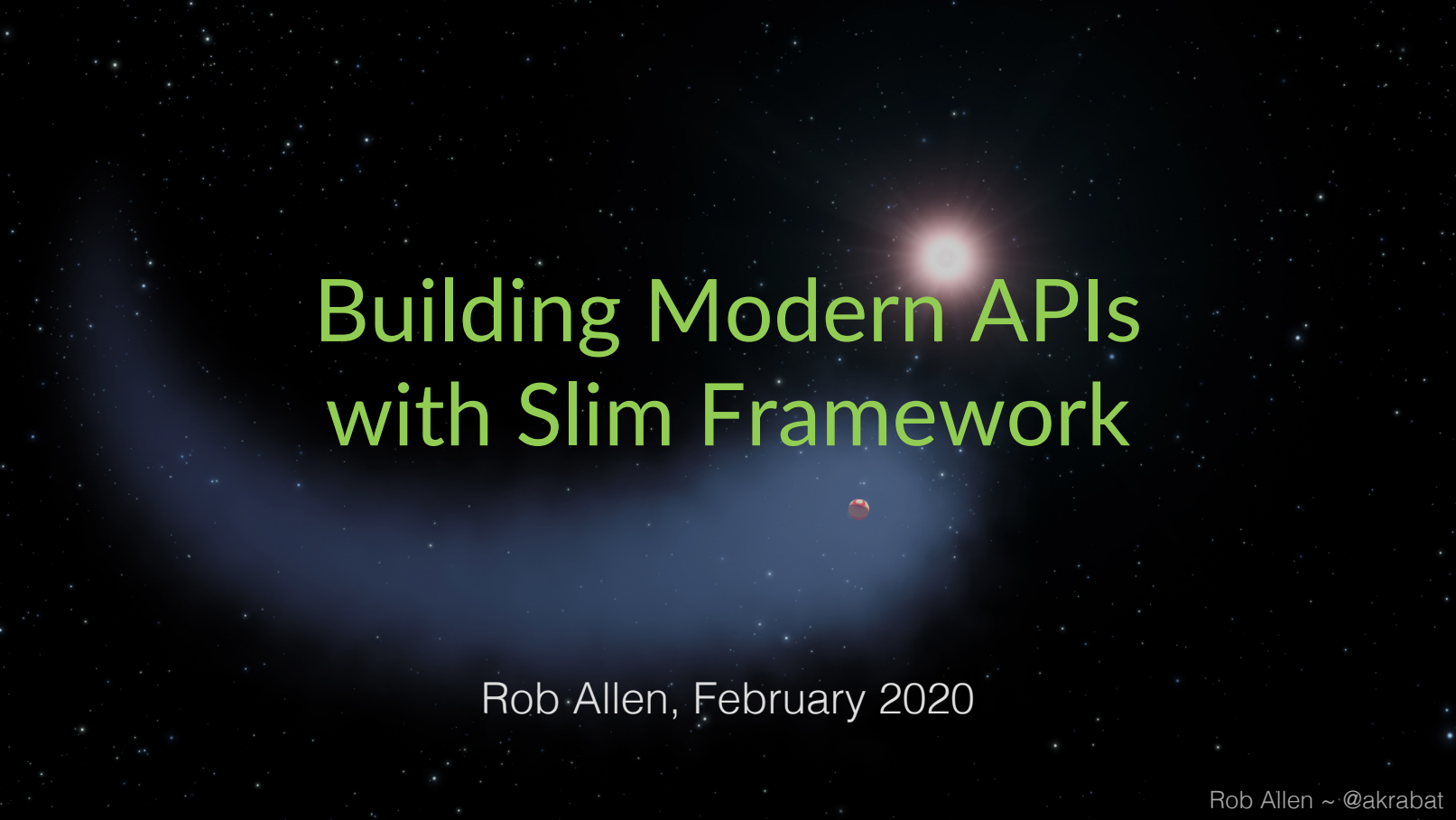

Building Modern APIs
with Slim Framework
Rob Allen, February 2020

Today's plan

- Learn a bit about Slim for context
- Learn the features of a good API
- Put them into practice within a Slim application
- Coffee & cake!

What do you know about APIs?

Rock-Paper-Scissors

An API to play Rock-Paper-Scissors

1. Create a new game
2. Make first player's move
3. Make second player's move
4. Get result

Create a game

```
$ curl -H "Content-Type: application/json" \
http://localhost:8888/games \
-d '{"player1": "Rob", "player2": "Jon"}'
```

Create a game

```
$ curl -H "Content-Type: application/json" \
http://localhost:8888/games \
-d '{"player1": "Rob", "player2": "Jon"}'
```

```
{
    "_links": {
        "makeNextMove": {
            "href": "/games/2ab83e2a-98d0-4110-b3ae-90d6fbf5/moves",
            "description": "Make a player's move"
        }
    }
}
```

Make a move

```
$ curl -H "Content-Type: application/json" \
http://localhost:8888/games/2ab83e2a-98d0-4110-b3ae-90d6fbf5/moves
-d '{"player": "Rob", "move": "rock"}'
```

Make a move

```
$ curl -H "Content-Type: application/json" \
http://localhost:8888/games/2ab83e2a-98d0-4110-b3ae-90d6fbf5/moves
-d '{"player": "Rob", "move": "rock"}'
```

```
{
    "_links": {
        "makeNextMove": {
            "href": "/games/2ab83e2a-98d0-4110-b3ae-90d6fbf5/moves",
            "description": "Make player 2's move"
        }
    }
}
```

Make other move

```
$ curl -H "Content-Type: application/json" \
http://localhost:8888/games/2ab83e2a-98d0-4110-b3ae-90d6fbf5/moves
-d '{"player": "Jon", "move": "rock"}'
```

Make other move

```
$ curl -H "Content-Type: application/json" \
http://localhost:8888/games/2ab83e2a-98d0-4110-b3ae-90d6fbf5/moves
-d '{"player": "Jon", "move": "rock"}'
```

```
{
    "result": "Draw. Both players chose rock",
    "_links": {
        "newGame": {
            "href": "/games/",
            "description": "Start a new game"
        }
    }
}
```


Slim
The C in MVC

Slim Framework

- Created by Josh Lockhart (phptherightway.com)
- PSR-4 autoloading
- PSR-7 Request and Response objects
- PSR-15 Middleware and Request Handlers
- PSR-11 DI container support

PHP-FIG

Bring your own components

Slim provides the router and dispatcher:

You provide:

- PSR-7 component
- PSR-11 DI container
- View layer (templates)
- Model layer (Database/ORM)

Getting started

```
$ composer create-project akrabat/slim4-starter hello-api
```

Slim4-Starter provides:

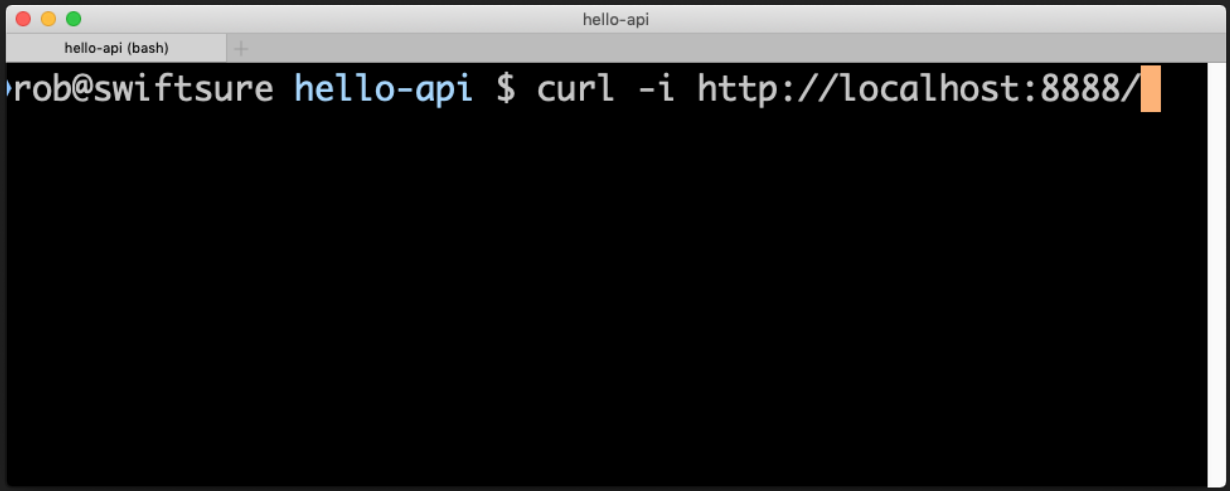
- Slim 4
- Slim-Psr7
- PHP-DI
- Monolog

Getting started

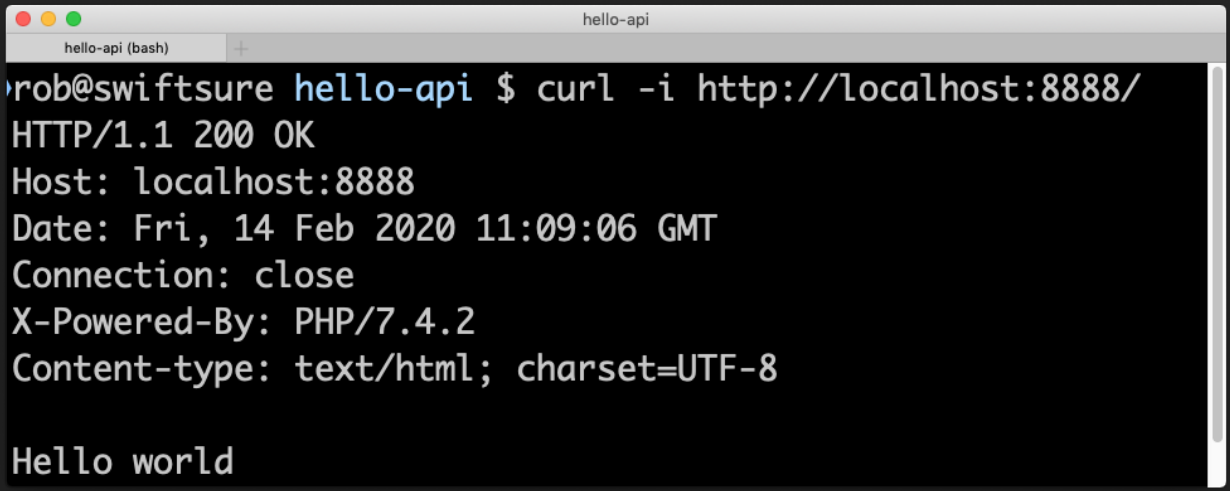
Start a web server

```
$ php -S 0.0.0.0:8888 -t public/
PHP 7.4.2 Development Server (http://0.0.0.0:8888) started
```

Getting started



Getting started



Directory structure

```
├── config/
│   ├── dependencies.php
│   ├── middleware.php
│   ├── routes.php
│   └── settings.php
├── public/
│   └── index.php
├── src/
│   └── Handler/
│       └── HomePageHandler.php
├── var/
│   ├── cache/
│   └── log/
├── vendor/
├── composer.json
└── composer.lock
```

How does Slim work?

1. Bootstrap application
2. Execute routing
3. Dispatch route handler
4. Return response

Routing

1. Inspect URL and matches segments
2. On match:

    - Add `Route` object to Request attribute (`__route__`)
    - Dispatch associated *route handler*

Route handlers

- Manage business logic operations
- Receive a PSR-7 `ServerRequest`
- Return a PSR-7 `Response`
- Implemented as PSR-15 `RequestHandler`

HomePageHandler

```
class HomePageHandler implements RequestHandlerInterface
{
    public function process(
        ServerRequestInterface $request,
    ) : ResponseInterface {
      $response = new Response();
      $response->getBody()->write("Hello $name");
    }
}
```

Coding time

Create a Slim app


HTTP is the foundation

It's all about HTTP

HTTP is a stateless request/response protocol that operates by exchanging messages.

RFC 7230

Client request

```
POST /v2.1/events/18/comments HTTP/1.1
Host: api.dev.joind.in
User-Agent: curl/7.54.0
Accept: application/xml; q=0.8, application/json
Content-Type: application/json
Content-Length: 59

{"comment":"Great Talk. Nothing wrong with it!","rating":5}
```

Server response

```
HTTP/1.1 401 Unauthorized
Server: Apache/2.2.22 (Debian)
Status: 400
Content-Length: 32
Connection: close
Content-Type: application/json; charset=utf8

["Invalid Authorization Header"]
```

PSR-7

OO interfaces to model HTTP

- `RequestInterface` (& `ServerRequestInterface`)
- `ResponseInterface`
- `UriInterface`
- `UploadedFileInterface`

Key feature 1: Immutability

`Request`, `Response`, `Uri` & `UploadFile` are *immutable*

```
$uri = new Uri('https://api.joind.in/v2.1/events');
$uri2 = $uri->withQuery('?filter=upcoming');
$uri3 = $uri->withQuery('?filter=cfp');
```

`with()` methods return a new object with the new information

Key feature 1: Immutability

```php
// This *does not work*
$response = new Response();
$response->withStatus(200);
$response->withHeader('Content-type', 'text/xml');
```

Key feature 1: Immutability

```
// This *does not work*
$response = new Response();
$response->withStatus(200);
$response->withHeader('Content-type', 'text/xml');

// This works: Reassign returned object
$response = new Response();
$response = $response->withStatus(200);
$response = $response->withHeader('Content-type', 'text/xml');
```

Key feature 2: Streams

Message bodies are *streams*

```
$body = new Stream();
$body->write('<p>Hello');
$body->write('World</p>');

$response = (new Response())
    ->withStatus(200, 'OK')
    ->withHeader('Content-Type', 'text/html')
    ->withBody($body);
```

API

Device ⟺ Server

/api/route — PUT — title, waypoint[] → routeID

/api/route/id — GET → Route, Waypoint[], Skin

/api/route/updates — POST → ["", "", ""]

/api/route/browse* — GET → [Route, Skin]

*Optional geo data

Let's talk APIs

Features of a good API

- Correctness
- Malleability
- Error handling
- Documentation

tl;dr

Ensure your API is maintainable and developer-friendly

Get it right!

Embrace HTTP methods

Method	Used for	Idempotent?
GET	Retrieve data	Yes
PUT	Change data	Yes
DELETE	Delete data	Yes
POST	Change data	No
PATCH	Update data	No

(HTTP methods are also known as *verbs*)

HTTP method negotiation

If a given resource (URI) doesn't support the requested HTTP verb, then return: `405 Method Not Allowed`

HTTP method negotiation

If a given resource (URI) doesn't support the requested HTTP verb, then return: `405 Method Not Allowed`

```
$ curl -i -X PUT -H "Accept: application/json" http://localhost:8888

HTTP/1.1 405 Method Not Allowed
Allow: GET
Content-type: application/json

{
    "message": "405 Method Not Allowed",
}
```

URLs matter

- Be consistent
- Prefer nouns for resource names
- Plural names work best for collections
- Unique URL for each resource (/users/123)
- Resources can be named after business processes too (e.g. customer-enrolment, money-transfer, merges)

Status codes

Send the right one for the right situation!

1xx	Informational	*(We're still working)*
2xx	Success	*(All done)*
3xx	Redirection	*(Go elsewhere)*
4xx	Client error	*(Your fault)*
5xx	Server error	*(Our fault)*

Rock-Paper-Scissors

Verb	URL	Purpose
`GET`	`/games`	List all games
`POST`	`/games`	Start a new game
`GET`	`/games/123`	Find out about game 123
`POST`	`/games/123/moves`	Play a move in game 123

Routing Uris in Slim

config/routes.php:

```
$app->get(
    '/games',
    App\Handler\ListGames::class
)->setName('games');
```

Routes have a method

config/routes.php:

```
$app->get(                                          // Method
    '/games',
    App\Handler\ListGames::class
)->setName('games');
```

$app method => HTTP verb

```
$app->get()
$app->post()
$app->put()
$app->patch()
$app->delete()
```

Multiple methods:

```
$app->any()
$app->map(['GET', 'POST'], …);
```

Routes have a pattern

config/routes.php:

```
$app->get(
    '/games',                                    // Patten
    App\Handler\ListGames::class
)->setName('games');
```

Route pattern

```php
// literal
$app->get('/games', $handler);

// placeholder within { & } (access as request attribute)
$app->get('/games/{id}', $handler);

// constrain using regex
$app->get('/games/{id:\d+}', $handler);

// optional segments use [ & ]
$app->get('/games[/{id:\d+}]', $handler);
$app->get('/news[/{y:\d{4}}[/{m:\d{2}}]]', $handler);
```

Routes have a handler

config/routes.php:

```
$app->get(
    '/games',
    App\Handler\ListGames::class                    // Handler
)->setName('games');
```

Route handlers

- Manage business logic operations
- Receive a PSR-7 `ServerRequest`
- Return a PSR-7 `Response`
- Implemented as PSR-15 `RequestHandler`

Responses in Slim

Create a new Response object and use the `with` methods:

```
$response = new Response();

// status code
$response = $response->withStatus(404);

// headers
$response = $response->withHeader('Content-Type','application/json');

// body
$response->getBody()->write(json_encode(['foo' => 'bar']));
```

Coding time

Handlers


Incoming data

Content-Type handling

The *Content-Type* header specifies the format of the incoming data

```
$ curl http://localhost:8888/games \
    -H "Content-Type: application/json" \
    -d '{"player1": "Rob", "player2": "Jon"}'
```

Read with getBody()

```
$app->post('/games',
  function ($request, $response) {
    $data = $request->getBody();
    $response->getBody()->write(print_r($data, true));
    return $response;
  }
);
```

Output is a string:

```
'{"player1": "Rob", "player2": "Jon"}'
```

Read with getParsedBody()

Add Slim's body-parsing middleware to your app:

```
$app->addBodyParsingMiddleware();
```

Use in your handler:

```
$app->post('/games',
  function ($request, $response) {
    $data = $request->getParsedBody();
    return $response->write(print_r($data, true));
  }
);
```

Read with getParsedBody()

```
$ curl -H "Content-Type: application/json" \
  -H "Content-Type: application/json" \
  -d '{"player1": "Rob", "player2": "Jon"}'
```

Output is an array:

```
Array
(
    [player1] => Rob,
    [player2] => Jon
)
```

This also works with XML

```
$ curl "http://localhost:8888/games" \
  -H "Content-Type: application/xml" \
  -d "<game><player1>Rob</player1><player2>Jon</player2></game>"
```

Output:

```
Array
(
    [player1] => Rob,
    [player2] => Jon
)
```

And form data

```
curl "http://localhost:8888/games" \
  -H "Content-Type: application/x-www-form-urlencoded" \
  -d "player1=Rob' -d 'player2=Jon"
```

Output:

```
Array
(
    [player1] => Rob,
    [player2] => Jon
)
```

addBodyParsingMiddleware() ?

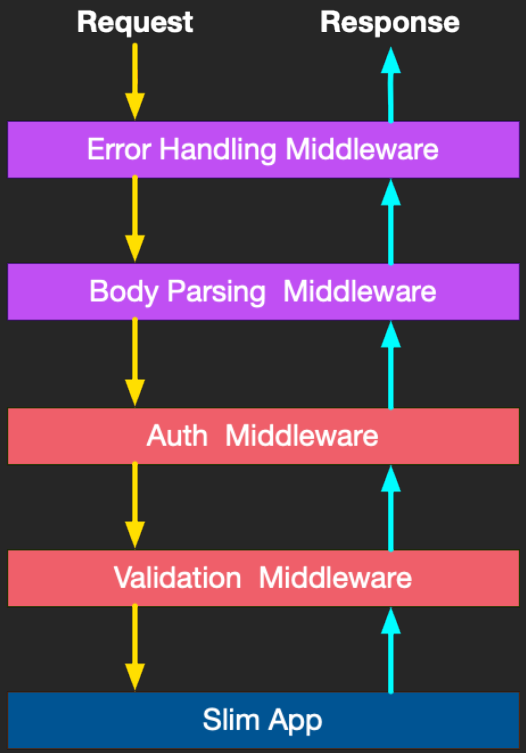
Middleware

Middleware is code that exists between the request and response, and which can take the incoming request, perform actions based on it, and either complete the response or pass delegation on to the next middleware in the queue.

Matthew Weier O'Phinney

Middleware

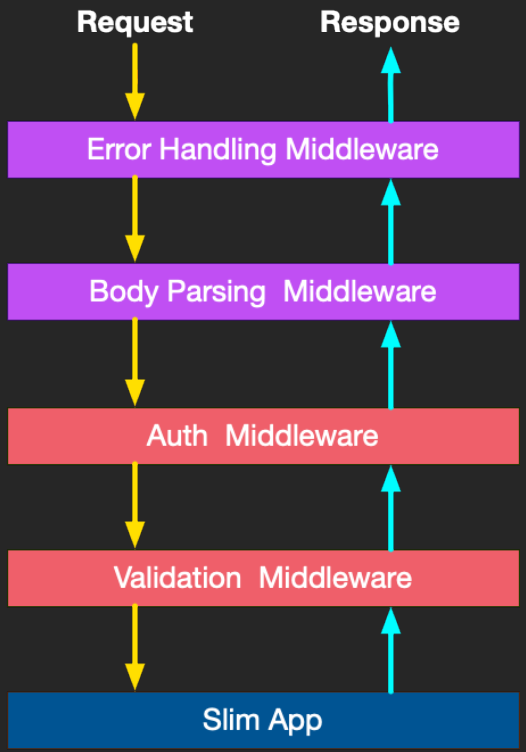
Take a request, return a response



Middleware

LIFO stack:

```
$app->add(ValidationMiddleware::class);
$app->add(AuthMiddleware::class);
$app->add(AuthMiddleware::class);
$app->addBodyParsingMiddleware();
$app->addErrorMiddleware(true, true, true);
```



PSR-15 MiddlewareInterface

```php
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface MiddlewareInterface
{
    public function process(
        ServerRequestInterface $request,
        RequestHandlerInterface $handler
    ) : ResponseInterface;
}
```

PSR-15 MiddlewareInterface

```
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface MiddlewareInterface
{
    public function process(
        ServerRequestInterface $request,
        RequestHandlerInterface $handler
    ) : ResponseInterface;
}
```

PSR-15 MiddlewareInterface

```php
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface MiddlewareInterface
{
    public function process(
        ServerRequestInterface $request,
        RequestHandlerInterface $handler
    ) : ResponseInterface;
}
```

PSR-15 MiddlewareInterface

```
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface MiddlewareInterface
{
     public function process(
        ServerRequestInterface $request,
        RequestHandlerInterface $handler
    ) : ResponseInterface;
}
```

TimerMiddleware

```php
class TimerMiddleware implements MiddlewareInterface
{
    public function process($request, $handler)
    {
        $start = microtime(true);

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

        $taken = microtime(true) - $start;

        return $response->withHeader('Time-Taken', $taken);
    }
}
```

TimerMiddleware

```
class TimerMiddleware implements MiddlewareInterface
{
    public function process($request, $handler)
    {
        $start = microtime(true);

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

        $taken = microtime(true) - $start;

        return $response->withHeader('Time-Taken', $taken);
    }
}
```

TimerMiddleware

```
class TimerMiddleware implements MiddlewareInterface
{
    public function process($request, $handler)
    {
        $start = microtime(true);

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

        $taken = microtime(true) - $start;

        return $response->withHeader('Time-Taken', $taken);
    }
}
```

TimerMiddleware

```
class TimerMiddleware implements MiddlewareInterface
{
    public function process($request, $handler)
    {
        $start = microtime(true);

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

        $taken = microtime(true) - $start;

        return $response->withHeader('Time-Taken', $taken);
    }
}
```

TimerMiddleware

```
class TimerMiddleware implements MiddlewareInterface
{
    public function process($request, $handler)
    {
        $start = microtime(true);

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

        $taken = microtime(true) - $start;

        return $response->withHeader('Time-Taken', $taken);
    }
}
```

Route Handlers

The other half of PSR-15!

Route Handlers

Any callable!

```
$app->add('/', function ($request, $response) { ... });
$app->add('/', ['RootController', 'aStaticFunction']);
$app->add('/', [new RootController(), 'aFunction']);
$app->add('/', RootController::class.':pingAction');
$app->add('/', RootHander::class);
```

Use the PSR-15 one

```
$app->add('/', RootHandler::class);
```

PSR-15 RouteHandlerInterface

```php
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface RequestHandlerInterface
{
    public function handle(
        ServerRequestInterface $request
    ): ResponseInterface;
}
```

PSR-15 RouteHandlerInterface

```php
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface RequestHandlerInterface
{
    public function handle(
        ServerRequestInterface $request
    ): ResponseInterface;
}
```

PSR-15 RouteHandlerInterface

```
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface RequestHandlerInterface
{
    public function handle(
        ServerRequestInterface $request
    ): ResponseInterface;
}
```

PSR-15 RouteHandlerInterface

```
namespace Psr\Http\Server;

use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface;

interface RequestHandlerInterface
{
    public function handle(
        ServerRequestInterface $request
    ): ResponseInterface;
}
```

HomePageHandler

```php
use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface as Request;
use Psr\Http\Server\RequestHandlerInterface;
use Slim\Psr7\Response;

class HomePageHandler implements RequestHandlerInterface
{
  public function handle(Request $request): ResponseInterface
  {
      $response = new Response();
      $response->getBody()->write('Hello World');
      return $response;
  }
}
```

HomePageHandler

```php
use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface as Request;
use Psr\Http\Server\RequestHandlerInterface;
use Slim\Psr7\Response;

class HomePageHandler implements RequestHandlerInterface
{
  public function handle(Request $request): ResponseInterface
  {
    $response = new Response();
    $response->getBody()->write('Hello World');
    return $response;
  }
}
```

HomePageHandler

```php
use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface as Request;
use Psr\Http\Server\RequestHandlerInterface;
use Slim\Psr7\Response;

class HomePageHandler implements RequestHandlerInterface
{
  public function handle(Request $request): ResponseInterface
  {
    $response = new Response();
    $response->getBody()->write('Hello World');
    return $response;
  }
}
```

HomePageHandler

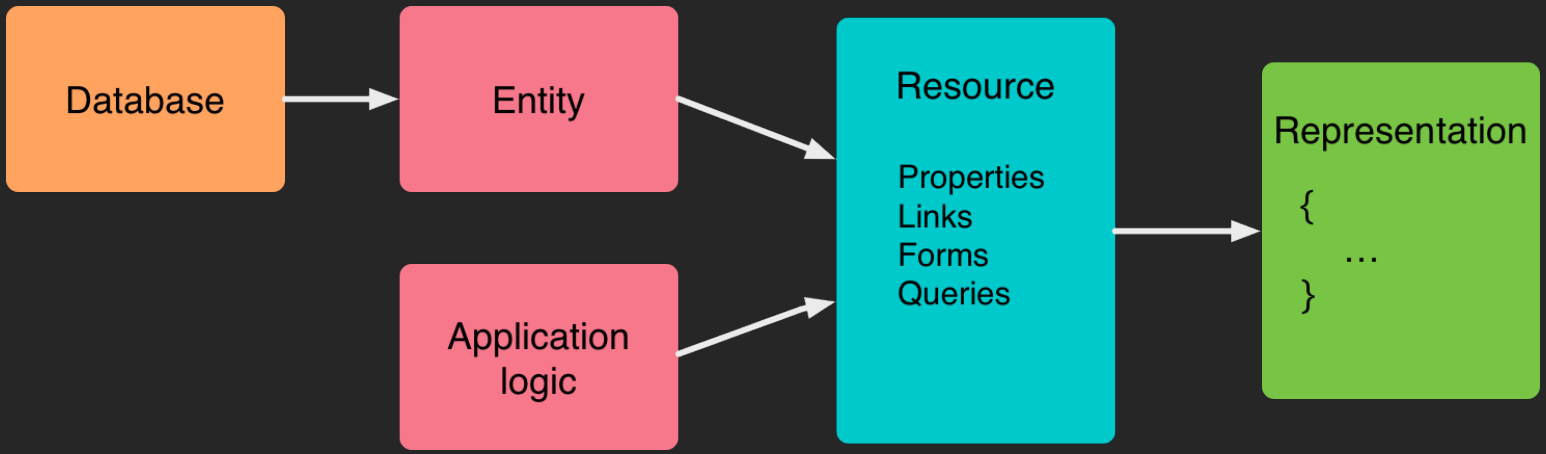
```php
use Psr\Http\Message\ResponseInterface;
use Psr\Http\Message\ServerRequestInterface as Request;
use Psr\Http\Server\RequestHandlerInterface;
use Slim\Psr7\Response;

class HomePageHandler implements RequestHandlerInterface
{
  public function handle(Request $request): ResponseInterface
  {
    $response = new Response();
    $response->getBody()->write('Hello World');
    return $response;
  }
}
```

Coding time

Reading data


Malleability

Decouple your representation



Hypermedia

- Media type used for a representation
- Links relationships between representations and states
    - Decouples client from server
    - Rename endpoints at will
    - Re-home endpoints on different domains

JSON and Hypermedia

JSON does not have a defined way of providing hypermedia links

Options:

- "Link" header (GitHub approach)
- application/collection+json
- application/hal+json

Hypermedia payloads

- Links should be fully qualified
- Always include `self` relation
- Add links to other related resources & collections

application/hal+json

http://stateless.co/hal_specification.html

```
{
  "_links": {
    "self": { "href": "https://example.com/orders/523" },
    "warehouse": { "href": "https://example.com/warehouse/56" },
    "invoice": { "href": "https://example.com/invoices/873" }
  },
  "currency": "GBP",
  "status": "shipped",
  "total": 123.45
}
```

Base URL in Slim

```php
class BaseUrlMiddleware implements MiddlewareInterface
{
    public function process($request, $handler)
    {
        $uri = $request->getUri();
        $scheme = $uri->getScheme();
        $authority = $uri->getAuthority();

        $rootUrl = ($scheme !== '' ? $scheme . ':' : '')
            . ($authority !== '' ? '//' . $authority : '');

        $request = $request->withAttribute('base_url', $rootUrl);
        return $handler->handle($request);
```

Creating links

```
public function handle(ServerRequestInterface $request)
{
  $baseUrl = $request->getAttribute('base_url');

  $listGamesUrl = $baseUrl . '/games';
  $gameUrl = $baseUrl . '/games/' . $id;

  // ...
```

HAL payloads: collection

```
$hal = new Hal($baseUrl . '/games');
foreach ($games as $game) {
    $data['player1'] = $game->player1();
    $data['player2'] = $game->player2();
    //...

    $self = $baseUrl . '/games/' . $game->id;
    $resource = new Hal($self, $data);
    $hal->addResource('game', $resource);
}

$hal->setData(['count' => count($games)]);
$json = $hal->asJson(true);
```

HAL output

```
$ curl http://localhost:8888/games/0a1846ab-df37-4f7b-8e42-c0ef3ec

{
  "player1": "Rob",
  "player2": "Jon",
  "status": "Game complete",
  "created": "2019-09-30 08:49:33",
  "result": "Rob wins. rock beats scissors.",
  "winner": "Rob",
  "_links": {
     ...
  }
}
```

HAL links

```
{
  ...
  "winner": "Rob",
  "_links": {
    "self": {
      "href": "http://localhost:8888/games/0a1846ab-df37-4f7b-8e42…
    },
    "newGame": {
      "href": "http://localhost:8888/games/",
      "description": "Start a new game"
    }
  }
}
```

Pagination

Mobile devices don't *that* much memory!

- Link relations: `first`, `last`, `next` & `prev` relations
- Include total count of items too

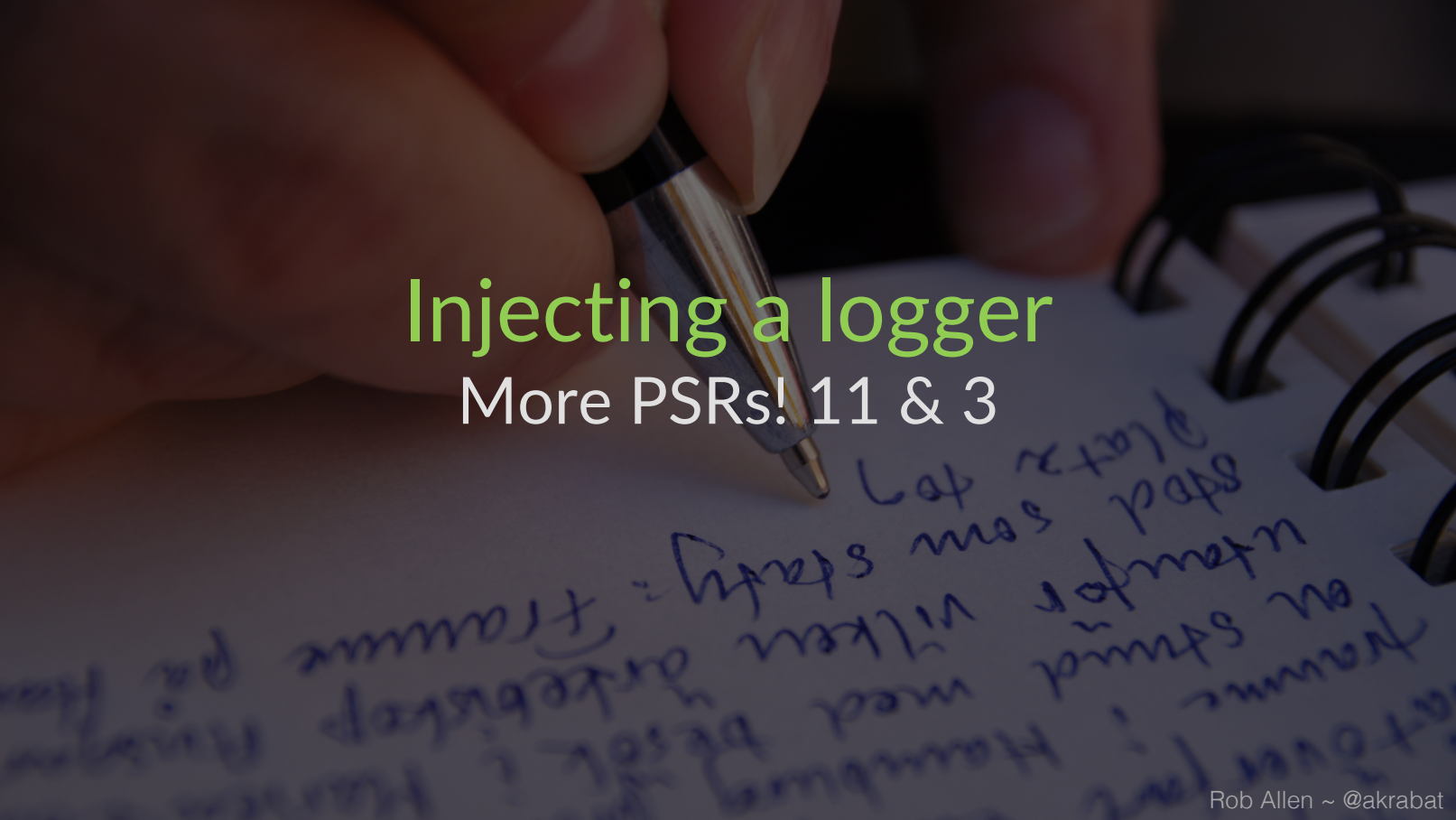
Coding time

Hypermedia

Error handling

Error handling

- Internal logging of errors for ourselves
- Error representations are first class citizens
- Code for computers, messages for humans



Injecting a logger

More PSRs! 11 & 3

Configure PHP-DI

```
$containerBuilder = new ContainerBuilder();

$containerBuilder->addDefinitions([
  // Factory for a PSR-3 logger
  LoggerInterface::class => function (ContainerInterface $c) {
      $logger = new Logger($settings['name']);
      $logger->pushHandler(new ErrorLogHandler());
      return $logger;
    },
]);

AppFactory::setContainer($containerBuilder->build());
$app = AppFactory::create();
```

Configure PHP-DI

```
$containerBuilder = new ContainerBuilder();

$containerBuilder->addDefinitions([
  // Factory for a PSR-3 logger
  LoggerInterface::class => function (ContainerInterface $c) {
      $logger = new Logger($settings['name']);
      $logger->pushHandler(new ErrorLogHandler());
      return $logger;
    },
]);

AppFactory::setContainer($containerBuilder->build());
$app = AppFactory::create();
```

Configure PHP-DI

```
$containerBuilder = new ContainerBuilder();

$containerBuilder->addDefinitions([
  // Factory for a PSR-3 logger
  LoggerInterface::class => function (ContainerInterface $c) {
      $logger = new Logger($settings['name']);
      $logger->pushHandler(new ErrorLogHandler());
      return $logger;
    },
]);

AppFactory::setContainer($containerBuilder->build());
$app = AppFactory::create();
```

Configure PHP-DI

```
$containerBuilder = new ContainerBuilder();

$containerBuilder->addDefinitions([
  // Factory for a PSR-3 logger
  LoggerInterface::class => function (ContainerInterface $c) {
      $logger = new Logger($settings['name']);
      $logger->pushHandler(new ErrorLogHandler());
      return $logger;
    },
]);

AppFactory::setContainer($containerBuilder->build());
$app = AppFactory::create();
```

Configure PHP-DI

```
$containerBuilder = new ContainerBuilder();

$containerBuilder->addDefinitions([
  // Factory for a PSR-3 logger
  LoggerInterface::class => function (ContainerInterface $c) {
      $logger = new Logger($settings['name']);
      $logger->pushHandler(new ErrorLogHandler());
      return $logger;
    },
]);

AppFactory::setContainer($containerBuilder->build());
$app = AppFactory::create();
```

PHP-DI autowiring

Just type-hint your constructor!

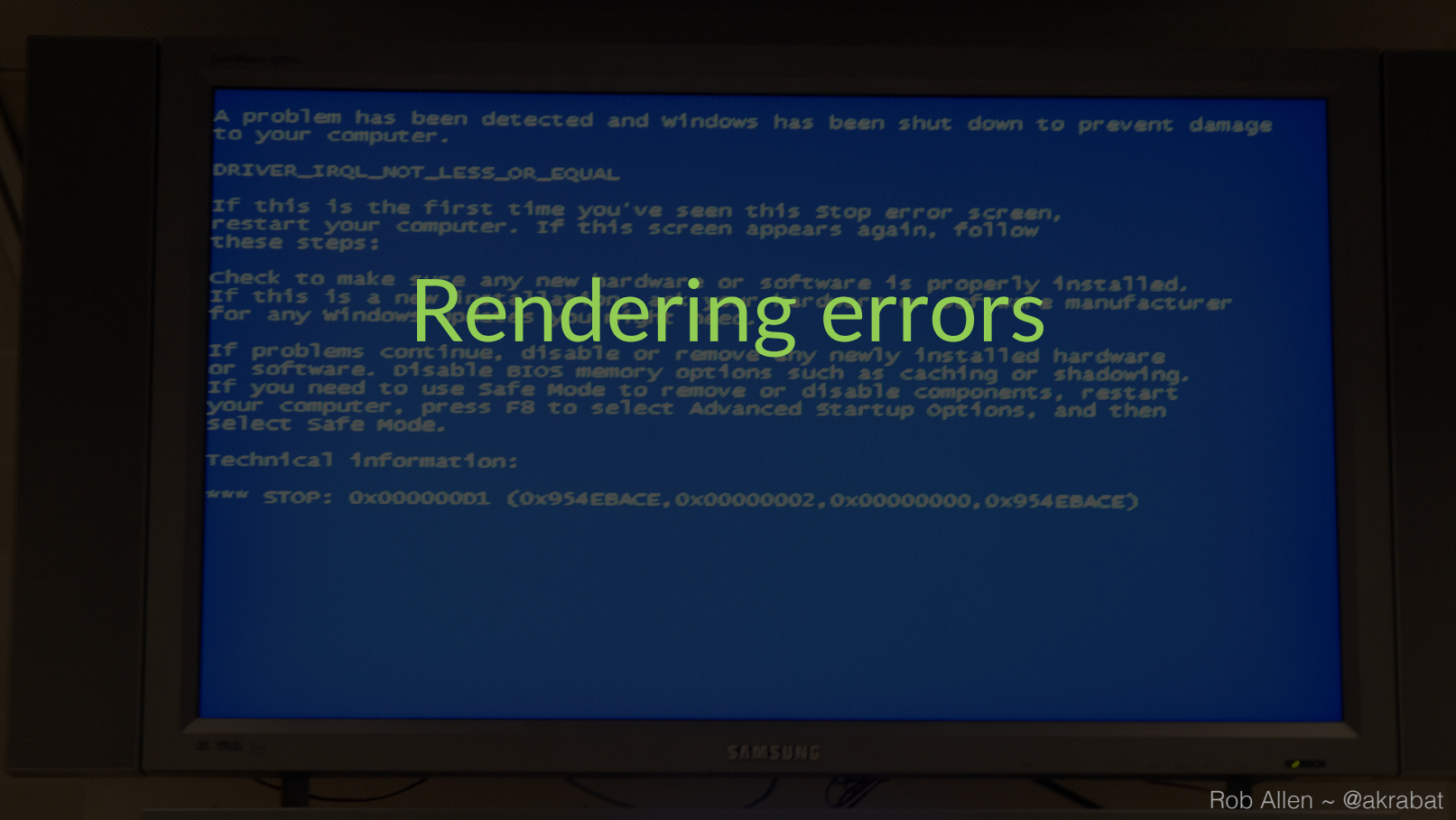
```
class GetGameHandler implements RequestHandlerInterface
{
    private $logger;

    public function __construct(LoggerInterface $logger)
    {
        $this->logger = $logger;
    }
    ...
```

Logging

```
class GetGameHandler implements RequestHandlerInterface
{
  public function handle(Request $request): ResponseInterface
  this->logger->info("Fetching game", ['id' => $id]);

  try {
    $games = $this->gameRepository->loadById($id);
  } catch (NotFoundException $e) {
    this->logger->info("No game found", ['id' => $id]);
    throw new HttpNotFoundException($request, 'No Game', $e);
  }
  ...
```

Logging

```
class GetGameHandler implements RequestHandlerInterface
{
  public function handle(Request $request): ResponseInterface
  this->logger->info("Fetching game", ['id' => $id]);

  try {
    $games = $this->gameRepository->loadById($id);
  } catch (NotFoundException $e) {
    this->logger->info("No game found", ['id' => $id]);
    throw new HttpNotFoundException($request, 'No Game', $e);
  }
  ...
```



Rendering errors

Slim's error handling

Add Slim's error handling middleware to render exceptions

```
$displayDetails = true;
$logErrors = true;
$logDetails = true;

$app->addErrorMiddleware($displayDetails, $logErrors, $logDetails);
```

Error rendering

```
$ http -j DELETE http://localhost:8888/game
```

Error rendering

```
$ http -j DELETE http://localhost:8888/game
HTTP/1.1 405 Method Not Allowed
Allow: GET
Content-type: application/json
```

Error rendering

```
$ http -j DELETE http://localhost:8888/game
HTTP/1.1 405 Method Not Allowed
Allow: GET
Content-type: application/json
{
  "exception": [
    {
      "code": 405,
      "file": ".../Slim/Middleware/RoutingMiddleware.php",
      "message": "Method not allowed: Must be one of: GET",
      "type": "Slim\\Exception\\HttpMethodNotAllowedException"
    }
  ],
  "message": "Method not allowed: Must be one of: GET"
}
```

Convert errors to HTTP exceptions

```
public function handle(Request $request): ResponseInterface
{
    $id = $request->getAttribute('id');
    try {
        $game = $this->gameRepository->loadById($id);
    } catch (GameNotFoundException $e) {
        throw new HttpNotFoundException($request, 'No Game', $e);
    } catch (Exception $e) {
        throw new HttpInternalServerErrorException($request,
            'An unknown error occurred', $e);
    }
```

Not found error

```
public function handle(Request $request): ResponseInterface
{
    $id = $request->getAttribute('id');
    try {
        $game = $this->gameRepository->loadById($id);
    } catch (GameNotFoundException $e) {
        throw new HttpNotFoundException($request, 'No Game', $e);
    } catch (Exception $e) {
        throw new HttpInternalServerErrorException($request,
            'An unknown error occurred', $e);
    }
```

Not found error

```
$ http -j http://localhost:8888/games/1234
HTTP/1.1 404 Not Found
Content-type: application/json

{
    "message": "No Game"
}
```

(Production mode: `$displayDetails = false`)

Generic error

```
public function handle(Request $request): ResponseInterface
{
    $id = $request->getAttribute('id');
    try {
        $game = $this->gameRepository->loadById($id);
    } catch (GameNotFoundException $e) {
        throw new HttpNotFoundException($request, 'No Game', $e);
    } catch (Exception $e) {
        throw new HttpInternalServerErrorException($request,
            'An unknown error occurred', $e);
    }
```

Generic error

```
$ http -j http://localhost:8888/games/abcd
HTTP/1.1 500 Internal Server Error
Content-type: application/json

{
  "exception": [
    {
      "code": 500,
      "file": ".../src/Handler/GetGameHandler.php",
      "line": 43,
      "message": "An unknown error occurred",
      "type": "Slim\\Exception\\HttpInternalServerErrorException"
    },
```

```
        {
            "code": 40,
            "file": ".../lib/Assert/Assertion.php",
            "line": 2752,
            "message": "Value \"abcd\" is not a valid integer.",
            "type": "Assert\\InvalidArgumentException"
        }
    ],
    "message": "An unknown error occurred"
}
```

(Development mode: `$displayDetails = true`)

Coding time

Error responses


Documentation

Documentation

- Tutorials
- Reference

OpenAPI Specification

- Spec-first API design
- Tooling: https://openapi.tools
    - Reference website: ReDoc
    - Linting/validation: Spectral
    - Mock server: Prism

OpenAPI Specification

```yaml
openapi: "3.0.2"

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

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

OpenAPI Specification

```yaml
paths:
  /games:
    post:
      summary: Create a new game
      description: Create a new game of Rock-Paper-Scissors
      operationId: createGame
      tags:
        - Game
      requestBody:
        description: Game to add
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NewGameRequest'
```

Test with prism

```
$ npm install -g @stoplight/prism-cli
$ prism mock rps-openapi.yaml

› [CLI] … awaiting Starting Prism…
› [HTTP SERVER] info  Server listening at http://127.0.0.1:4010
› [CLI] info  POST  http://127.0.0.1:4010/games
› [CLI] info  POST  http://127.0.0.1:4010/games/e3..1/moves
```

Test with prism

```
$ curl -i -X POST http://localhost:4010/games
HTTP/1.1 400 Bad Request
content-type: application/json

{"message":"Must provide both player1 and player2"}
```

Test with prism

```
$ curl -i -X POST http://localhost:4010/games
HTTP/1.1 400 Bad Request
content-type: application/json

{"message":"Must provide both player1 and player2"}


› [HTTP SERVER] post /games info  Request received
› [NEGOTIATOR] info  Request contains an accept header: */*
› [VALIDATOR] warning  Request did not pass the validation rules
› [NEGOTIATOR] success  Found response 400.
› [NEGOTIATOR] success  The response 400 has a schema.
› [NEGOTIATOR] success  Responding with status code 400
› [VALIDATOR] error Violation: request Body parameter is required
```

Demo

The RPS OpenAPI Spec


To sum up

To sum up

- HTTP method negotiation
- Content-type negotiation
- Hypermedia
- Error handling
- Documentation

Resources

- https://akrabat.com/category/api/
- https://akrabat.com/category/slim-framework/
- https://github.com/akrabat/slim4-rps-api

- https://apihandyman.io
- https://apievangelist.com
- http://restcookbook.com


Thank you!
Rob Allen - Independent API developer
http://akrabat.com - @akrabat

Photo credits

- The Fat Controller: HiT Entertainment
- Foundation: https://www.flickr.com/photos/armchairbuilder/6196473431
- APIs: https://www.flickr.com/photos/ebothy/15723500675
- Incoming Data: https://www.flickr.com/photos/natspressoffice/13085089605
- Computer code: https://www.flickr.com/photos/n3wjack/3856456237/
- Road sign: https://www.flickr.com/photos/ell-r-brown/6804246004
- Car crash: EuroNCAP
- Writing: https://www.flickr.com/photos/froderik/9355085596/
- Error screen: https://www.flickr.com/photos/lrosa/2867091465/
- Books: https://www.flickr.com/photos/mdales/48981707361/
- Pattery wheel: https://www.flickr.com/photos/61091655@N00/6831352744/
- Rocket launch: https://www.flickr.com/photos/gsfc/16495356966
- Stars: https://www.flickr.com/photos/gsfc/19125041621