323d-0114-9c3d-d6f0d48968cf",
```

Feedback

Rob Allen ~ @akrabat

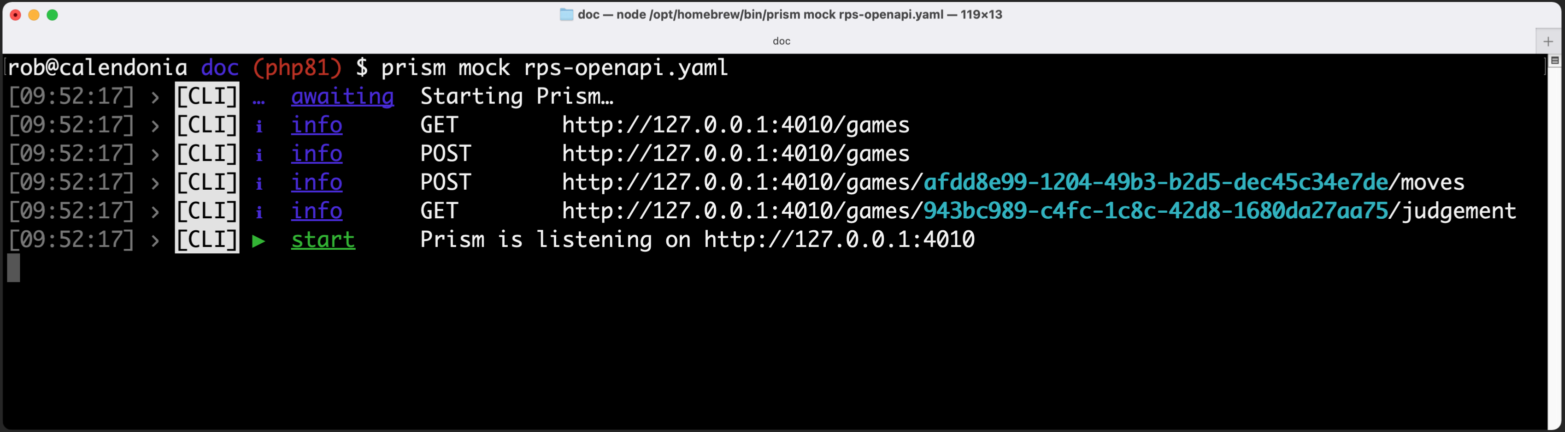
Demo Time!

Generating docs

Developers

Mock server

```
$ prism mock openapi.yaml
```



doc — node /opt/homebrew/bin/prism mock rps-openapi.yaml — 119×13
doc

```
rob@calendonia doc (php81) $ prism mock rps-openapi.yaml
[09:52:17] › [CLI] …  awaiting  Starting Prism…
[09:52:17] › [CLI] ℹ  info      GET        http://127.0.0.1:4010/games
[09:52:17] › [CLI] ℹ  info      POST       http://127.0.0.1:4010/games
[09:52:17] › [CLI] ℹ  info      POST       http://127.0.0.1:4010/games/afdd8e99-1204-49b3-b2d5-dec45c34e7de/moves
[09:52:17] › [CLI] ℹ  info      GET        http://127.0.0.1:4010/games/943bc989-c4fc-1c8c-42d8-1680da27aa75/judgement
[09:52:17] › [CLI] ▶  start     Prism is listening on http://127.0.0.1:4010
```

Make API calls

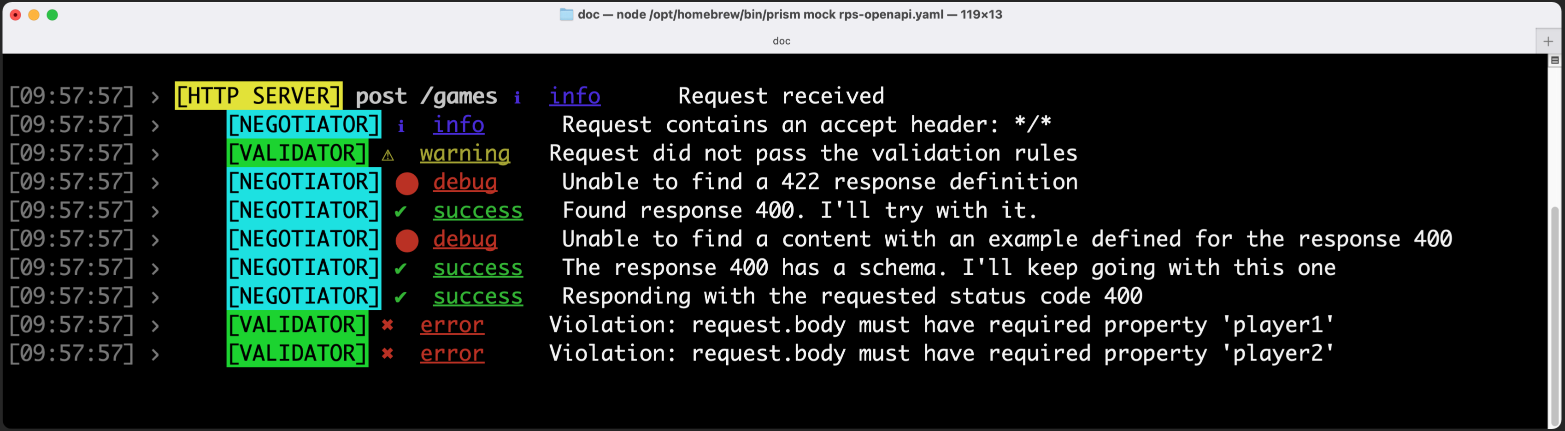
```
$ curl http://127.0.0.1:4010/games -d '{}'
```

Make API calls

```
$ curl http://127.0.0.1:4010/games -d '{}'
{"message":"Must provide both player1 and player2"}
```

Make API calls

```
$ curl http://127.0.0.1:4010/games -d '{}'
{"message":"Must provide both player1 and player2"}
```



doc — node /opt/homebrew/bin/prism mock rps-openapi.yaml — 119×13
doc

```
[09:57:57] › [HTTP SERVER] post /games ℹ  info       Request received
[09:57:57] ›     [NEGOTIATOR] ℹ  info       Request contains an accept header: */*
[09:57:57] ›     [VALIDATOR] ⚠  warning    Request did not pass the validation rules
[09:57:57] ›     [NEGOTIATOR] ●  debug      Unable to find a 422 response definition
[09:57:57] ›     [NEGOTIATOR] ✔  success    Found response 400. I'll try with it.
[09:57:57] ›     [NEGOTIATOR] ●  debug      Unable to find a content with an example defined for the response 400
[09:57:57] ›     [NEGOTIATOR] ✔  success    The response 400 has a schema. I'll keep going with this one
[09:57:57] ›     [NEGOTIATOR] ✔  success    Responding with the requested status code 400
[09:57:57] ›     [VALIDATOR] ✖  error      Violation: request.body must have required property 'player1'
[09:57:57] ›     [VALIDATOR] ✖  error      Violation: request.body must have required property 'player2'
```

Demo Time!

Using a mock server

Validation

The `schema` section can be used to validate the request *and* response

- Validate early and return a 422
- Validate that we return what we say we will
- Put it in CI to prevent regressions

But I already have validation!

Your code:

- isn't good enough!
- isn't reusable!
- doesn't match the docs!

But I already have validation!

Your code:

- isn't good enough!
- isn't reusable!
- doesn't match the docs!

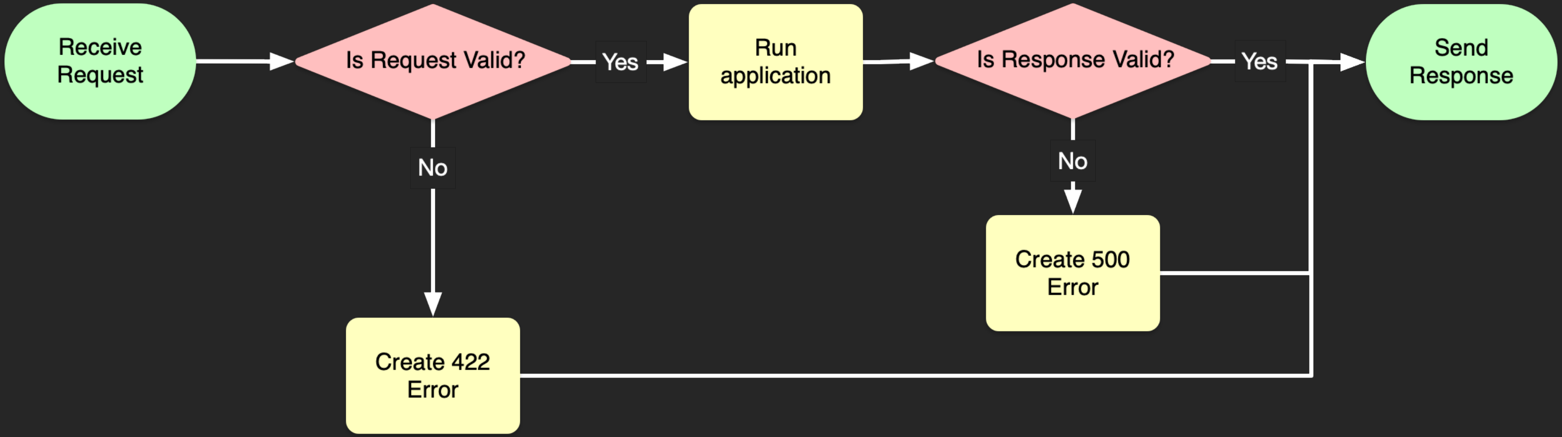
However...

Business logic validation still needed!

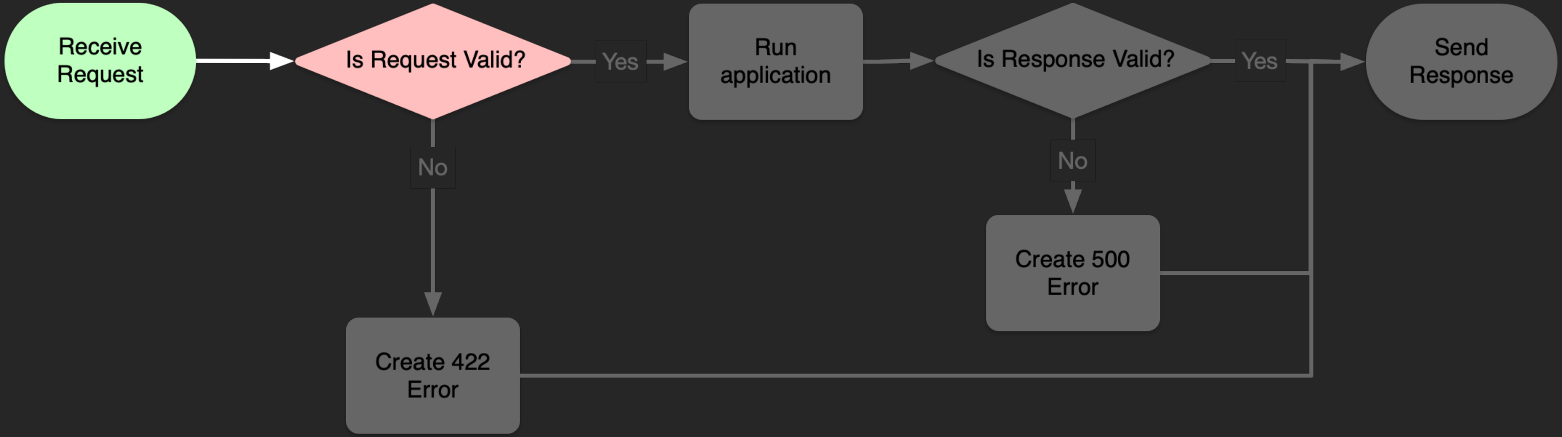
Validation in PHP

- `league/openapi-psr7-validator`
- `opis/json-schema`

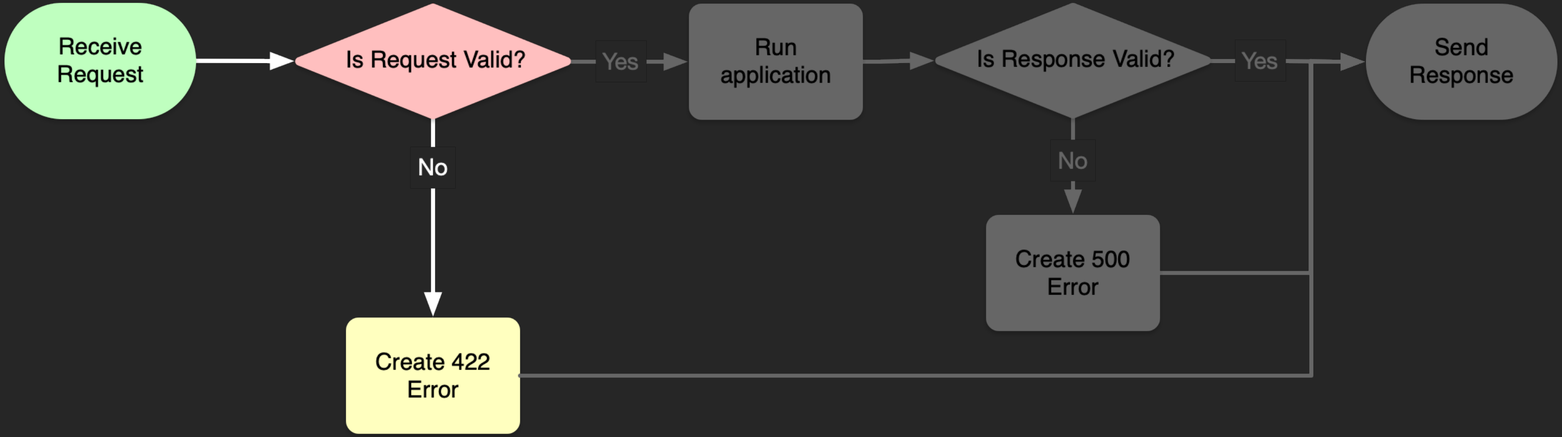
Validation middleware



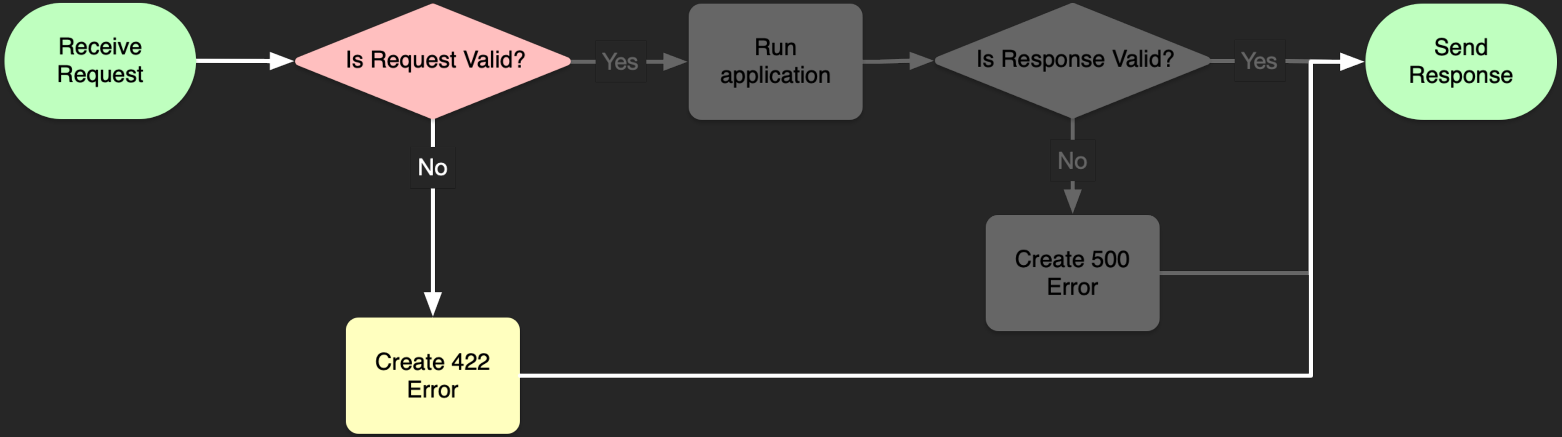
Test Request



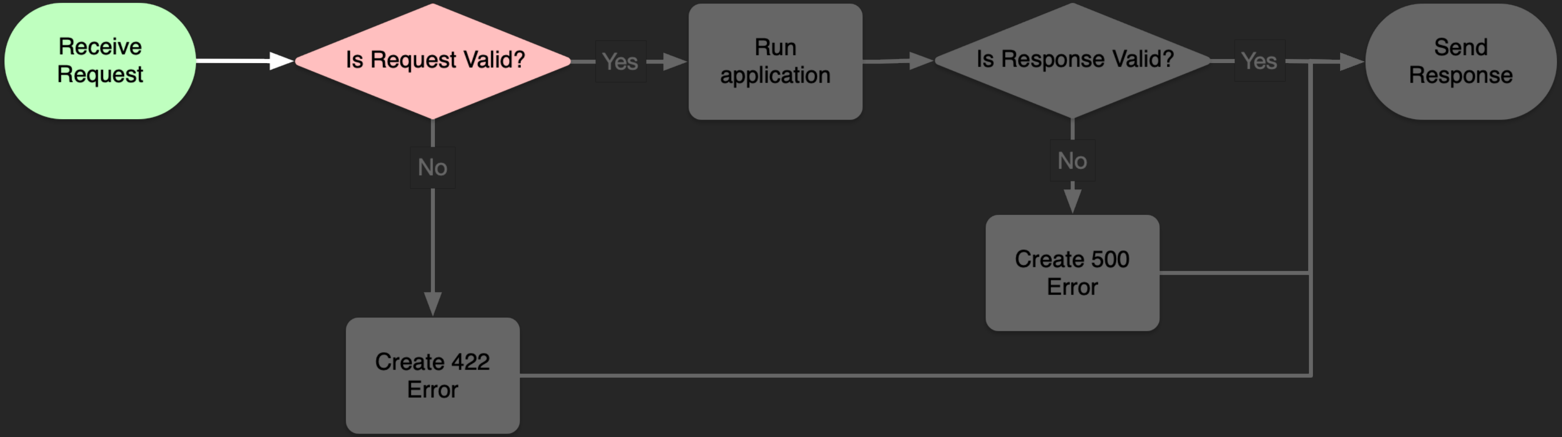
Request is invalid



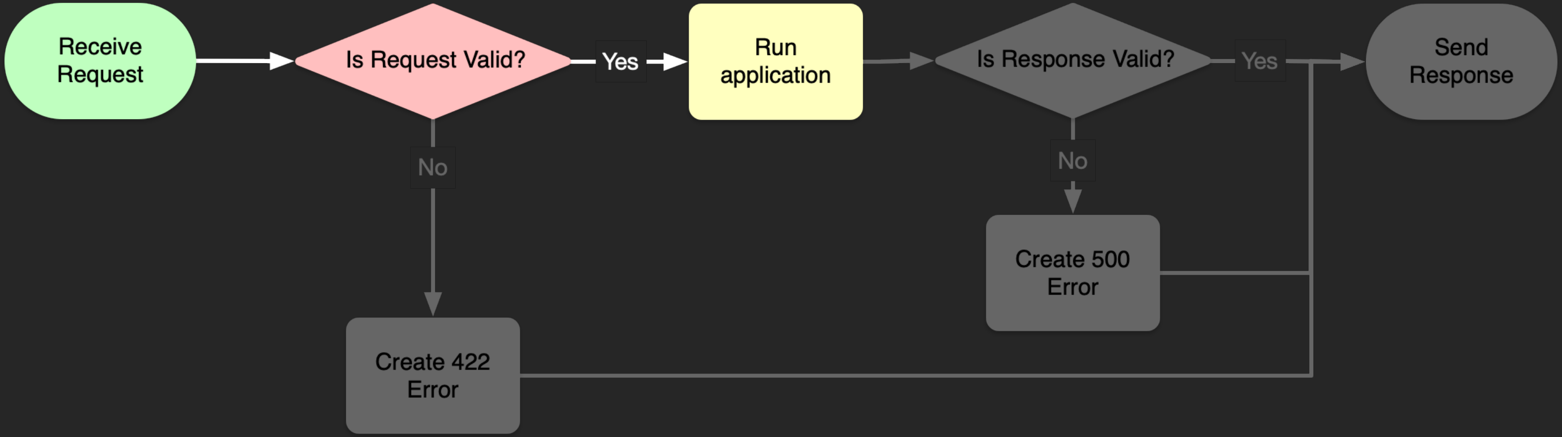
Request is invalid



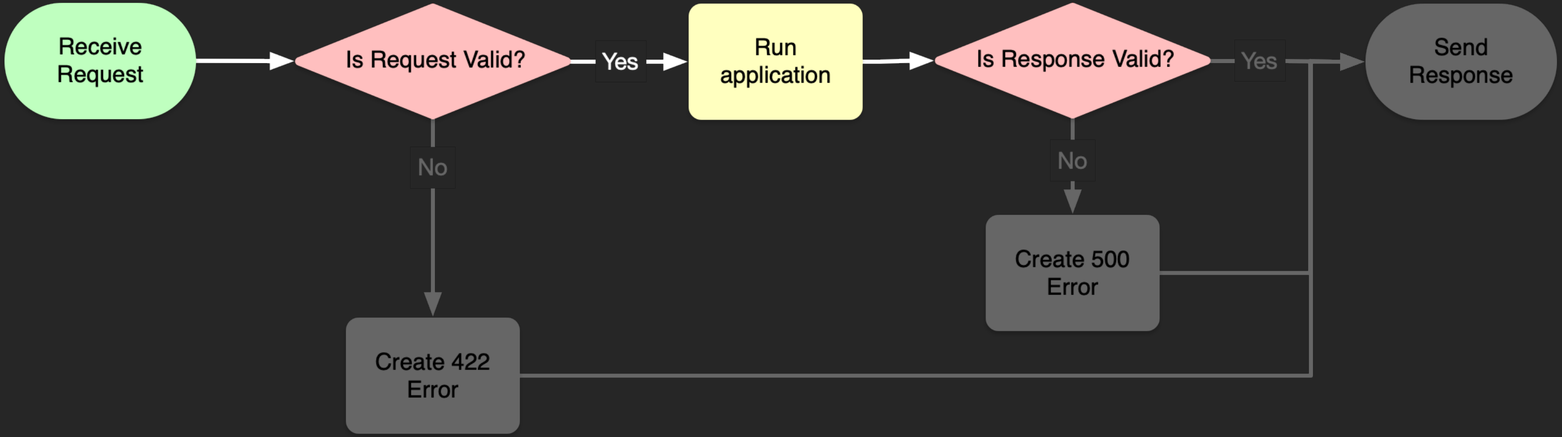
Test Request



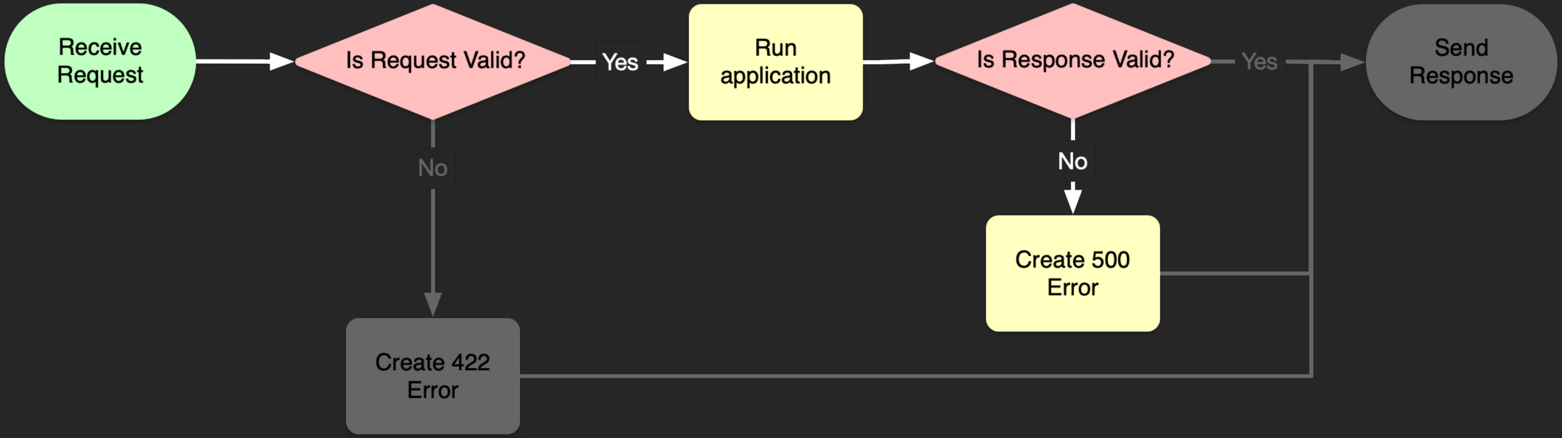
Request is valid



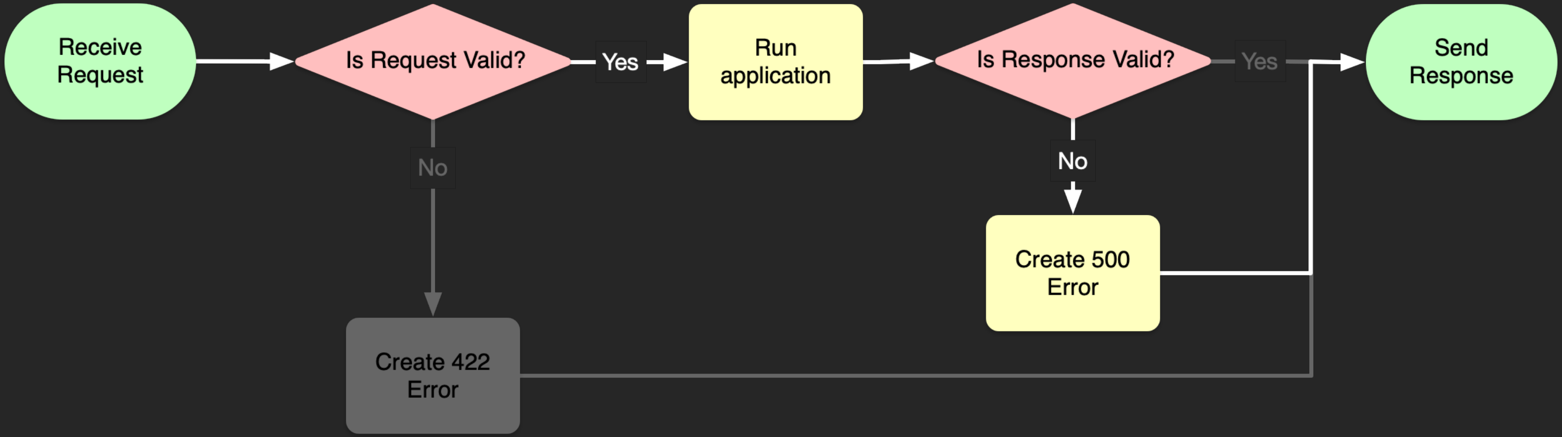
Test Response



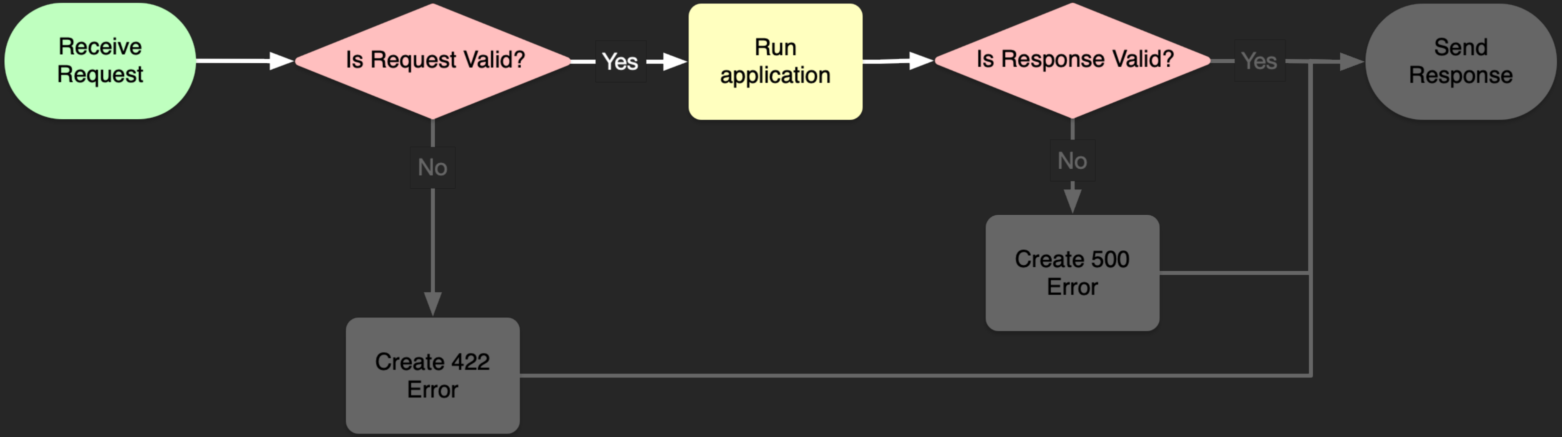
Response is invalid



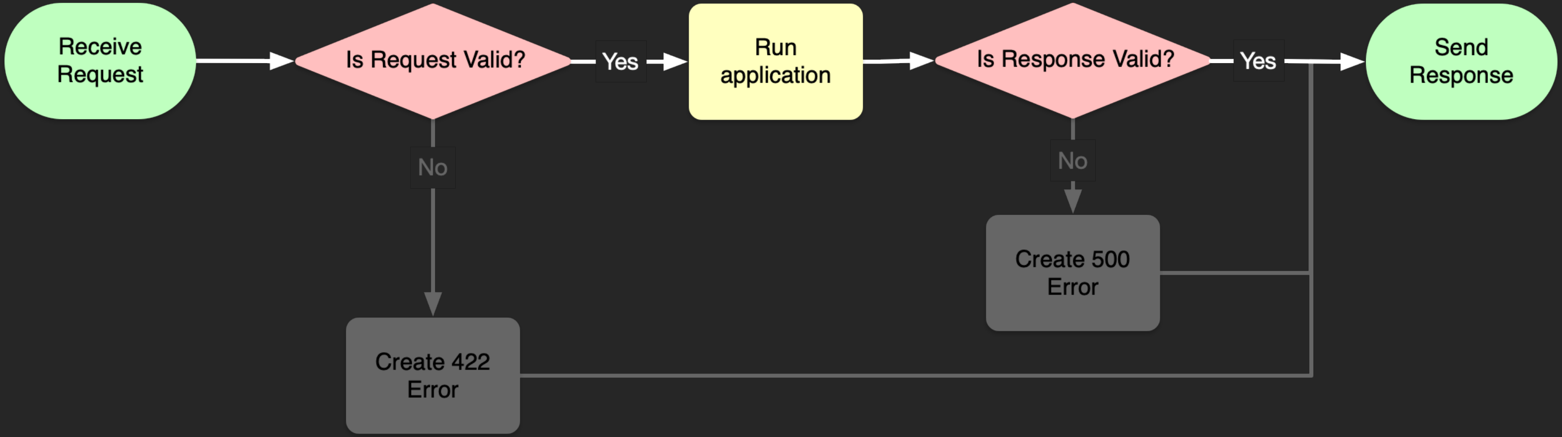
Response is invalid



Successful validation



Successful validation



Validation middleware

```php
class OpenApiValidationMiddleware implements MiddlewareInterface
{
  public function __construct(string $oasFilename, Cache $cache)
  {
    $builder = new ValidatorBuilder();
    $builder->fromYamlFile($oasFilename);
    $builder->setCache($cache)->overrideCacheKey('openapi');

    $this->reqValidator = $builder->getServerRequestValidator();
    $this->respValidator = $builder->getResponseValidator();
  }

  public function process($request, $handler)
  {
    try {
      // validate request
      $match = $this->reqValidator->validate($request);
    } catch (ValidationFailed $e) {
      throw new HttpException($request, 422, $e);
    }

    // process
    $response = $handler->handle($request);

    try {
      // validate response
      $this->respValidator->validate($match, $response);
      return $response;
    } catch (ValidationFailed $e) {
      throw new HttpException($request, 500, $e);
    }
  }
}
```

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```

Coding Time!

Validating a PHP API

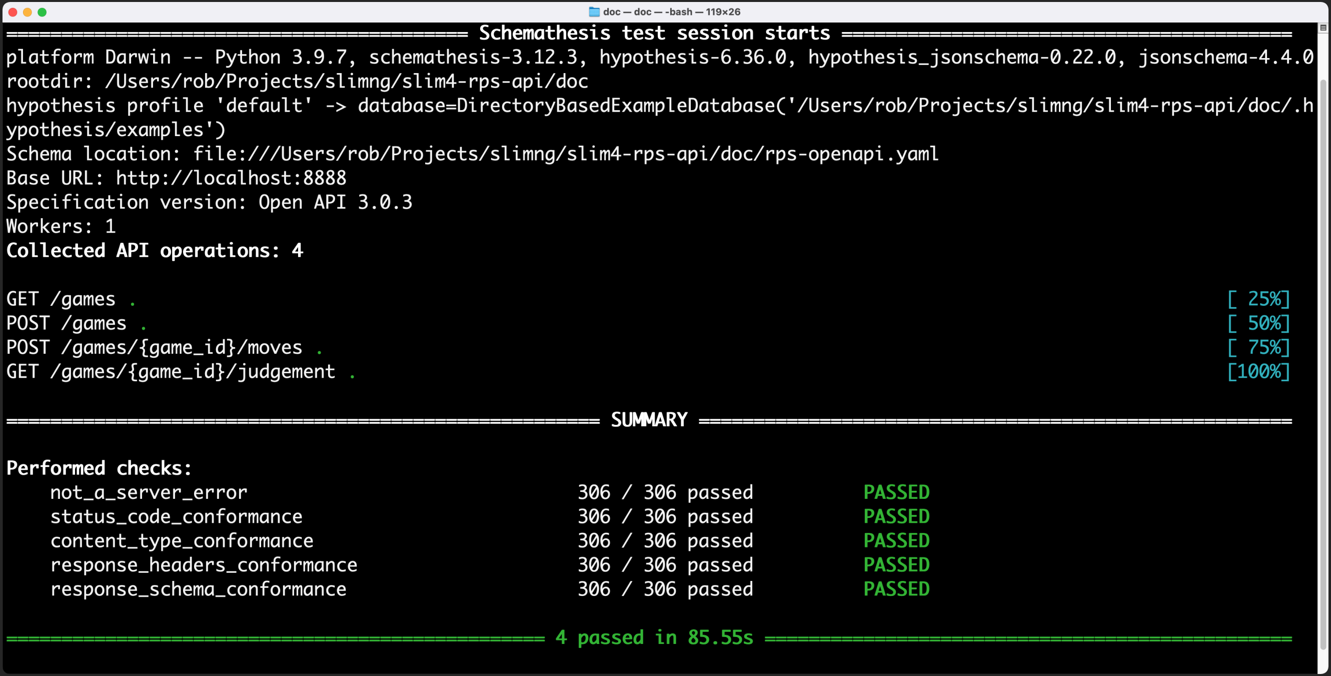
Compliance Testing

Schemathesis reads your OpenAPI spec and tests your API against it

```
pip install schemathesis

schemathesis run --stateful=links --checks all \
  --base-url=http://localhost:8888 \
  doc/openapi.yaml
```

Compliance Testing



```
=========================================== Schemathesis test session starts ===========================================
platform Darwin -- Python 3.9.7, schemathesis-3.12.3, hypothesis-6.36.0, hypothesis_jsonschema-0.22.0, jsonschema-4.4.0
rootdir: /Users/rob/Projects/slimng/slim4-rps-api/doc
hypothesis profile 'default' -> database=DirectoryBasedExampleDatabase('/Users/rob/Projects/slimng/slim4-rps-api/doc/.h
ypothesis/examples')
Schema location: file:///Users/rob/Projects/slimng/slim4-rps-api/doc/rps-openapi.yaml
Base URL: http://localhost:8888
Specification version: Open API 3.0.3
Workers: 1
Collected API operations: 4

GET /games .                                                                                                    [ 25%]
POST /games .                                                                                                   [ 50%]
POST /games/{game_id}/moves .                                                                                   [ 75%]
GET /games/{game_id}/judgement .                                                                                [100%]

======================================================= SUMMARY ========================================================

Performed checks:
    not_a_server_error                              306 / 306 passed          PASSED
    status_code_conformance                         306 / 306 passed          PASSED
    content_type_conformance                        306 / 306 passed          PASSED
    response_headers_conformance                    306 / 306 passed          PASSED
    response_schema_conformance                     306 / 306 passed          PASSED

================================================== 4 passed in 85.55s ==================================================
```

Other Interesting Tools

- *Optic*: BC Break Detection
- *php-openapi-faker*: Create fake data from OpenAPI spec
- *Response2Schema*: Generate OpenAPI spec from JSON object
- *Laravel OpenAPI*: Generate OpenAPI spec from a Laravel app

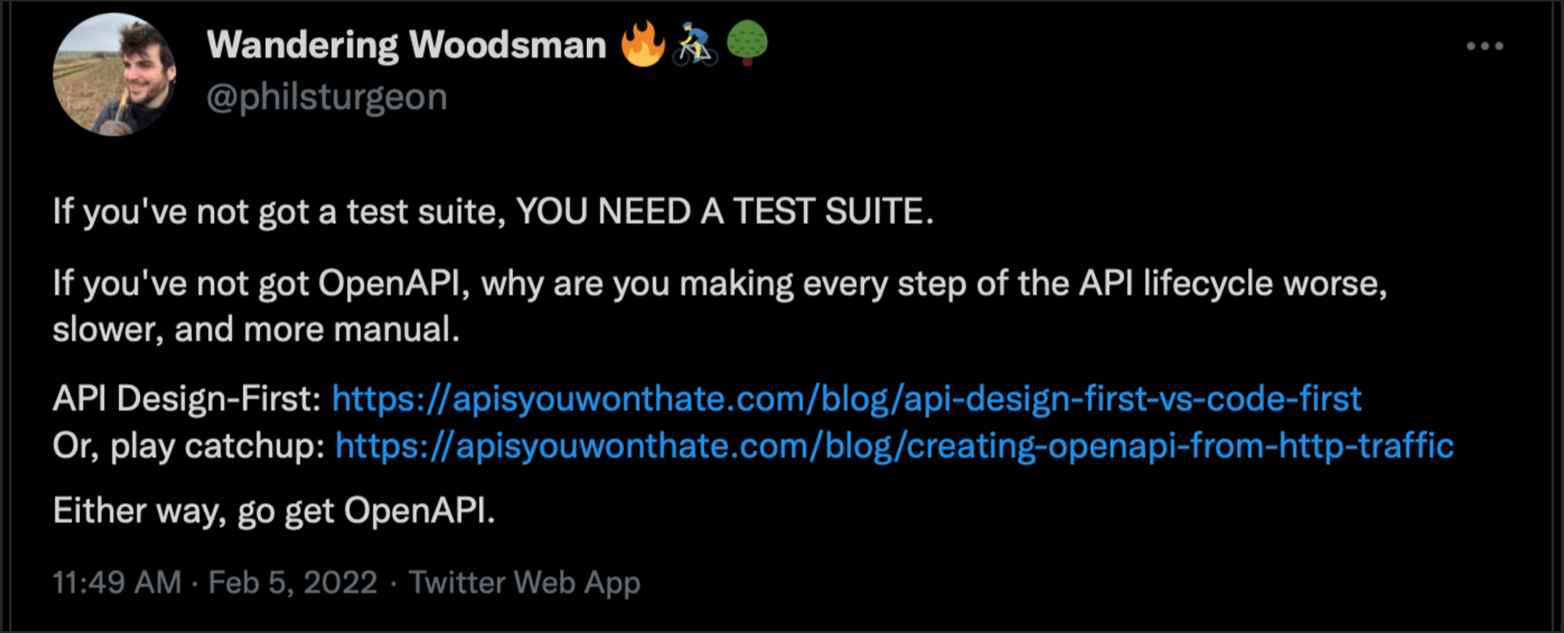
Many more at https://openapi.tools

To sum up

Resources

- https://www.openapis.org
- https://openapi.tools

- https://github.com/thephpleague/openapi-psr7-validator
- https://github.com/akrabat/slim4-rps-api



Wandering Woodsman 🔥🚴🌳
@philsturgeon

If you've not got a test suite, YOU NEED A TEST SUITE.

If you've not got OpenAPI, why are you making every step of the API lifecycle worse, slower, and more manual.

API Design-First: https://apisyouwonthate.com/blog/api-design-first-vs-code-first
Or, play catchup: https://apisyouwonthate.com/blog/creating-openapi-from-http-traffic

Either way, go get OpenAPI.

11:49 AM · Feb 5, 2022 · Twitter Web App

Thank you!

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