

NodeJS





Somkiat Puisungnoen

Somkiat Puisungnoen

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... 22 Pending Items

Intro

Software Craftsmanship

Software Practitioner at สยามชัมนาภิกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Post Photo/Video Live Video Life Event

What's on your mind?

Public Post

Somkiat Puisungnoen 15 mins · Bangkok · ⚙️

Java and Bigdata



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Agenda

Introduction to Node.js

Learn to write code with Node.js

Command-line application

Working with ECMAScript(ES)

Develop REST APIs

Testable and Testing

Working with database (RDBMS and NoSQL)

Deployment



**[https://github.com/up1/
course-nodejs-2020](https://github.com/up1/course-nodejs-2020)**



NodeJS



What Node.js ?

JavaScript on the server
Open source, Free
Run on many platforms

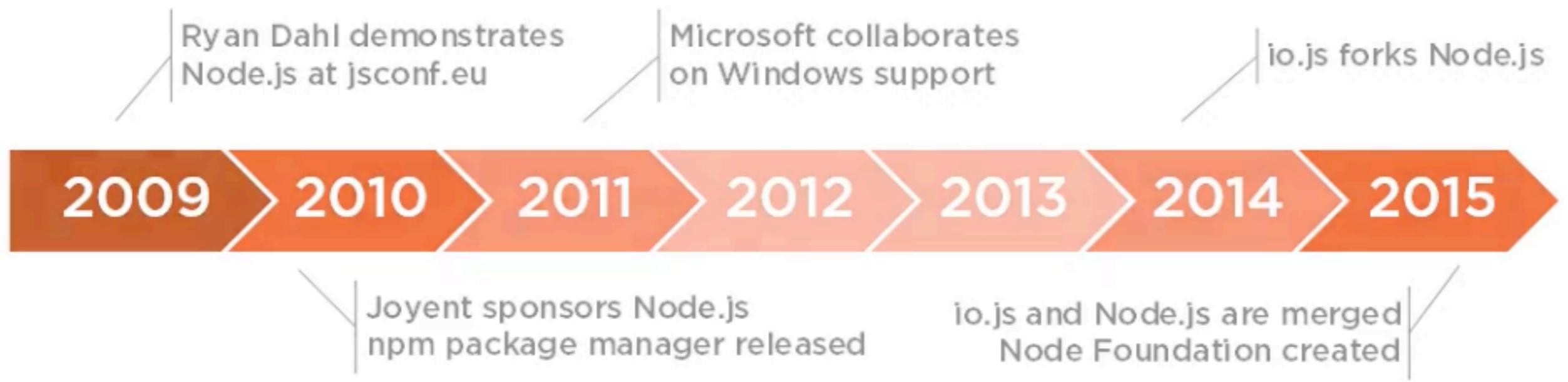


What Node.js ?

Asynchronous event-driven JavaScript runtime
Designed to build network applications



History of Node.js



What Node.js ?

Node.js® is a JavaScript runtime built on **Chrome's V8 JavaScript engine**. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient. Node.js' package ecosystem, **npm**, is the largest ecosystem of open source libraries in the world.

<https://nodejs.org/en/>



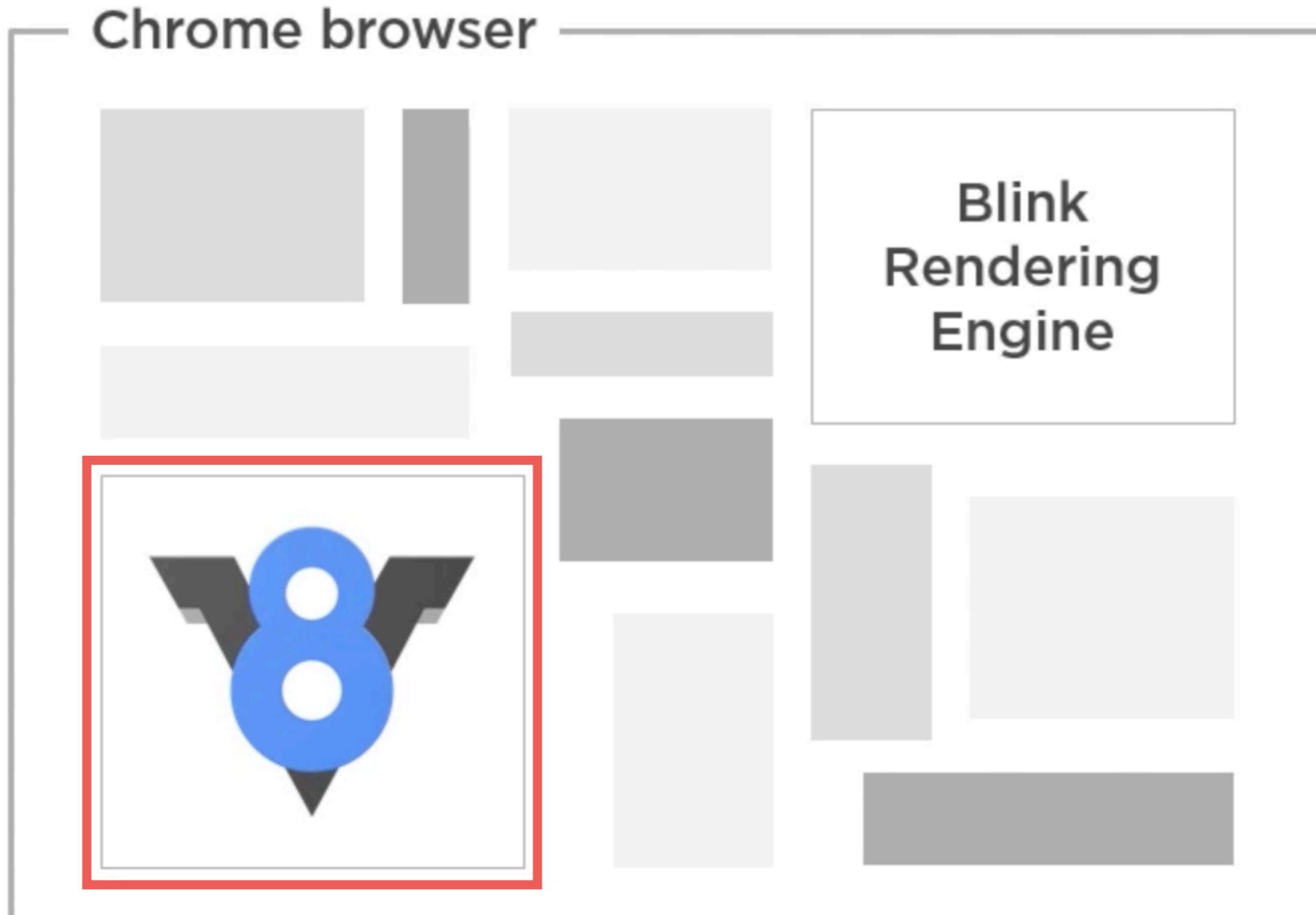
What Node.js ?

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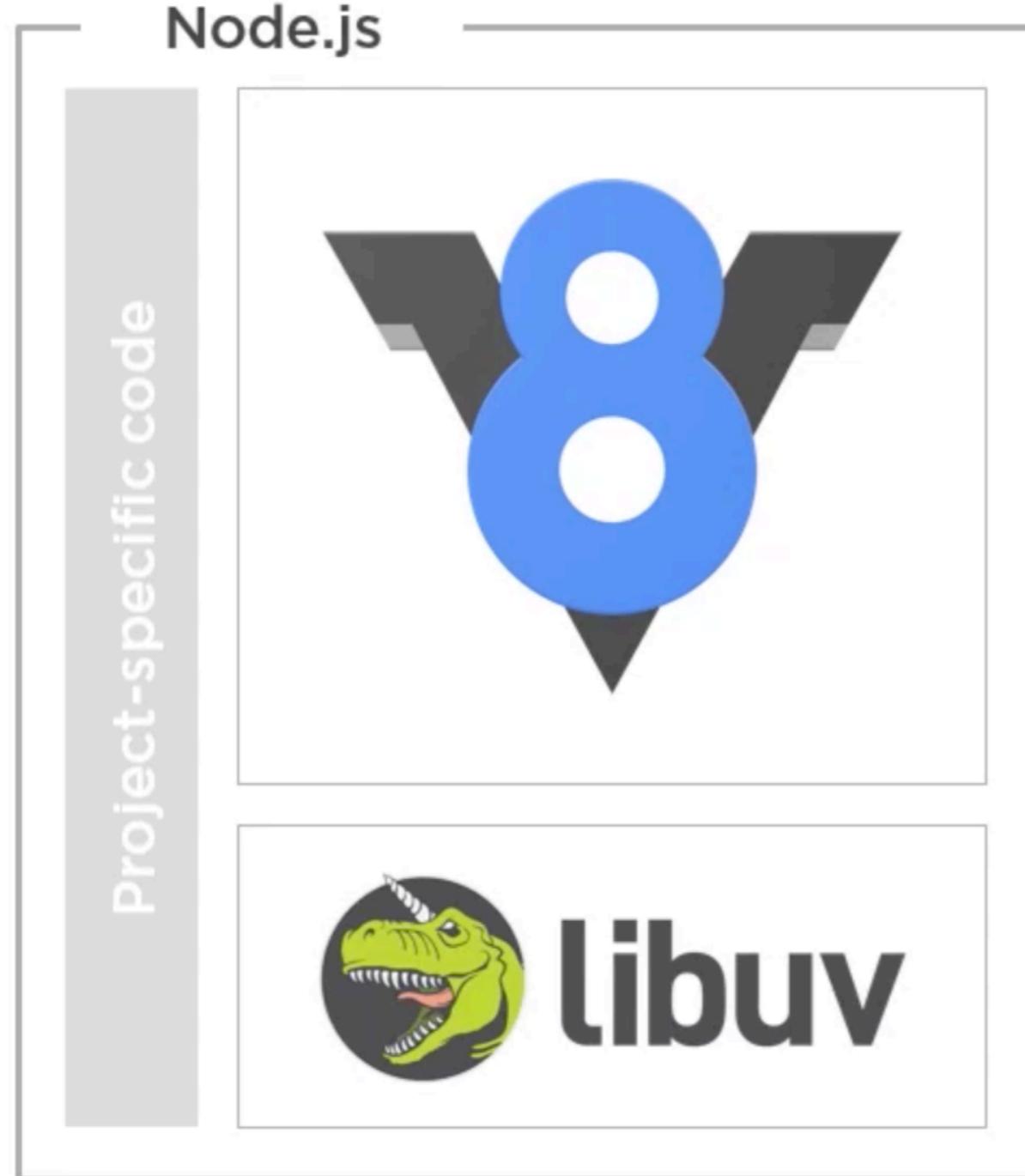
<https://nodejs.org/en/>



What Node.js ?



What Node.js ?



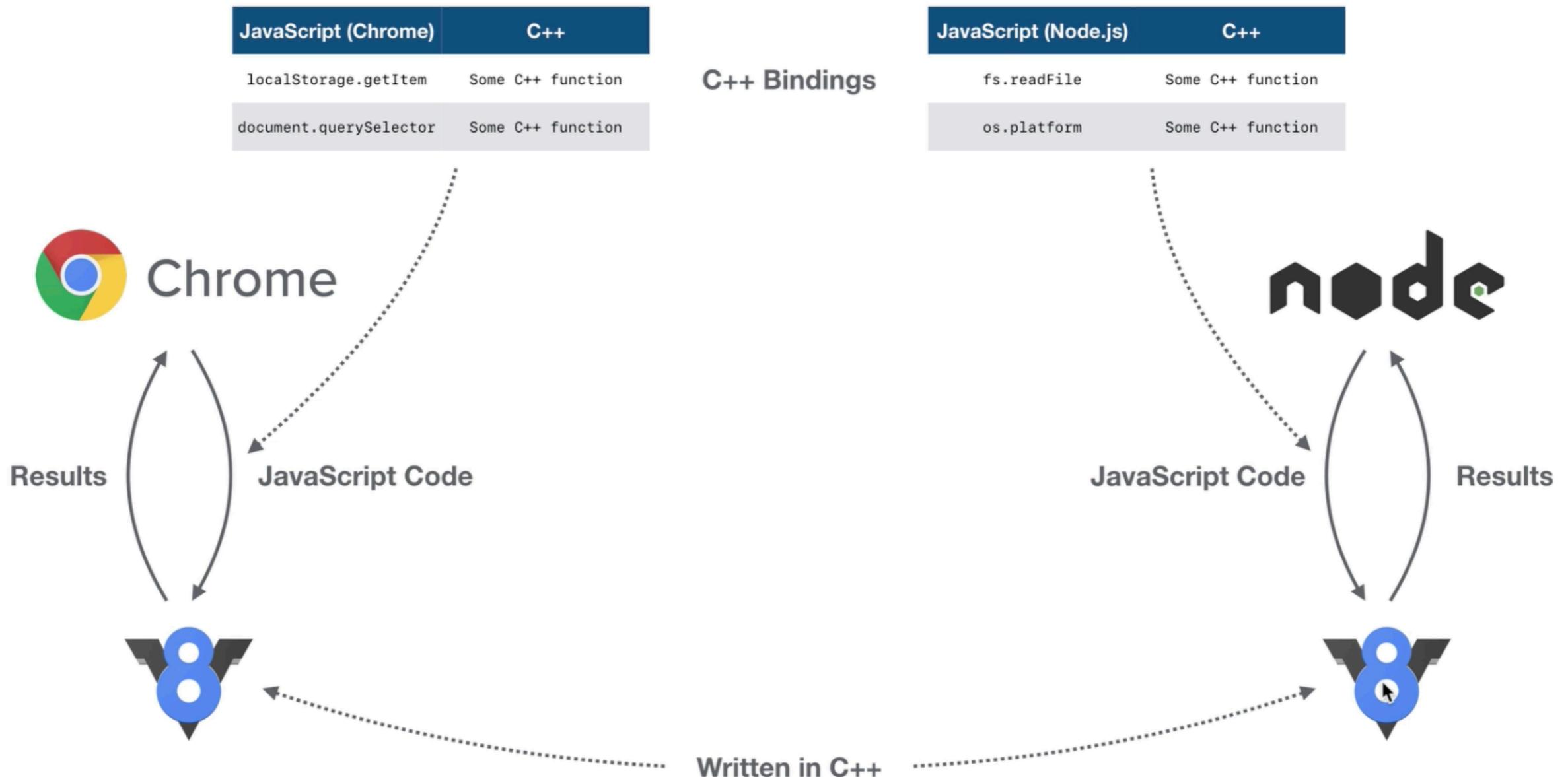
- JavaScript
- Asynchronous I/O
- Event Loop

<https://libuv.org/>



What Node.js ?

The V8 JavaScript Engine



What Node.js ?

Node.js® is a JavaScript runtime built on Chrome's V8 JavaScript engine. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient. Node.js' package ecosystem, npm, is the largest ecosystem of open source libraries in the world.

<https://nodejs.org/en/>



Blocking vs Non-blocking

Blocking



Non-Blocking



Run Node.js

\$node <file>



```
const http = require('http');

const hostname = '127.0.0.1';
const port = 3000;

const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('Hello World');
});

server.listen(port, hostname, () => {
  console.log(`Server running at http://${hostname}:${port}/`);
});
```



```
const http = require('http');

const hostname = '127.0.0.1';
const port = 3000;

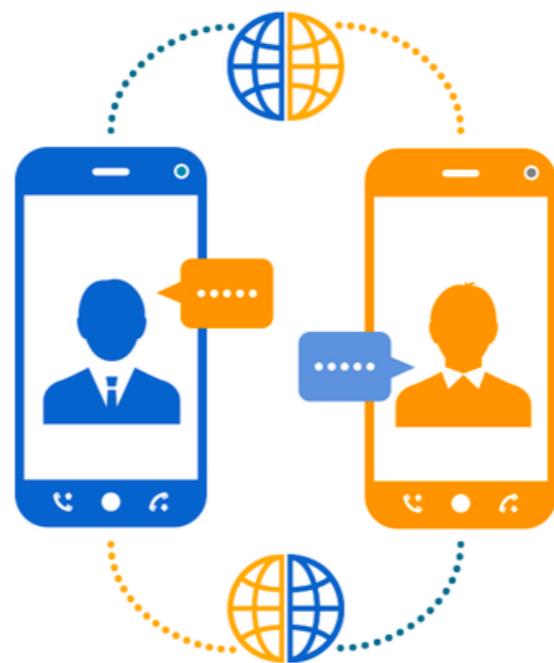
const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('Hello World');
});

server.listen(port, hostname, () => {
  console.log(`Server running at http://${hostname}:${port}/`);
});
```

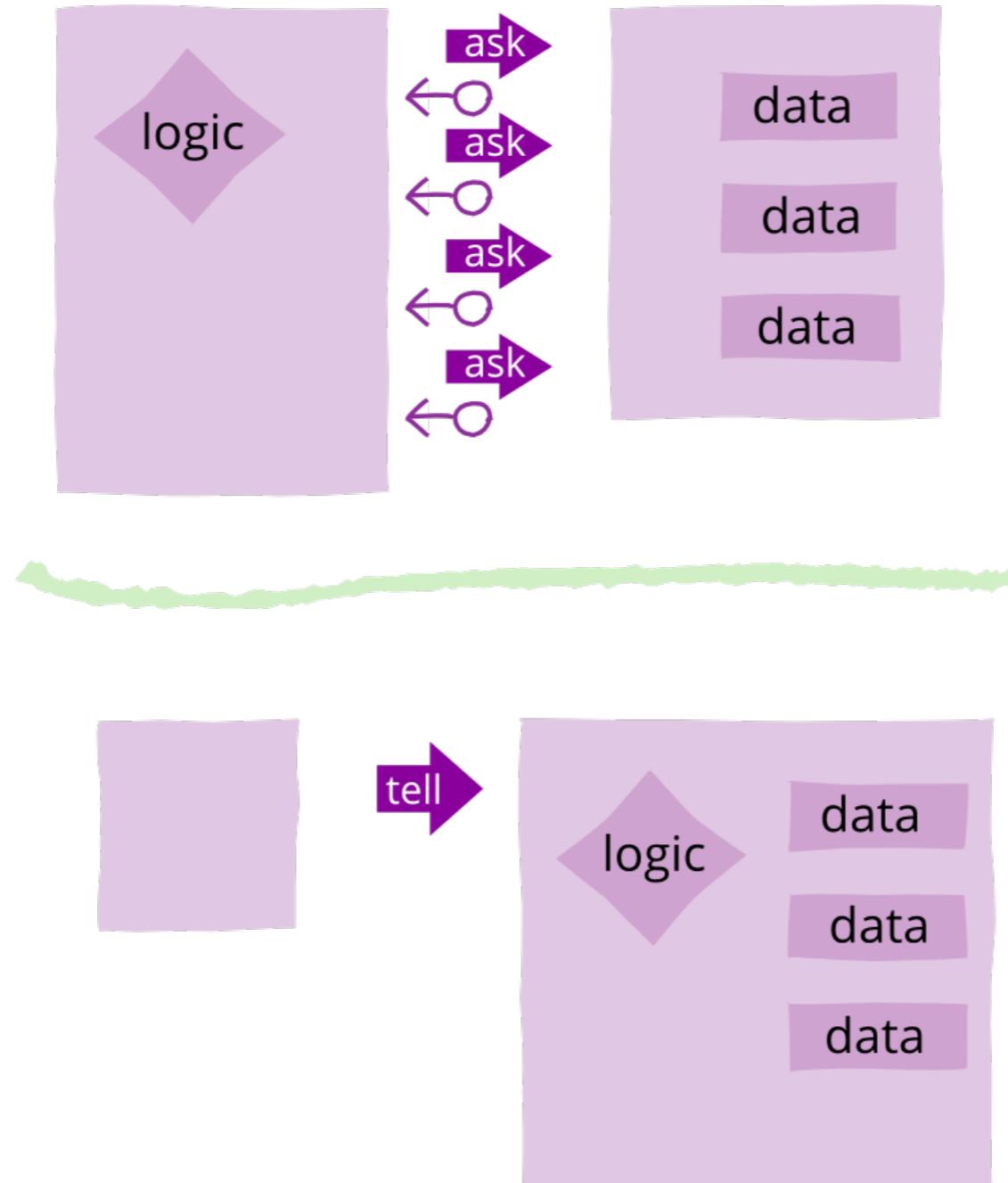
Callback function



Callback function



Tell Don't Ask



<https://martinfowler.com/bliki/TellDontAsk.html>



Function in Node.js



Function

First-class citizen in Node.js

```
function sayHi(name) {  
  console.log(`Say hi ${name}`);  
}
```

```
function add(a, b) {  
  return a + b;  
}
```

```
function show(fn) {  
  console.log(`Result⇒${fn}`);  
}
```



Function

First-class citizen in Node.js

```
const sayHi = function (name) {  
  console.log(`Say hi ${name}`);  
};
```

```
const add = function (a, b) {  
  return a + b;  
};
```

```
const show = function (fn) {  
  console.log(`Result⇒${fn}`);  
};
```



Arrow function in ES6

```
const sayHi = (name) => {
  console.log(`Say hi ${name}`);
};

const add = (a, b) => {
  return a + b;
};

const show = (fn) => {
  console.log(`Result⇒${fn}`);
};
```



Error conventions in Node.js

First argument of callback function is an error

```
const callback = function(error, returnValue) {  
  if(error) {  
    console.log(error);  
    return;  
  }  
  console.log(returnValue);  
}
```

```
const someFunction = function(value, callback) {  
  if(value) {  
    callback(null, "Without error");  
  } else {  
    callback(new Error("With error"));  
  }  
}
```



const vs let vs var



const vs let vs var

const (default in ES6)

the identifier can't be reassigned

let

the identifier may be reassigned (auto-rebind)

var

don't use !!

use var to signal untouched legacy code



const vs let vs var

```
const name= 'somkiat';
var count = 1;

if(true) {
  let count = 2;
  name = 'new name'; // TypeError: Assignment to constant variable.
}

console.log(count); // 1
```



const vs let vs var

var

var apple = 



a thing in a box
named "apple"

apple = 



you can swap
item later

let

let apple = 



a thing in a box
named "apple" w/
protection shield

apple =  NG

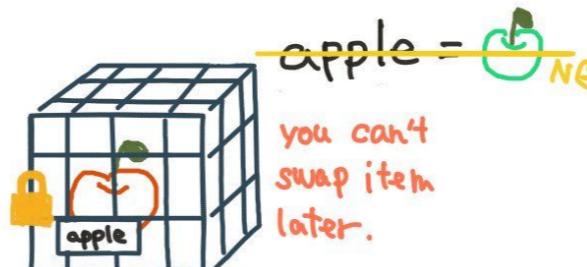
OK!
you can swap item
only if you ask
inside of the shield

const

const apple = 



a thing in
LOCKED cage
named "apple"



apple =  NG

you can't
swap item
later.



apple.multiply(3)
OK!
... but you can ask
the item to change itself
(if the item has method
to do that)



Working with Array

```
const products = ['Beer', 'Rice'];
products.push('New beer');

for (let index = 0; index < products.length; index++) {
  console.log(products[index]);
}

for (const product of products) {
  console.log(product);
}

products.forEach(function(product){
  console.log(product);
});

products.forEach((product) => {
  console.log(product);
});
```

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Array



Array operation

ForEach / Iterate
Filter
Map
Reduce
Find
etc...



For ... of vs For .. in

For ... in

Loop over an enumerable

For ... of

Loop over an iterable



Thinking Asynchronous



Overview

Event loop

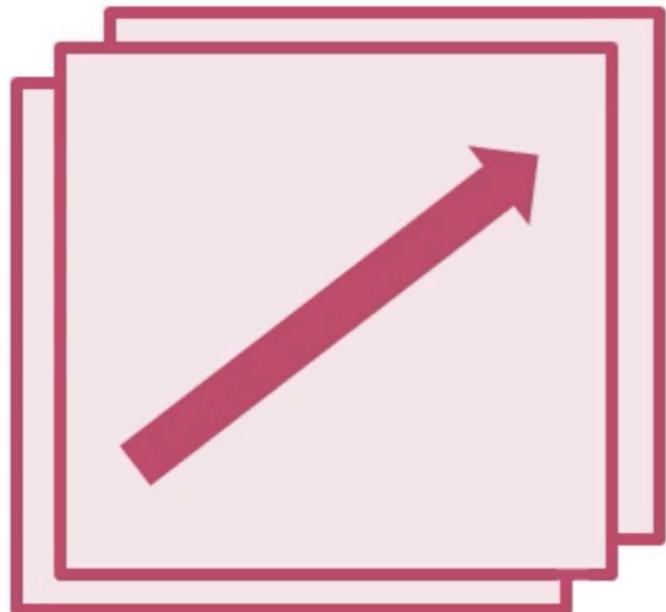
Asynchronous development

Node APIs and EventEmitters

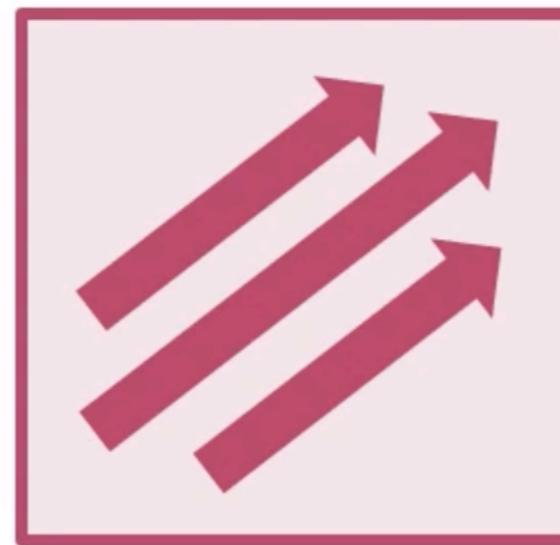
Stream



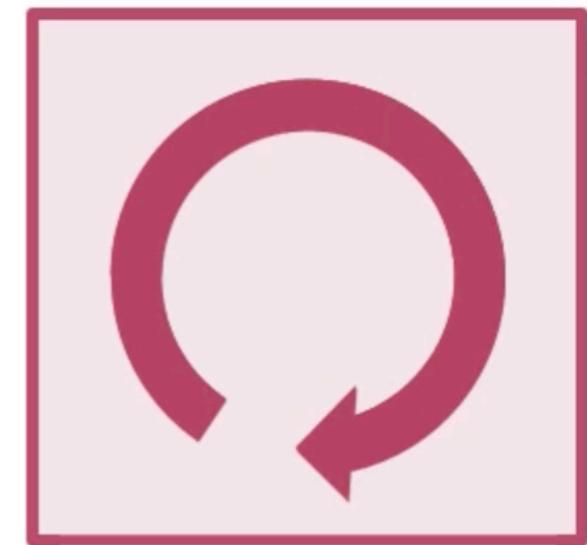
How Node.js work ?



Process-Per-Client
(Multi-Process)



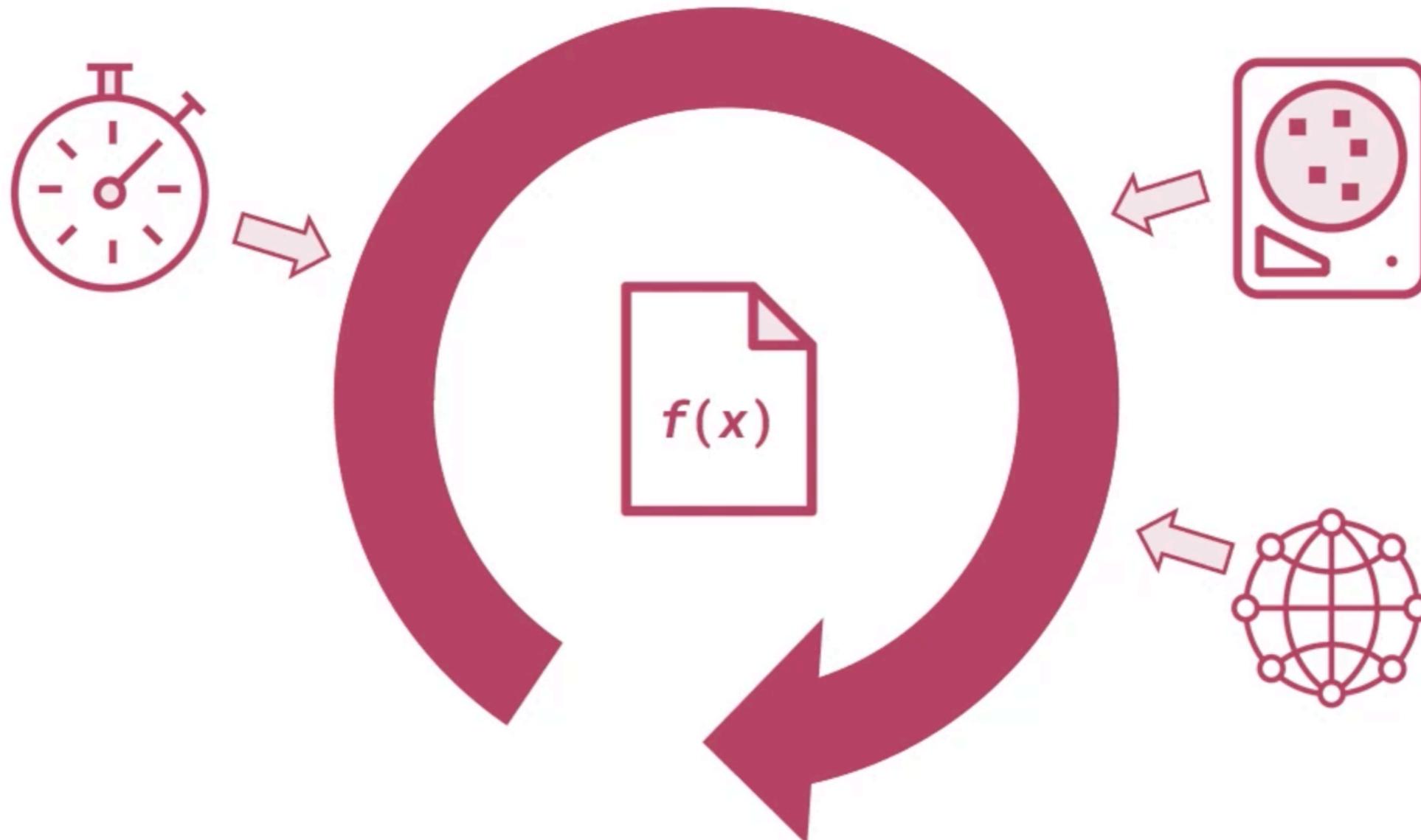
Thread-Per-Client
(Multi-Threaded)



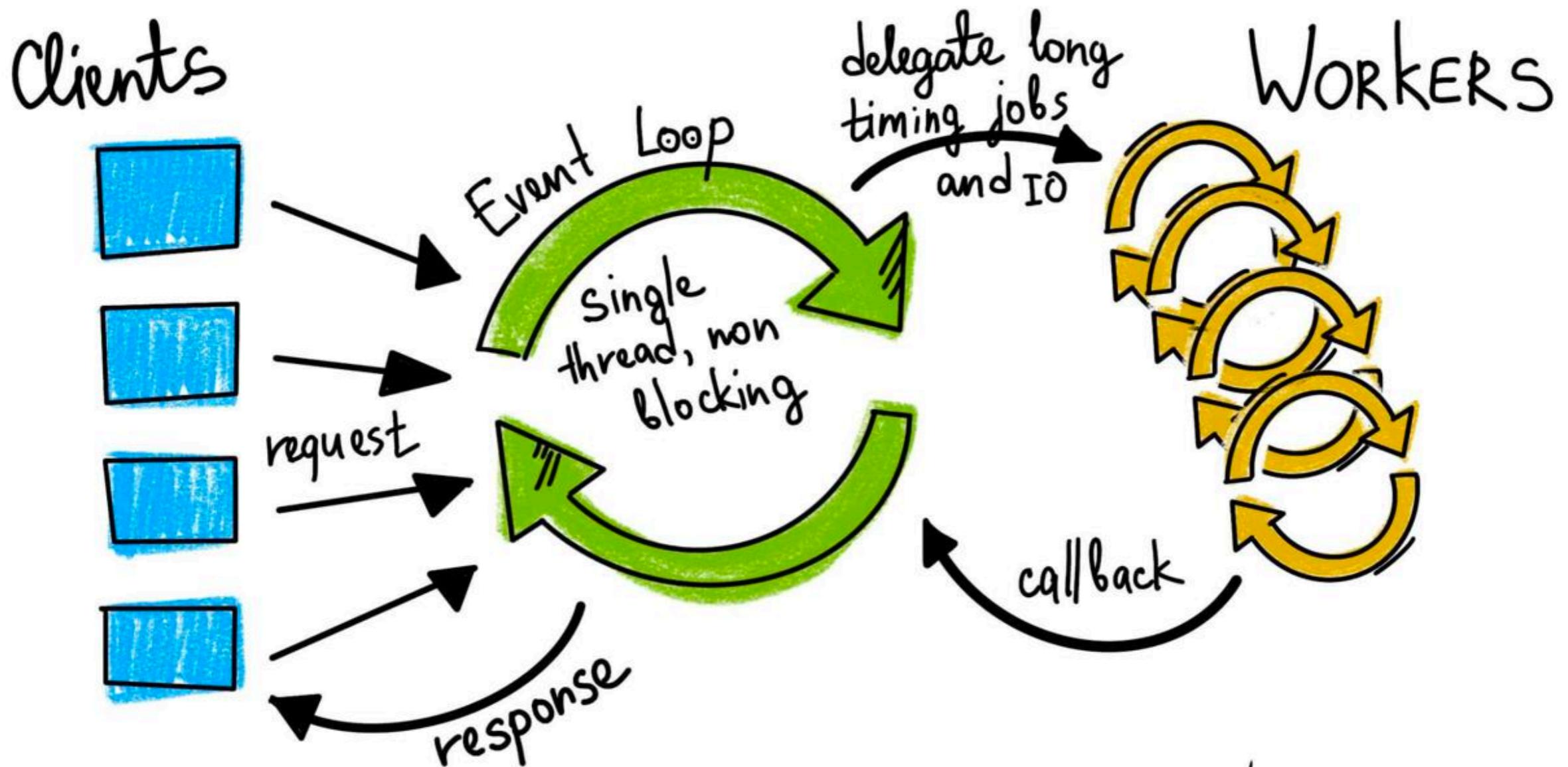
Event Loop
("Single Threaded")



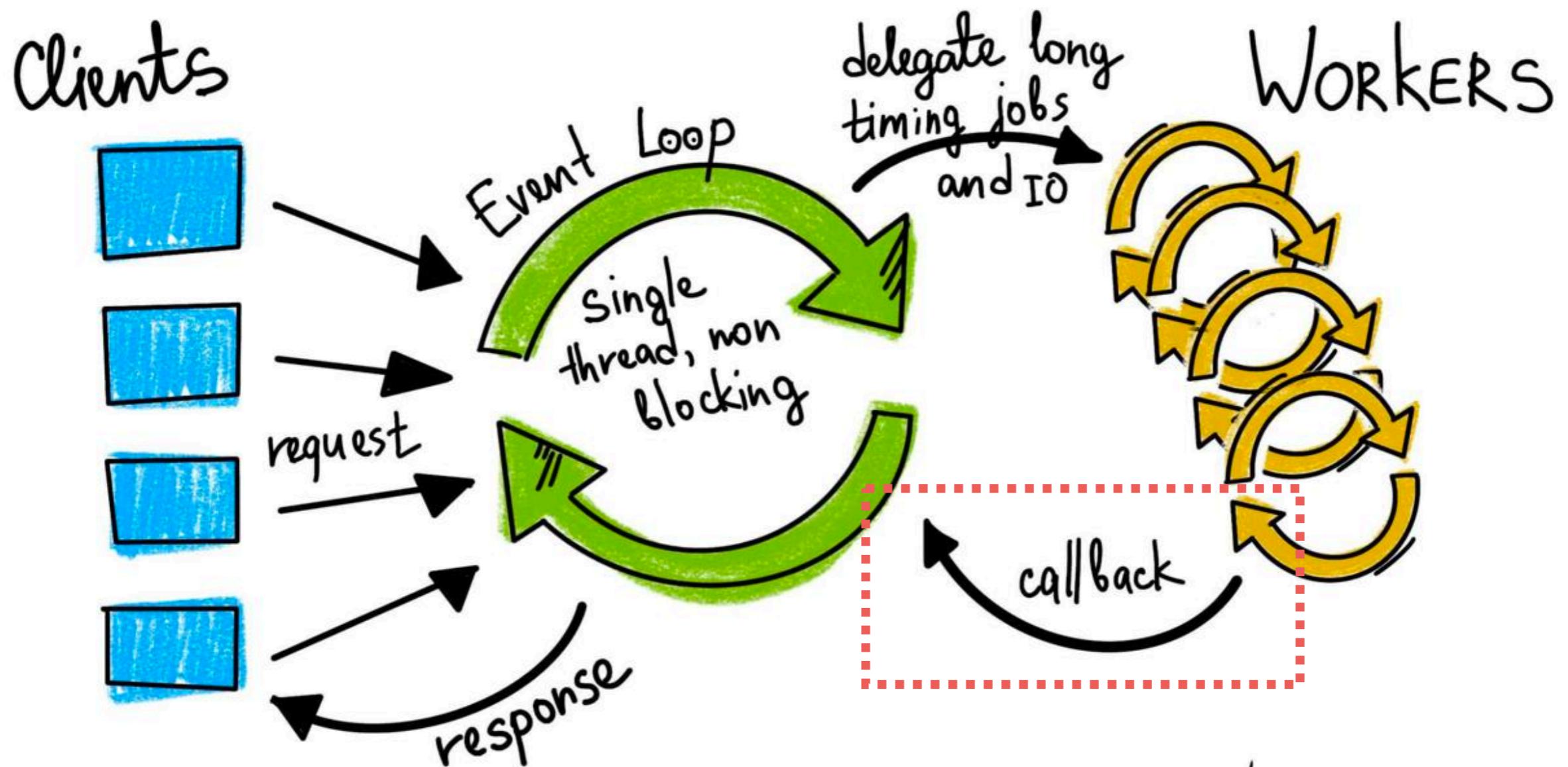
Node's Event Loop



Node's Event Loop



Node's Event Loop



@luminousmen.com



Sync vs Async



Synchronous programming

```
function serveCustomer(customer) {  
  let order = customer.placeOrder(menu)  
  let food = cook.prepareFood(order)  
  let tip = customer.eatAndPay(food)  
  return tip  
}
```



Asynchronous programming !!

Callbacks

Async.js

Promises

Async/Await

Generators/yield

EventEmitter

Functor + chaining + composition



Working with callbacks

```
function serveCustomer(customer, done) {  
  customer.placeOrder(menu, (error, order) => {  
    cook.prepareFood(order, (error, food) => {  
      customer.eatAndPay(food, done)  
    }  
  }  
}  
}
```



Callbacks hell



```
function serveCustomer(customer, done) {  
  customer.placeOrder(menu, (error, order) => {  
    cook.prepareFood(order, (error, food) => {  
      customer.eatAndPay(food, done)  
    }  
  }  
}  
}
```

<http://callbackhell.com/>



Callback hell Pyramid of doom Christmas tree



Promises and Async/Await



Working with promises

```
function add(a, b) {  
  return new Promise((resolve) => {  
    setTimeout(() => resolve(a + b), Math.random() * 10 * 1000);  
  });  
}  
  
function print(input) {  
  console.log(input);  
}  
  
add(1, 3).then(result => print(result));  
add(10, 30).then(print);  
  
console.log("Processing ....");
```



Working with promises

```
function serveCustomer(customer) {  
  return customer.placeOrder(menu)  
    .then(order => cook.prepareFood(order))  
    .then(food => customer.eatAndPay(food))  
}
```



Working with async/await

```
const serveCustomer = async (customer) => {  
  let order = await customer.placeOrder(menu)  
  let food = await cook.prepareFood(order)  
  let tip = await customer.eatAndPay(food)  
  return tip  
}
```



EventEmitter

<https://nodejs.org/api/events.html>



Working with EventEmitter

```
const serveCustomer = (customer, done) => {
  customer.on('decided', order => {
    order.on('prepared', food => customer.eatAndPay(food))
    cook.prepareFood(order)
  })
  customer.on('leaving', tip => done(null, tip))
  customer.placeOrder(menu)
}
```

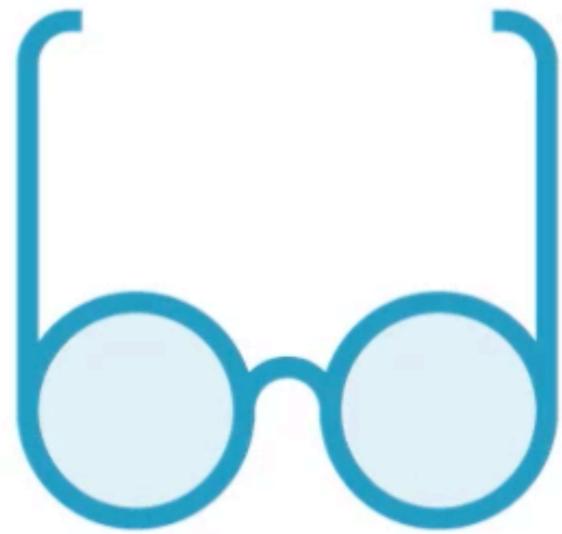


Stream

<https://nodejs.org/api/stream.html>



Types of Stream



Readable Streams



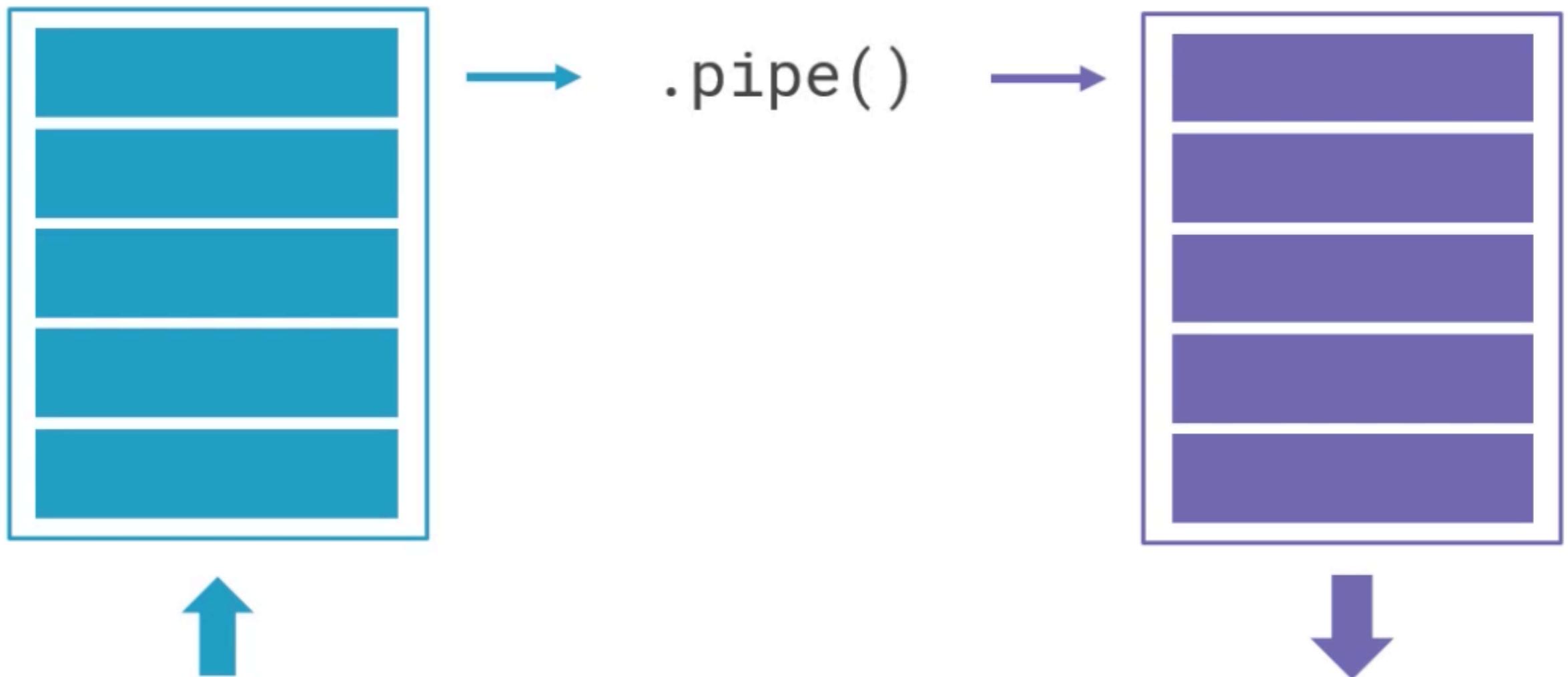
Read/Write Streams
(Duplex, Transform)



Writable Streams



Piping Stream



Stream in Node.js APIs



`fs.ReadStream`



`fs.WriteStream`



`http.ClientRequest`



`http.IncomingMessage`



`http.ServerResponse`



`zlib.createGzip()`



Example

```
const server = http.createServer((req, res) => {
  res.setHeader("Content-Type", "text/plain");
  res.setHeader("Content-Encoding", "gzip");

  fs.createReadStream(path.join(__dirname, "data.txt"))
    .pipe(zlib.createGzip())
    .pipe(res);

});
```



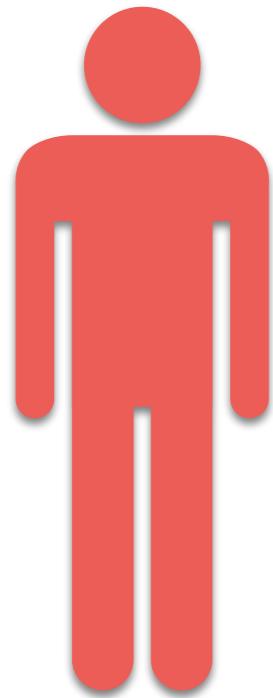
Workshop

Callback, Promise, Async/Await, Event



Workshop

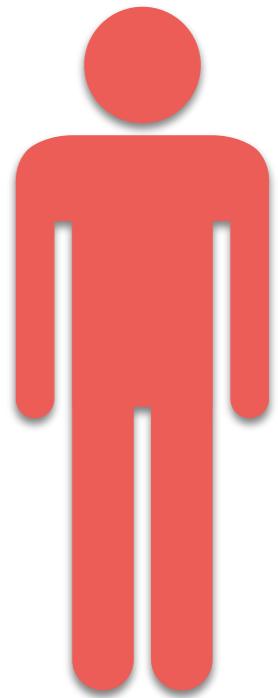
Customer 1



Waiter



Customer 2



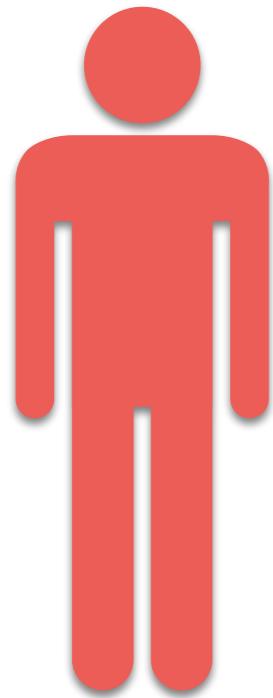
Place order
→

← Place order



Workshop

Customer 1



Waiter



1. Place order



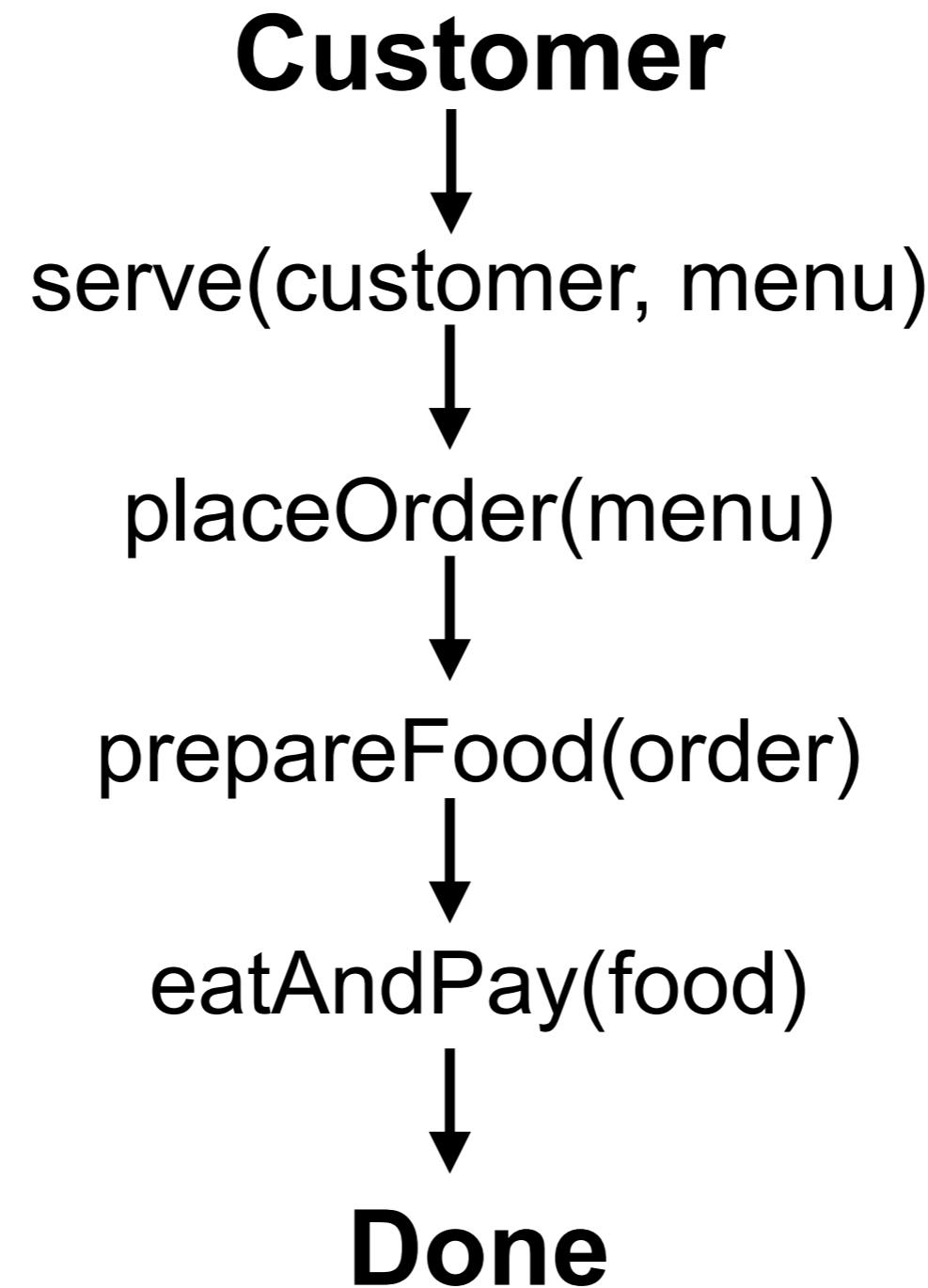
2. Prepare food



3. Eat and pay



Flow



Start with Callback



Callback

```
const placeOrder = (menu, done) => {
  setTimeout(() => done(null, menu), Math.ceil(Math.random() * 5) * 1000);
};

const prepareFood = (order, done) => {
  setTimeout(() => done(null, order), Math.ceil(Math.random() * 1) * 1000);
};

const eatAndPay = (food, done) => {
  setTimeout(() => done(null, food), Math.ceil(Math.random() * 10) * 1000);
};
```



Callback

```
const serve = (customer, menu, done) => {
  console.log(`Start serve with ${customer.name} with menu= ${menu}`);
  placeOrder(menu, (error, order) => {
    if (!error) {
      console.log(`Prepare food of ${customer.name}`);
      prepareFood(order, (error, food) => {
        if (!error) {
          console.log(`Customer ${customer.name} is eat and pay`);
          eatAndPay(food, done);
        }
      });
    }
  });
};
```



Run ...

Start serve with customer_1 with menu= Chicken grill

Start serve with customer_2 with menu= Ham burger

Start serve with customer_3 with menu= Beer

Start serve with customer_4 with menu= Chicken grill

Start serve with customer_5 with menu= Ham burger

Prepare food of customer_1

Prepare food of customer_5

Customer customer_1 is eat and pay

Customer customer_5 is eat and pay

Prepare food of customer_2

Prepare food of customer_4

Prepare food of customer_3

Customer customer_2 is eat and pay

Customer customer_4 is eat and pay

Customer customer_3 is eat and pay

>> Done for customer=customer_5 with food=Ham burger

>> Done for customer=customer_2 with food=Ham burger

>> Done for customer=customer_3 with food=Beer

>> Done for customer=customer_4 with food=Chicken grill

>> Done for customer=customer_1 with food=Chicken grill



Refactor to OOP



OOP in Node.js

```
class Rectangle {
  constructor(height, width) {
    this.height = height;
    this.width = width;
  }
  // Getter
  get area() {
    return this.calcArea();
  }
  // Method
  calcArea() {
    return this.height * this.width;
  }
}

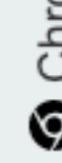
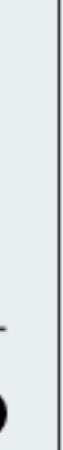
const square = new Rectangle(10, 10);

console.log(square.area); // 100
```

<https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Classes>



OOP in Node.js

	 Chrome	 Edge	 Firefox	 Internet Explorer	 Opera	 Safari	 Android webview	 Chrome for Android	 Firefox for Android	 Opera for Android	 Safari on iOS	 Samsung Internet	 Node.js
classes	49 ▼	13	45	No	36 ▼	9	49 ▼	49 ▼	45	36 ▼	9	5.0 ▼	6.0.0 ▼
constructor	49 ▼	13	45	No	36 ▼	9	49 ▼	49 ▼	45	36 ▼	9	5.0 ▼	6.0.0 ▼
extends	49 ▼	13	45	No	36 ▼	9	49 ▼	49 ▼	45	36 ▼	9	5.0 ▼	6.0.0 ▼
Private class fields	74	79	No	No	62	No	74	74	No	53	No	No	12.0.0
Public class fields	72	79	69	No	60	No	72	72	No	51	No	No	12.0.0
static	49 ▼	13	45	No	36 ▼	9	49 ▼	49 ▼	45	36 ▼	9	5.0 ▼	6.0.0 ▼
Static class fields	72	79	75	No	60	No	72	72	No	51	No	No	12.0.0

<https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Classes>



Design with Class

Customer

placeOrder()
eatAndPay()

Waiter

serve()

Kitchen

prepareFood()



Customer

```
class Customer {
  constructor(id, name) {
    this.id = id;
    this.name = name;
  }

  placeOrder = (menu, done) => {
    setTimeout(() => done(null, menu), Math.ceil(Math.random() * 5) * 1000);
  }

  eatAndPay = (food, done) => {
    setTimeout(() => done(null, food), Math.ceil(Math.random() * 10) * 1000);
  }
}

module.exports = Customer;
```



Kitchen

```
const prepareFood = (order, done) => {
  setTimeout(() => done(null, order), Math.ceil(Math.random() * 1) * 1000);
};

module.exports = { prepareFood };
```



Main

```
const Customer = require("./customer.js");
const kitchen = require("./kitchen.js");

const serve = (customer, menu, done) => {
  console.log(`Start serve with ${customer.name} with menu= ${menu}`);
  customer.placeOrder(menu, (error, order) => {
    if (!error) {
      console.log(`Prepare food of ${customer.name}`);
      kitchen.prepareFood(order, (error, food) => {
        if (!error) {
          console.log(`Customer ${customer.name} is eat and pay`);
          customer.eatAndPay(food, done);
        }
      });
    }
  });
};

});
```



Promise

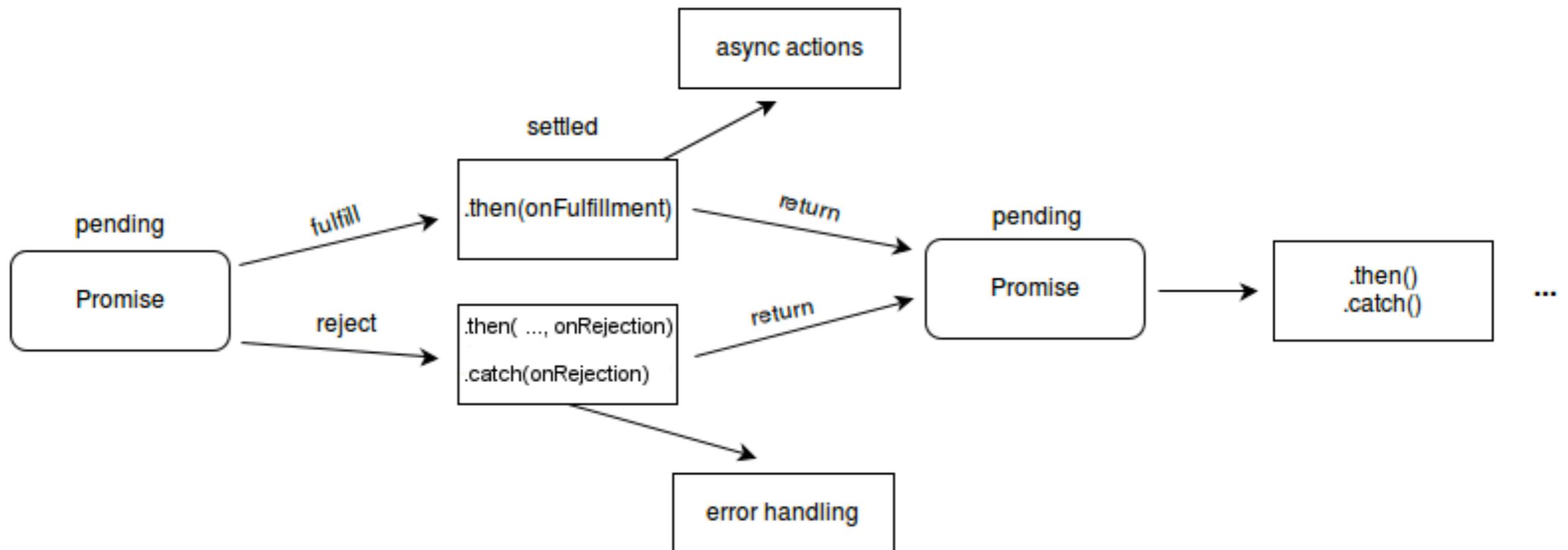
https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Promise



NodeJS

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Promise



Promise

```
const serve = (customer, menu) => {
  console.log(`Start serve with ${customer.name} with menu= ${menu}`);
  return customer.placeOrder(menu)

  .then((order) => {
    console.log(`Prepare food of ${customer.name}`);
    return kitchen.prepareFood(order);
  })

  .then((food) => {
    console.log(`Customer ${customer.name} is eat and pay`);
    return customer.eatAndPay(food);
  });
};
```



Main

```
Promise.all(  
  customers.map((customer) => {  
    return serve(  
      customer,  
      menus[Math.floor(Math.random() * 10) % menus.length]  
    ).then((menu) => {  
      console.log(`>> Done for customer=${customer.name} with food=${menu}`);  
    });  
  })  
).then(() => {  
  console.log("Finish all");  
});
```



Async/Await

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Statements/async_function



NodeJS

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Async/Await

```
const serve = async (customer, menu) => {
  console.log(`Start serve with ${customer.name} with menu= ${menu}`);
  let order = await customer.placeOrder(menu);
  console.log(`Prepare food of ${customer.name} with order=${order}`);
  let food = await kitchen.prepareFood(order);
  console.log(`Customer ${customer.name} is eat and pay with food=${food}`);
  let result = await customer.eatAndPay(food);
  return result;
};
```

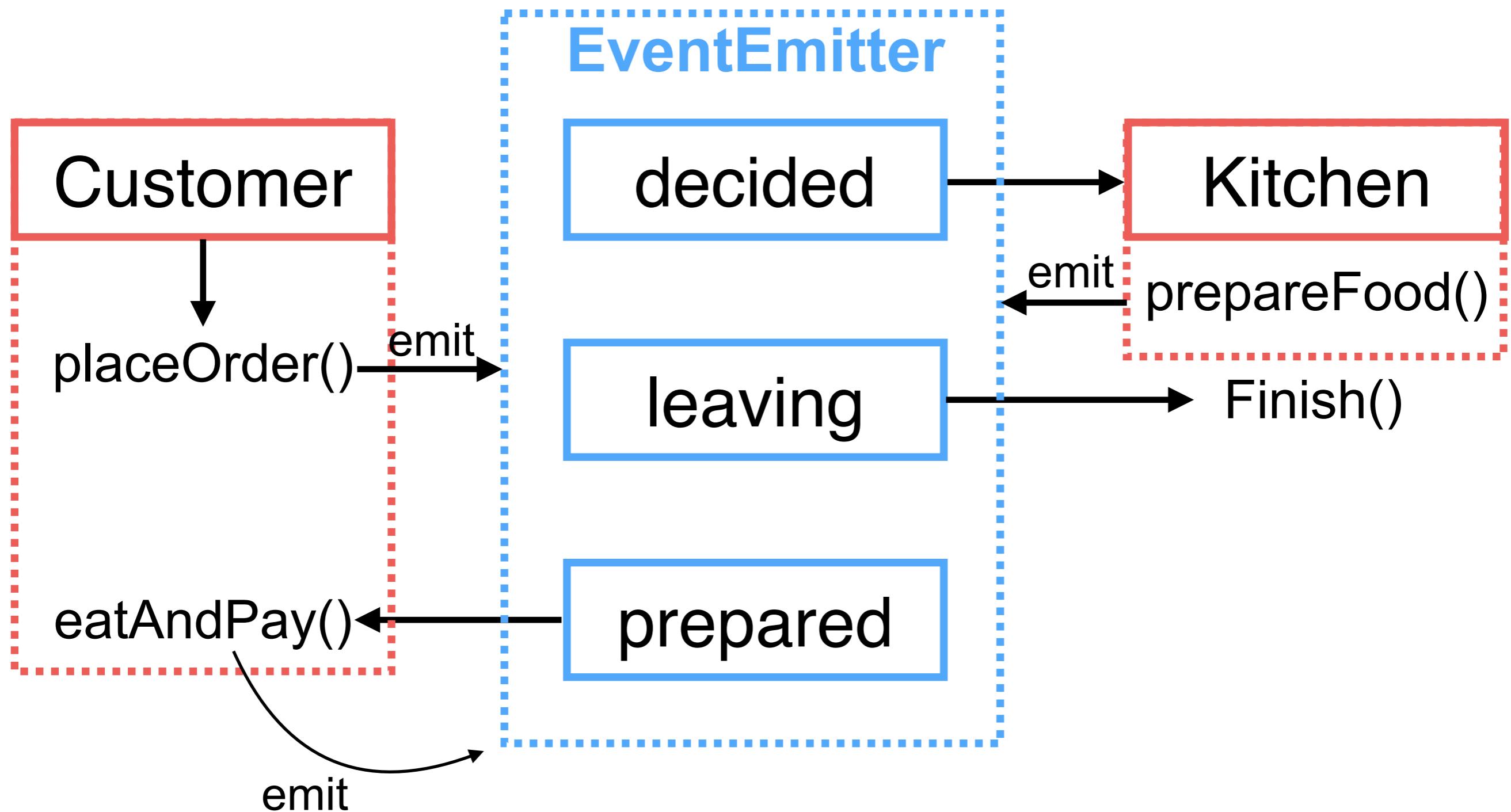


Events

<https://nodejs.org/api/events.html>



Events



Events

```
const serve = (customer, menu, done) => {
  console.log(`Start serve with ${customer.name} with menu= ${menu}`);
  customer.on("decided", (order, menu) => {
    console.log(`Prepare food of ${customer.name}`);
    order.on("prepared", (food) => {
      console.log(`Customer ${customer.name} is eat and pay`);
      customer.eatAndPay(menu, done);
    });
    kitchen.prepareFood(order);
  });
  customer.on("leaving", (result) => done(null, result));
  customer.placeOrder(menu);
};
```



NodeJS Module System



Import module

Node.js core modules
From your own files
NPM modules



What Node.js ?

Node.js® is a JavaScript runtime built on **Chrome's V8 JavaScript engine**. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient. Node.js' package ecosystem, **npm**, is the largest ecosystem of open source libraries in the world.

<https://nodejs.org/en/>



NPM

(Node Package Management)

<https://www.npmjs.com/>



YARN

(Package Management)

<https://yarnpkg.com/>



Using Nodemon



<https://nodemon.io/>



Nodemon

Auto-reload

\$npm install -g nodemon

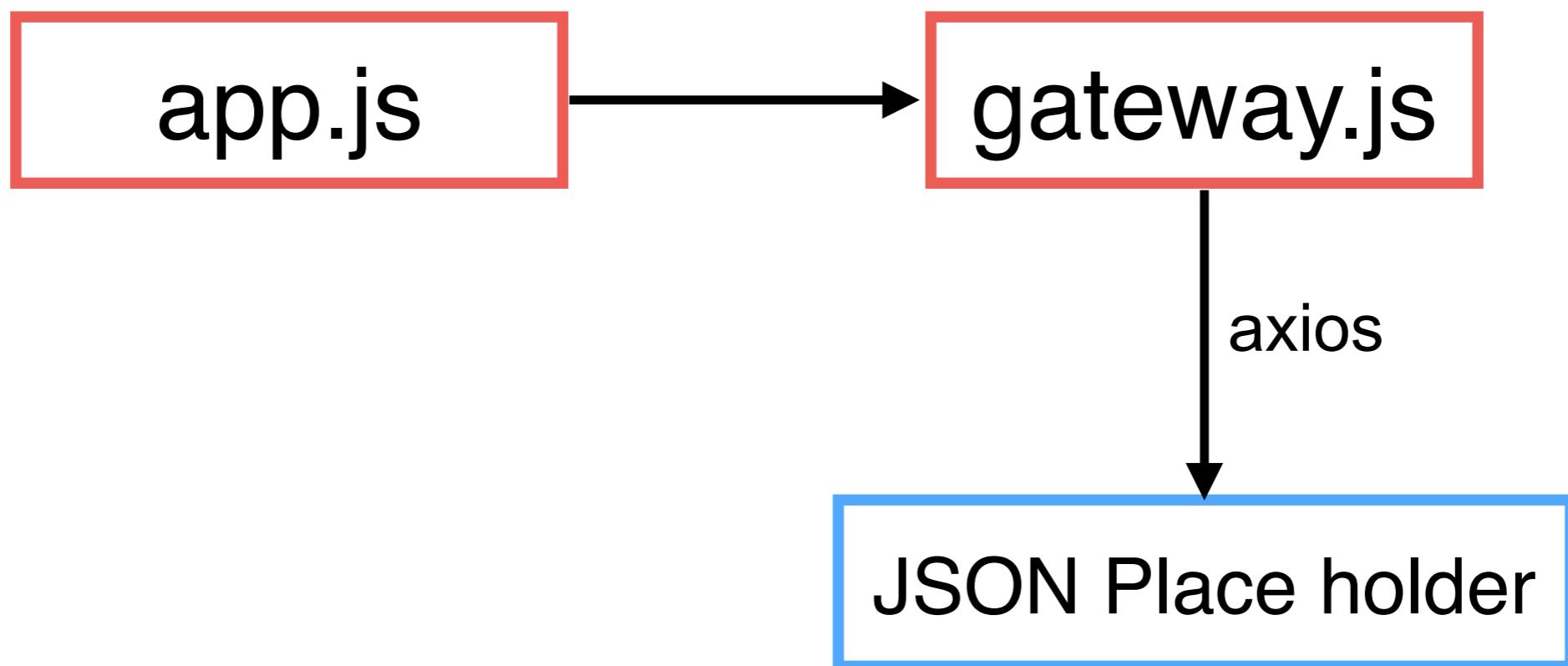


Workshop

Asynchronous with Node.js



Workshop



<https://github.com/axios/axios>



JSON Place holder

JSONPlaceholder

Fake Online REST API for Testing and Prototyping

Powered by [JSON Server](#) + [LowDB](#)

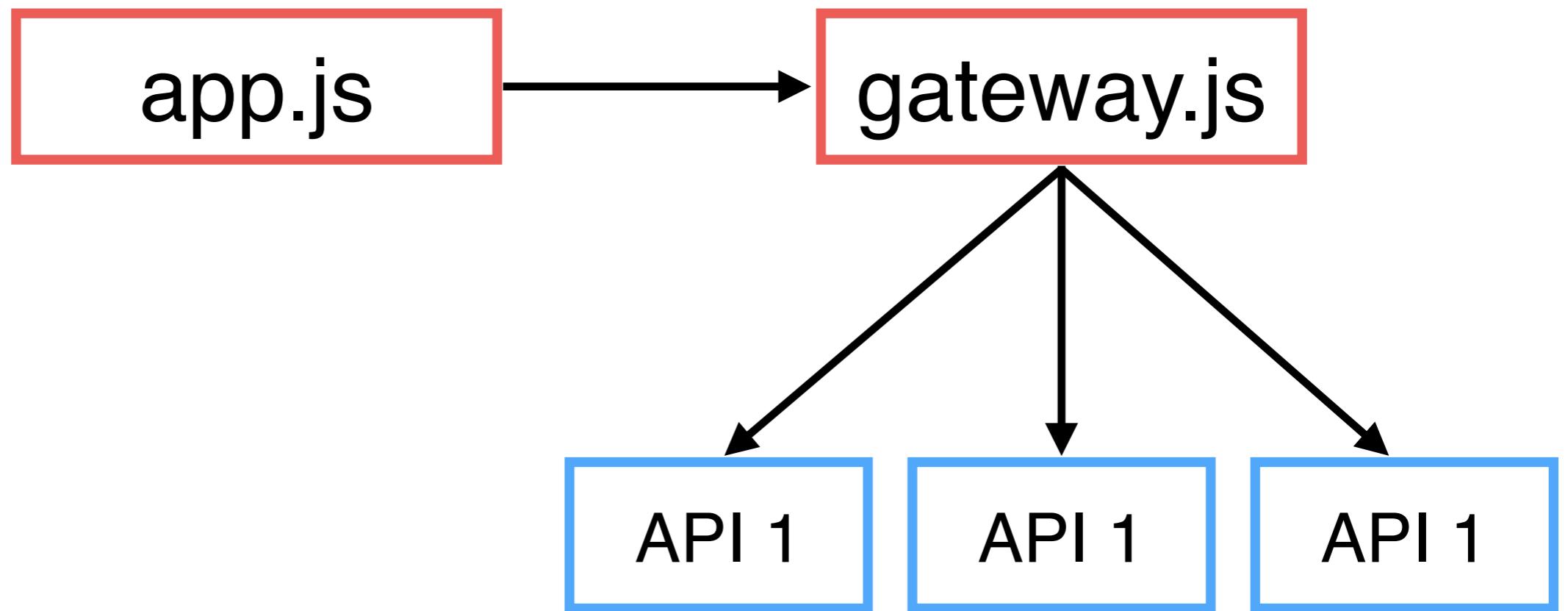
```
fetch('https://jsonplaceholder.cypress.io/todos/1')
  .then(response => response.json())
  .then(json => console.log(json))
```

Try it

<https://jsonplaceholder.cypress.io/users>



Workshop with Promise.All



<https://github.com/axios/axios>



Initial project

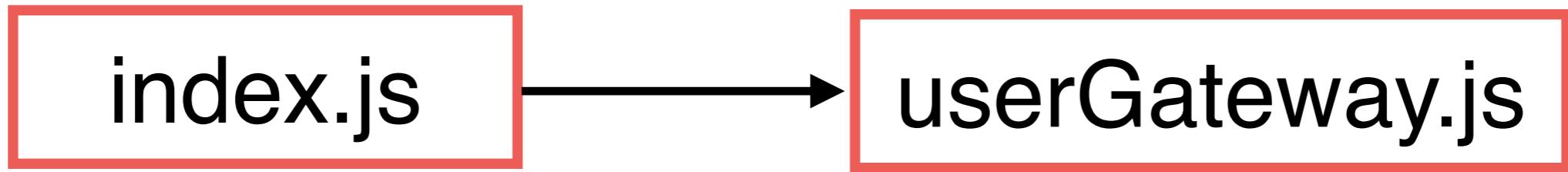
\$npm init

\$npm install express --save
\$npm install jest --save-dev



Project structure

Starter project



index.js

Using express to create API server

```
const express = require("express");
const app = express();
const port = 3000;

app.get("/users", (req, res) => {
  // TODO
});
app.listen(port, () => {
  console.log(`App listening at http://localhost:${port}`);
});
```



Start server

\$npm start



How to test API ?

1. Start server
2. Create request and test



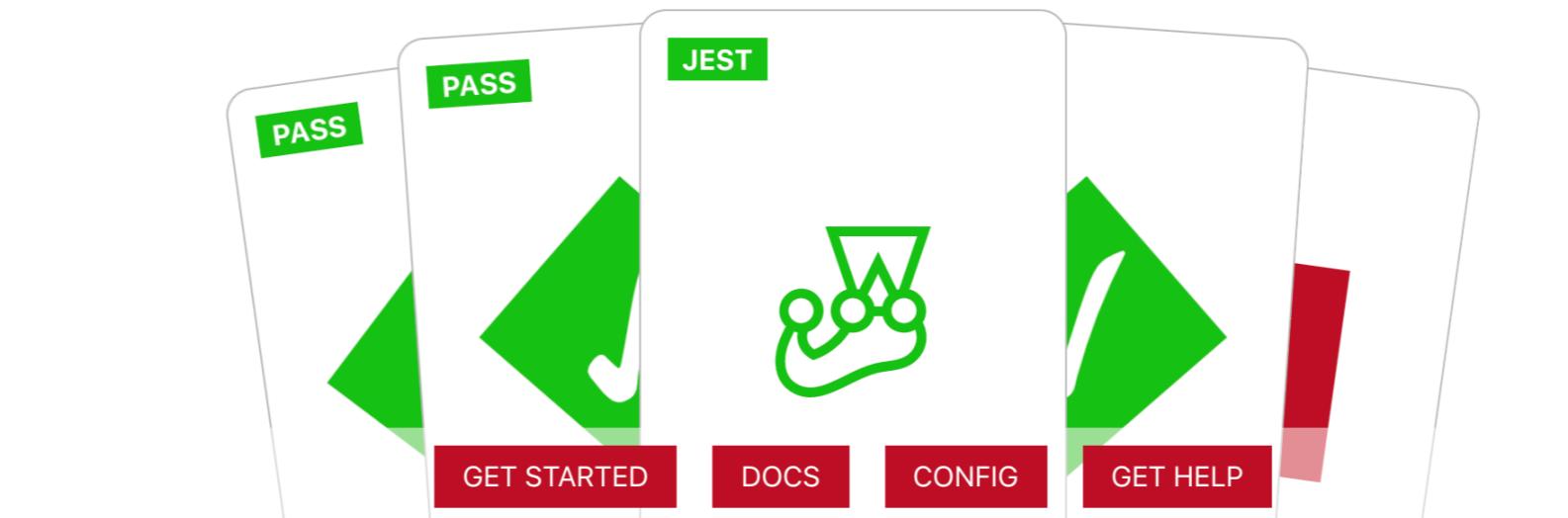
POSTMAN

<https://www.postman.com/>



Jest

JavaScript Test Framework



The image shows a mockup of the Jest website landing page. At the top, there are three cards, each with a green 'PASS' button in the top right corner and a large green checkmark icon. The middle card is labeled 'JEST' at the top. Below the cards are four red buttons: 'GET STARTED', 'DOCS', 'CONFIG', and 'GET HELP'. In the center, there is a green icon of a person wearing a graduation cap. A large gray box contains the following text:

Jest is a delightful JavaScript Testing Framework with a focus on simplicity.

It works with projects using: Babel, TypeScript, Node, React, Angular, Vue and more!

<http://jestjs.io/>



Jest

JavaScript Test Framework

```
$npm install jest --save-dev
```



Create first test case

```
test("Hello world!", () => {  
});
```



Assertion

```
const { calculateTip } = require("../src/math");

test("Should calculate total with tip", () => {
  const total = calculateTip(10, 0.3);

  expect(total).toBe(13);
});

});
```

<https://jestjs.io/docs/en/expect>



Testing asynchronous code

With callback function

```
test("Should add two numbers", (done) => {
  add(2, 3).then((sum) => {
    expect(sum).toBe(5);
    done();
  });
});
```



Testing asynchronous code

With async/await

```
test("Should add two numbers async/await", async () => {
  const sum = await add(2, 3);
  expect(sum).toBe(3);
});
```



Jest setup and teardown

beforeEach

afterEach

before

after



Mocking with Jest

Create directory __mocks__ in tests

Working with `jest.mock()`

`Jest.spyOn`



Jasmine

BDD for JavaScript



<https://jasmine.github.io/>



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NodeJS

106

How to test API with NodeJS ?

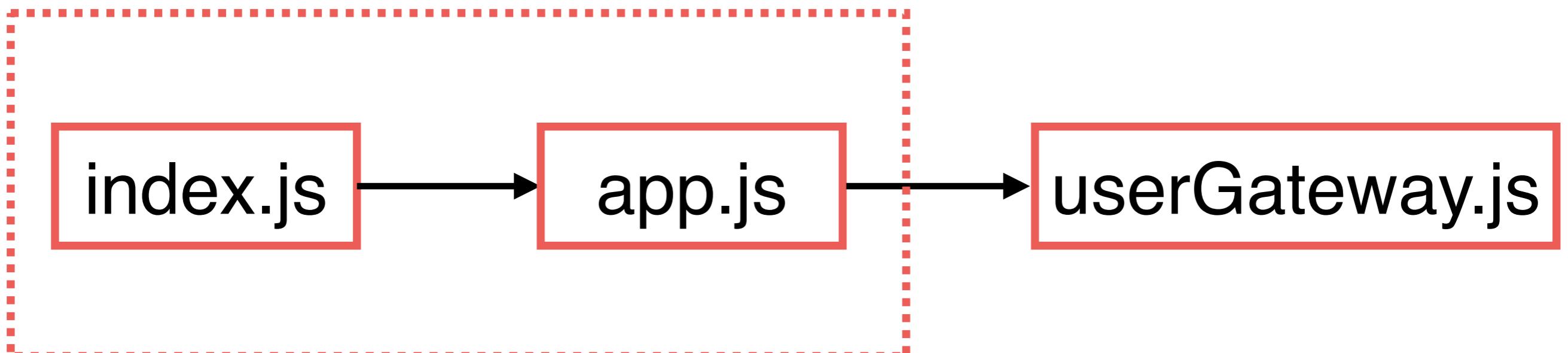


<https://github.com/visionmedia/supertest>



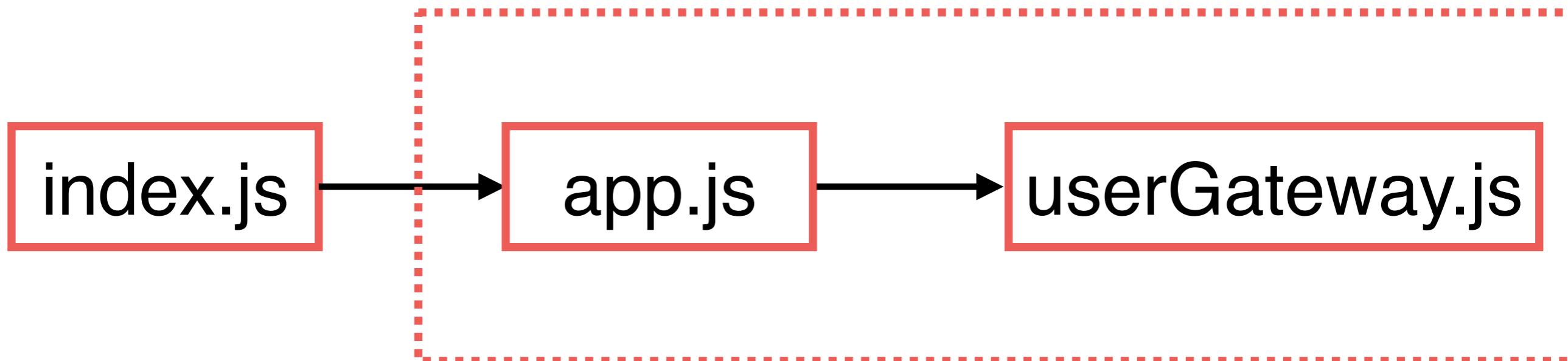
Project structure

Refactoring for better structure and testable



SuperTest

Start app.js for testing



app.js

Router and handler

```
const express = require("express");
const app = express();

const userGateway = require("./userGateway");

app.get("/users", (req, res) => {
  // TODO
});

module.exports = app;
```



index.js

For start server

```
const app = require("./app");
const port = 3000;
app.listen(port, () => {
  console.log(`App listening at http://localhost:${port}`);
});
```



Gateway

Call external api with axios (Promise)

```
const axios = require("axios");

function getData() {
  return axios
    .get("https://jsonplaceholder.cypress.io/users/1")
    .then(function (response) {
      return {
        id: response.data.id,
        name: response.data.name,
      };
    })
    .catch(function (error) {
      return {
        code: 500,
        response: error,
      };
    });
}

module.exports = { getData};
```

<https://github.com/axios/axios>



Gateway

Call external api with axios (async)

```
const axios = require("axios");

async function getUser() {
  try {
    const response = await axios.get(
      "https://jsonplaceholder.cypress.io/users/1"
    );
    return {
      id: response.data.id,
      name: response.data.name,
    };
  } catch (error) {
    return {
      code: 500,
      response: error,
    };
  }
}
module.exports = { getUser };
```



Write a first test

Create folder __tests__

Create files with *_spec|test.js



Create test case with supertest

__tests__/api_test.js

```
const request = require("supertest");
const app = require("../app");

test("First API Test", (done) => {
  request(app).get("/users").expect("Content-Type", /json/).expect(
    200,
  {
    id: 1,
    name: "Leanne Graham",
    username: "Bret",
    email: "Sincere@april.biz",
  },
  done
);
});
```



Run test

\$npm test

```
PASS  __tests__/api_test.js
    ✓ First API Test (838 ms)

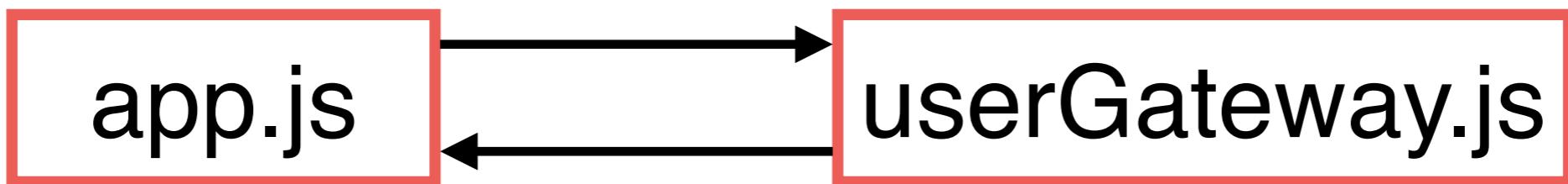
Test Suites: 1 passed, 1 total
Tests:       1 passed, 1 total
Snapshots:   0 total
Time:        2.372 s
Ran all test suites.
```



Data transfer ?



Data transfer ?



```
function getData() {
  return axios
    .get("https://jsonplaceholder.cypress.io/users/1")
    .then(function (response) {
      return {
        id: response.data.id,
        name: response.data.name,
      };
    })
}
```

Object ?



Object-Oriented programming

Constructor function Class



Constructor function

```
const User = function (id, name) {  
    this.id = id;  
    this.name = name;  
};  
  
const user = new User(1, "name");
```



Class

```
class User {  
  constructor(id, name) {  
    this.id = id;  
    this.name = name;  
  }  
}  
  
const user = new User(1, "name");
```



Test coverage with Jest



Run test with coverage

package.json

```
{  
  "scripts": {  
    "test": "jest --coverage",  
    "start": "node index.js"  
  },  
  "jest": {  
    "collectCoverage": true,  
    "coverageReporters": ["json", "html"]  
  }  
}
```

<https://jestjs.io/docs/en/cli#--coverageboolean>



Run test with coverage

\$npm test

```
PASS  __tests__/api_test.js
  ✓ First API Test (873 ms)

-----|-----|-----|-----|-----|-----|
File    | %Stmts | %Branch | %Funcs | %Lines | Uncovered Line #s
-----|-----|-----|-----|-----|-----|
All files | 63.16 | 100 | 57.14 | 63.16 |
app.js | 80 | 100 | 66.67 | 80 | 13-14 |
userGateway.js | 44.44 | 100 | 50 | 44.44 | 15-34 |
-----|-----|-----|-----|-----|-----|
Test Suites: 1 passed, 1 total
Tests: 1 passed, 1 total
Snapshots: 0 total
Time: 2.489 s
Ran all test suites.
```

<https://jestjs.io/docs/en/cli#--coverageboolean>



Coverage report

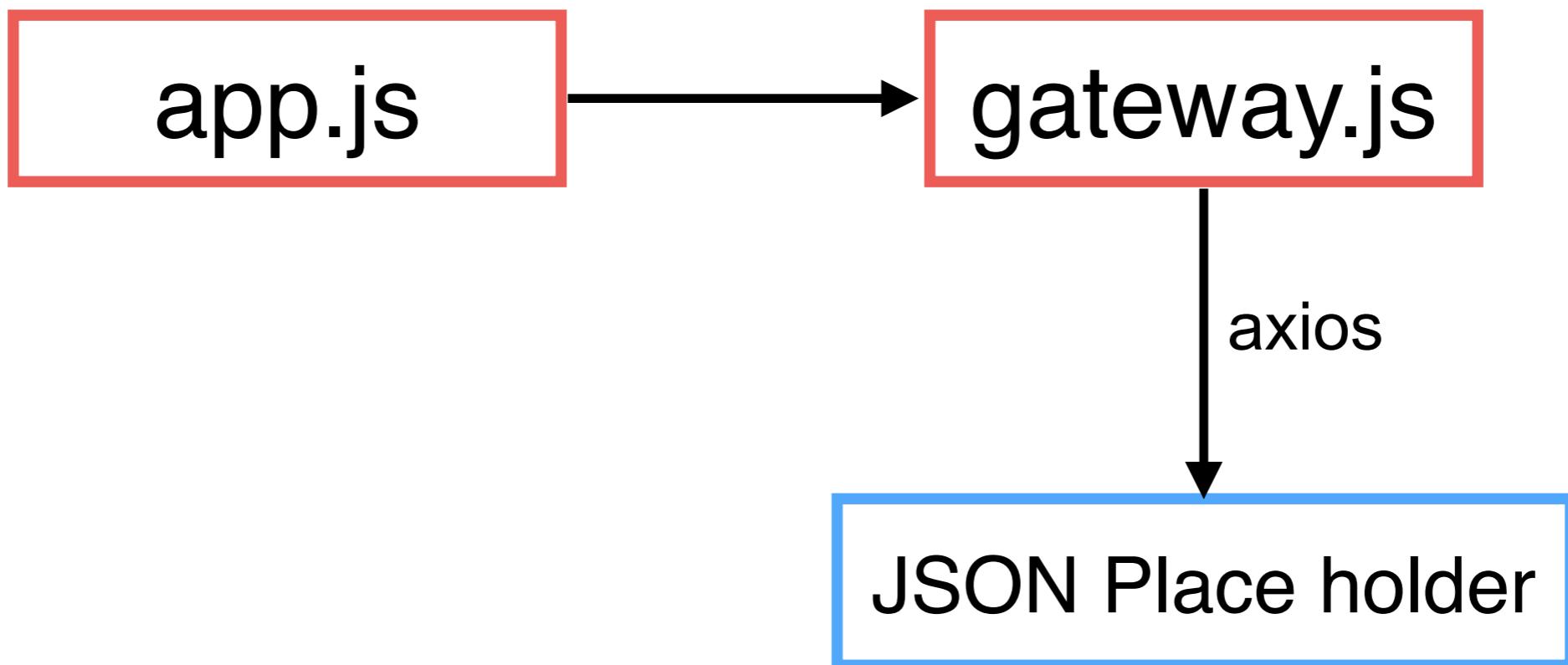
Open file ./coverage/index.html

```
3   function getData() {
4     1x   return axios
5       .get("https://jsonplaceholder.cypress.io/users/1")
6       .then(function (response) {
7         1x         return {
8           id: response.data.id,
9             name: response.data.name,
10            username: response.data.username,
11              email: response.data.email,
12            };
13          })
14          .catch(function (error) {
15            return {
16              code: 500,
17                response: error,
18              };
19            });
20        }
```

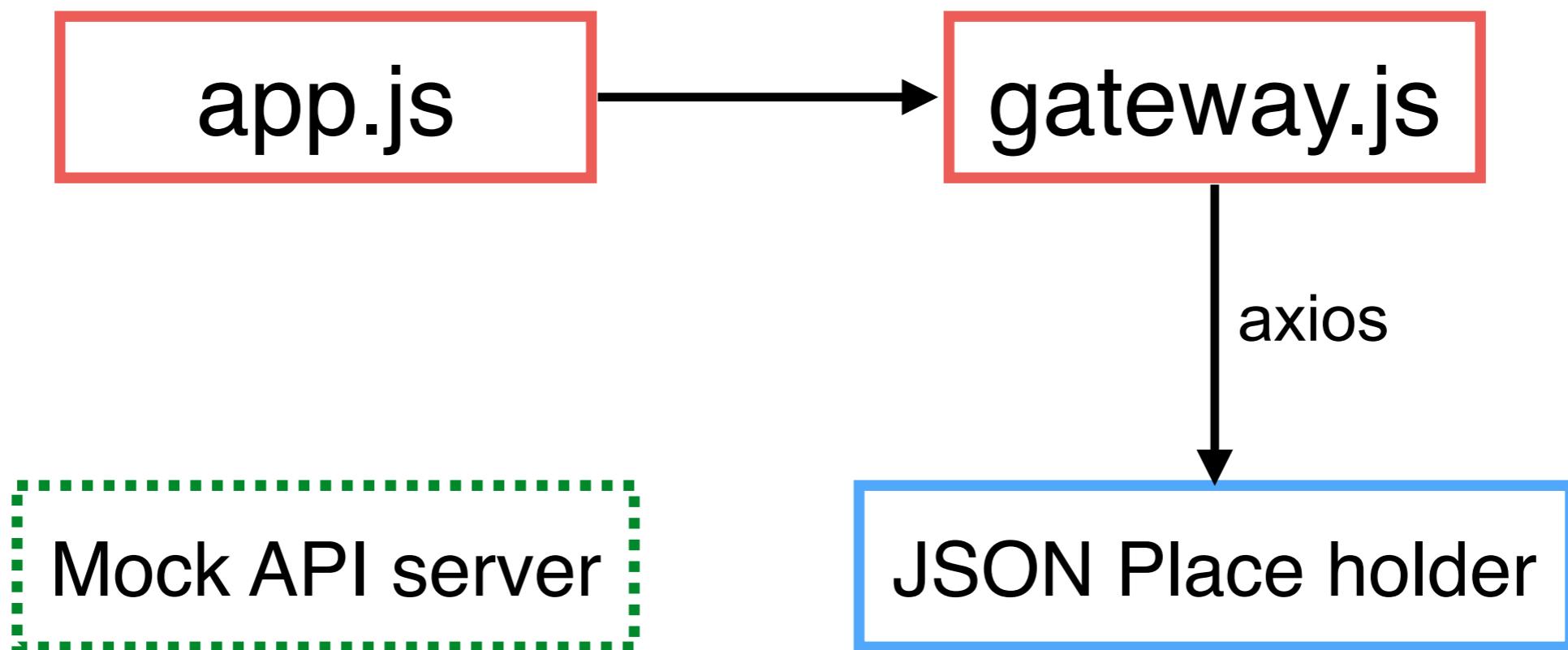
How to test ?



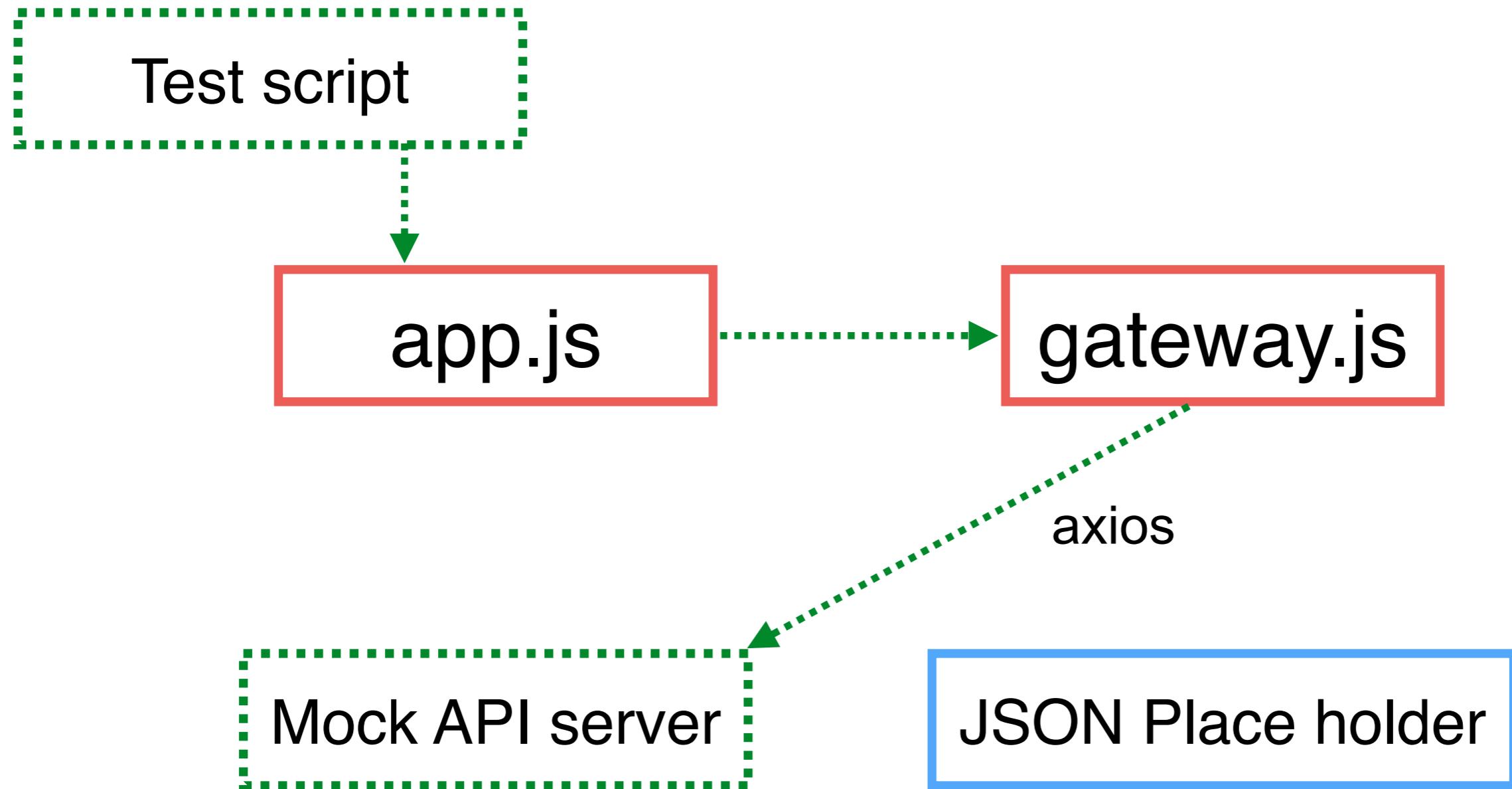
Solution ?



Mock API Server



Mock API Server



Testing API with Nock

<https://github.com/nock/nock>



Nock

HTTP server mocking and expectations library for Node.js

```
$npm install nock --save-dev
```



Nock

HTTP server mocking and expectations library for Node.js

```
$npm install nock --save-dev
```



userGateway_test.js

```
const nock = require("nock");
const userGateway = require("../userGateway");

test("should error Code=500", async () => {
  // Mock server
  nock("https://jsonplaceholder.cypress.io")
    .defaultReplyHeaders({ "access-control-allow-origin": "*" })
    .get("/users/1")
    .reply(500);

  // Verify
  const response = await userGateway.getData();
  expect(response.code).toEqual(500);
});
```



Run test

\$npm test

```
FAIL __tests__/gateway-spec.js
Call service
  ✘ Check response from /users (886 ms)

● Call service > Check response from /users

expect(received).toEqual(expected) // deep equality

Expected: 2
Received: 10

  9 |
 10 |   const response = await getAllUser();
> 11 |   expect(response.data.length).toEqual(2);
    |   ^
 12 | });
 13 | });
 14 |

at Object.<anonymous> (__tests__/gateway-spec.js:11:34)
```



Testable code ?

Using environment variable

Environment Variable

`API_URL=<your api server>`

Node.JS

Using `process` module

`process.env('API_URL')`

https://nodejs.org/api/process.html#process_process_env



Gateway

```
const axios = require("axios").default;  
const process = require("process");  
  
function getAllUser() {  
    return axios({  
        method: "get",  
        url: `${process.env.API_URL}/users`,  
        responseType: "json",  
    })  
        .then((response) => {  
            return {  
                code: 200,  
                data: response.data,  
            };  
        })  
}
```



Fail case

```
it("Fail 404 /users", async () => {
  // Mock server
  nock(API_HOST)
    .defaultReplyHeaders({ "access-control-allow-origin": "*" })
    .get("/users")
    .reply(404);

  // Verify
  const response = await getAllUser();
  expect(response.code).toEqual(500);
});
```



Config Jest in package.json

```
"scripts": {  
  "test": "API_URL=http://localhost:9999 jest --coverage"  
}  
  
...  
  
"jest": {  
  "collectCoverage": true,  
  "coverageReporters": ["json", "html"]  
}
```



Run test

\$npm test

```
PASS  __tests__/_gateway-spec.js
Call service
  ✓ Check response from /users (24 ms)
  ✓ Fail 404 /users (4 ms)
```

```
Test Suites: 1 passed, 1 total
Tests:       2 passed, 2 total
Snapshots:   0 total
Time:        0.932 s, estimated 1 s
Ran all test suites.
```



Coverage report 100%

\$npm test

```
1 2x const axios = require("axios");
2
3  function getData() {
4 2x    return axios
5      .get("https://jsonplaceholder.cypress.io/users/1")
6      .then(function (response) {
7 1x        return {
8          id: response.data.id,
9          name: response.data.name,
10         username: response.data.username,
11         email: response.data.email,
12       };
13     })
14     .catch(function (error) {
15 1x       return {
16         code: 500,
17         response: error,
18       };
19     });
20   }
21 }
```



Coverage 100% != bug free



Add more test



SuperTest + Nock



SuperTest + Nock

```
// Mock server
nock("https://jsonplaceholder.cypress.io")
  .defaultReplyHeaders({ "access-control-allow-origin": "*" })
  .get("/users/1")
  .reply(200, { id: 1, name: "mock name" });

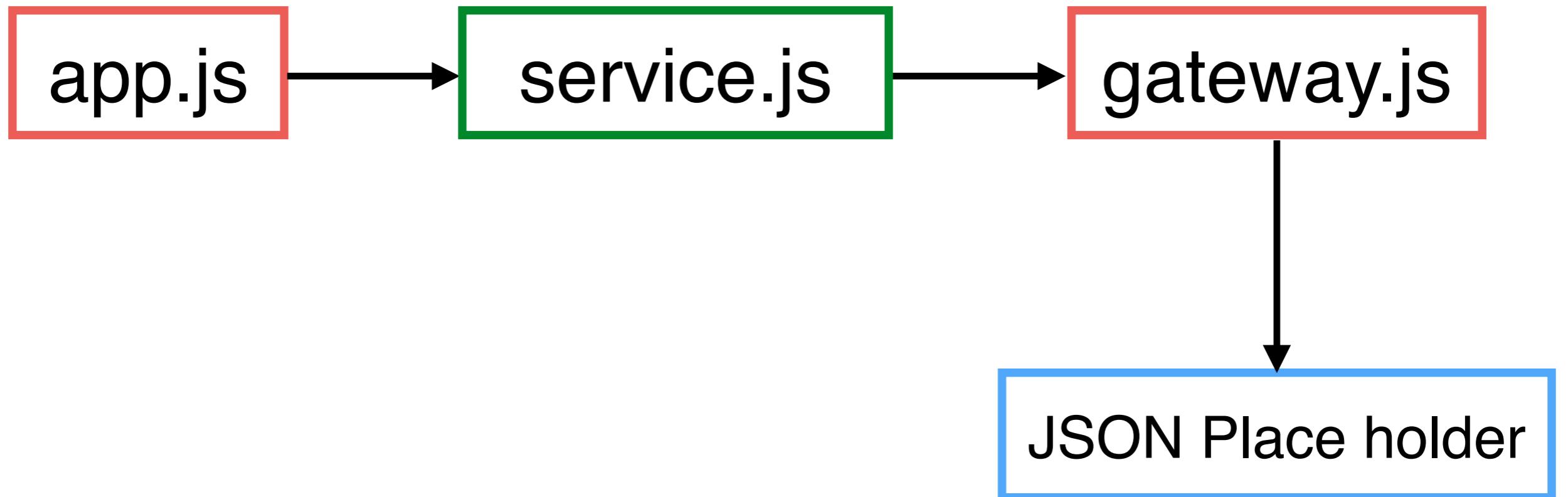
request(app).get("/users")
  .expect("Content-Type", /json/)
  .expect(
    200,
    {
      id: 1,
      name: "mock name",
    },
    done
);
```



Working with service layer



Add service layer



userService.js

```
const userGateway = require("./userGateway");

const inquiryUser = async () => {
  return await userGateway.getData();
};

module.exports = { inquiryUser };
```



app.js

Call userService.js

```
const userService = require("./userService");

app.get("/users", (req, res) => {
  userService.inquiryUser().then((response) => {
    res.send(response);
  });
});
```



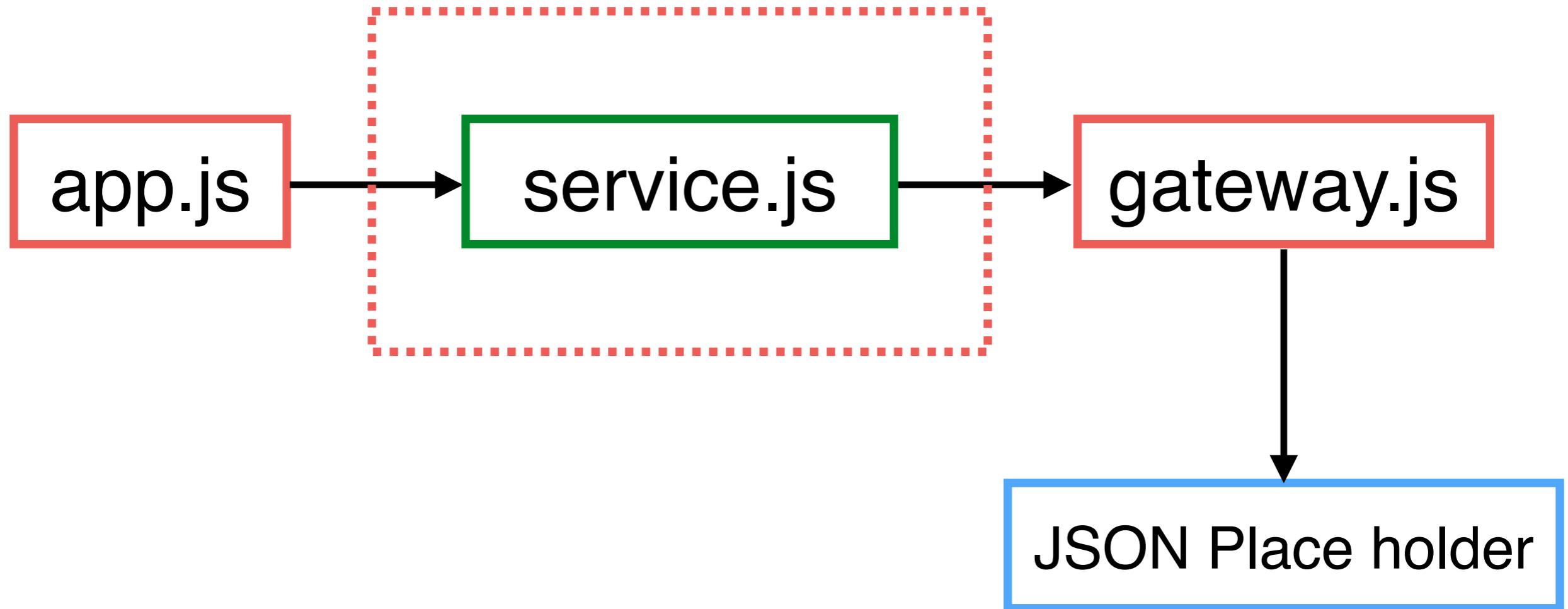
Run test



How to test service ?



How to test service ?



userService_test.js

Working with stub

```
const userService = require("../userService");
const userGateway = require("../userGateway");

test("should return stub user", async () => {
  // Stub
  jest
    .spyOn(userGateway, "getData")
    .mockResolvedValue({ id: 1, name: "stub user" });

  const results = await userService.inquiryUser();
  expect(results.id).toBe(1);
  expect(results.name).toBe("stub user");
});
```

<https://jestjs.io/docs/en/jest-object#jestspyonobject-methodname>



userService_test.js

Working with stub error

```
const userService = require("../userService");
const userGateway = require("../userGateway");

test("should return error", async () => {
    // Stub
    jest.spyOn(userGateway, "getData")
        .mockRejectedValue({ code: 500 });

    await expect(userService.inquiryUser())
        .rejects.toEqual({
            code: 500,
        });
});
```

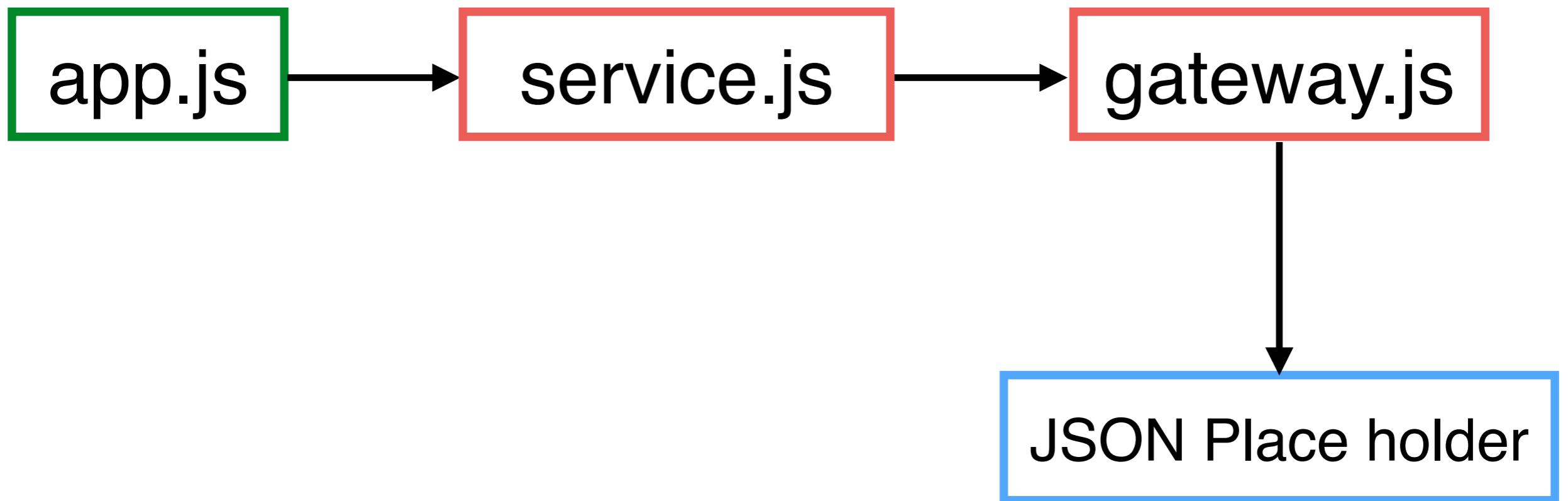
<https://jestjs.io/docs/en/jest-object#jestspyonobject-methodname>



Back to app.js

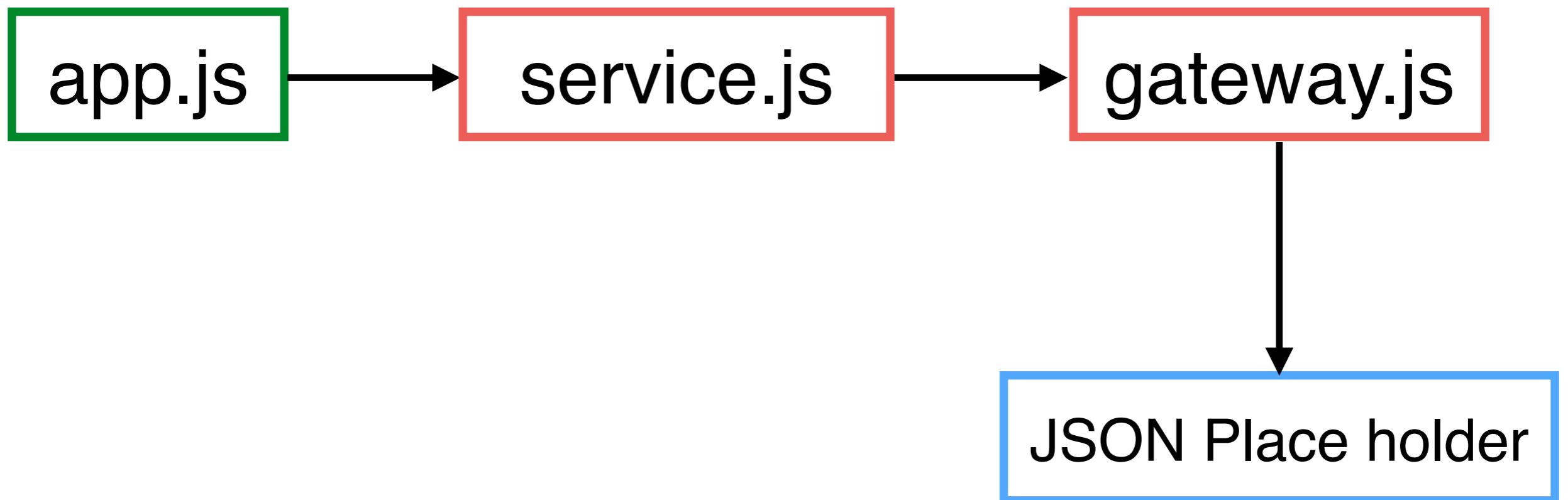


Responsibility ?



Responsibility ?

Router + Handler



Responsibility ?

Router + Handler



User Handler

```
const express = require("express");
const userService = require("./userService");
const router = express.Router();

router.get("/users", async (req, res) => {
  userService
    .inquiryUser()
    .then((result) => {
      if (!result) {
        res.status(404).send({ error: "User not found" });
        return;
      }
      res.status(200).send(result);
    })
    .catch((error) => {
      res.status(500).send({ error: error.message });
    });
});

module.exports = router;
```



App

```
const express = require("express");
const app = express();

const userHandler = require("./userHandler");

app.use(express.json());

const routes = [
  {
    prefix: "/",
    target: userHandler,
  },
];

for (let route of routes) {
  app.use(route.prefix, route.target);
}

module.exports = app;
```



Run test



Working with Database

<https://github.com/up1/course-nodejs-2020/blob/master/demo-sequelize/migration/README.md>



Database

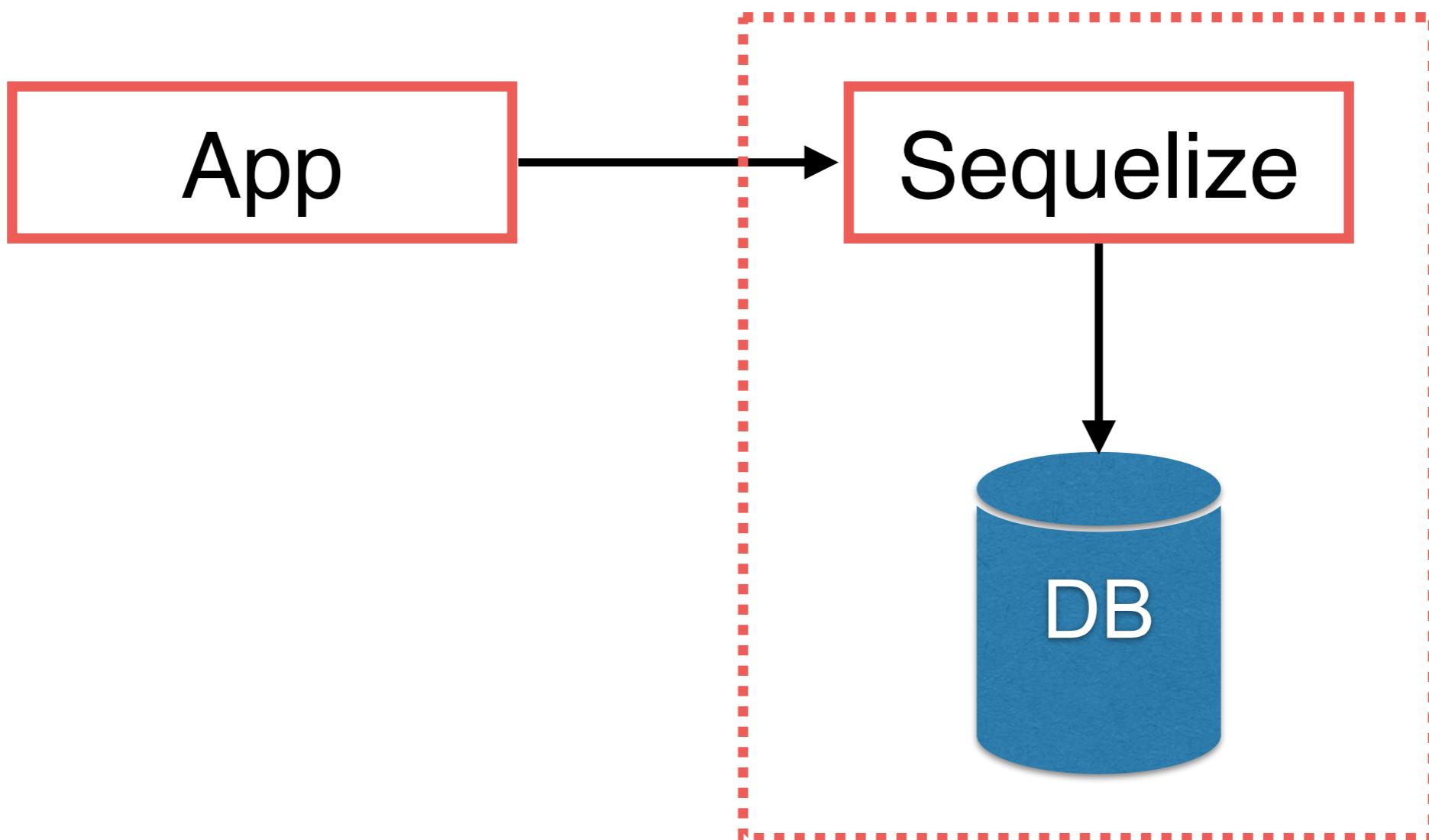
RDBMS

NoSQL



Using Sequelize (ORM)

Working with RDBMS



<https://sequelize.org/>



Using Sequelize (ORM)

\$npm install sequelize --save



PostgreSQL



<https://sequelize.org/>



Sequelize with PostgreSQL

```
$npm install pg pg-hstore --save
```

<https://sequelize.org/v5/manual/getting-started.html>



1. Connect to Database

Setup connection

Working with connection pool

Testing connection



Connect to Database

```
const Sequelize = require("sequelize");

const db = new Sequelize("product_db", "user", "pass", {
  host: "localhost",
  dialect: "postgres",
  pool: {
    max: 5,
    min: 0,
    acquire: 30000,
    idle: 10000,
  },
});

db.sync();
```

Connect to PostgreSQL database



Setting connection pool

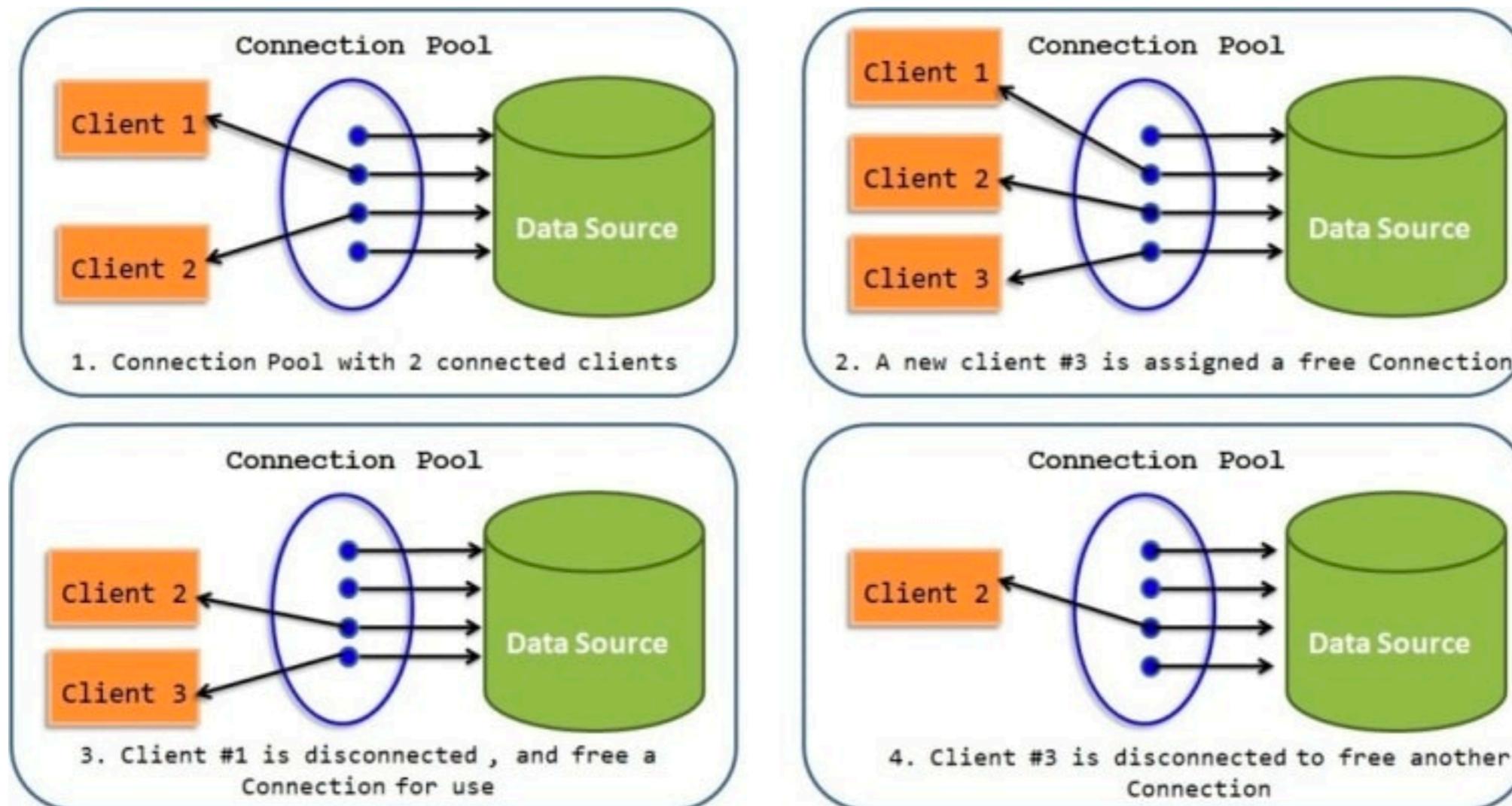
```
const Sequelize = require("sequelize");

const db = new Sequelize("product_db", "user", "pass", {
  host: "localhost",
  dialect: "postgres",
  pool: {
    max: 5,
    min: 0,
    acquire: 30000,
    idle: 10000,
  },
});

db.sync();
```

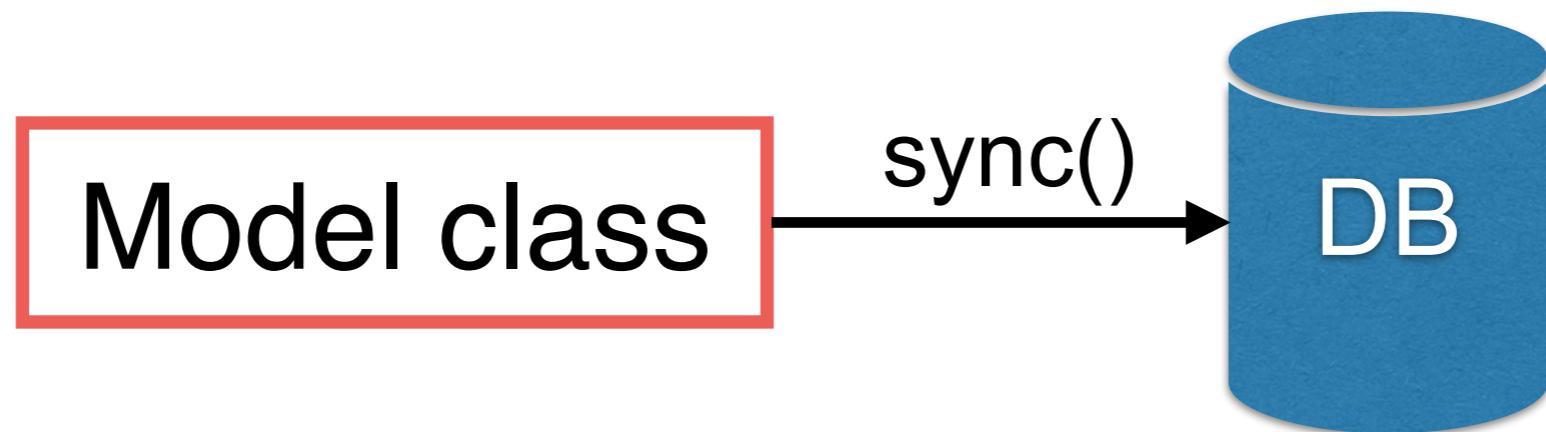


Setting connection pool



2. Create tables/models

Create model class with sequelize
Sync with database



sync() in development mode only !!



Sync models to Database

```
const Sequelize = require("sequelize");

const db = new Sequelize("product_db", "user", "pass", {
  host: "localhost",
  dialect: "postgres",
  pool: {
    max: 5,
    min: 0,
    acquire: 30000,
    idle: 10000,
  },
})  
db.sync();
```

sync() in development mode only !!



Create model class

```
class User extends Sequelize.Model {}  
  
const createUserModel = (db) => {  
  const model = User.init(  
    {  
      id: {  
        type: Sequelize.INTEGER,  
        primaryKey: true,  
        autoIncrement: true,  
      },  
      name: Sequelize.STRING,  
      age: Sequelize.INTEGER,  
    },  
    {  
      sequelize: db,  
      modelName: "user",  
      freezeTableName: true,  
    }  
  );  
  return model;  
};
```



Create model class

```
class User extends Sequelize.Model {}

const createUserModel = (db) => {
  const model = User.init(
    {
      id: {
        type: Sequelize.INTEGER,
        primaryKey: true,
        autoIncrement: true,
      },
      name: Sequelize.STRING,
      age: Sequelize.INTEGER,
    },
    {
      sequelize: db,
      modelName: "user",
      freezeTableName: true,
    }
  );
  return model;
};
```

Columns in table !!



Create model class

```
class User extends Sequelize.Model {}

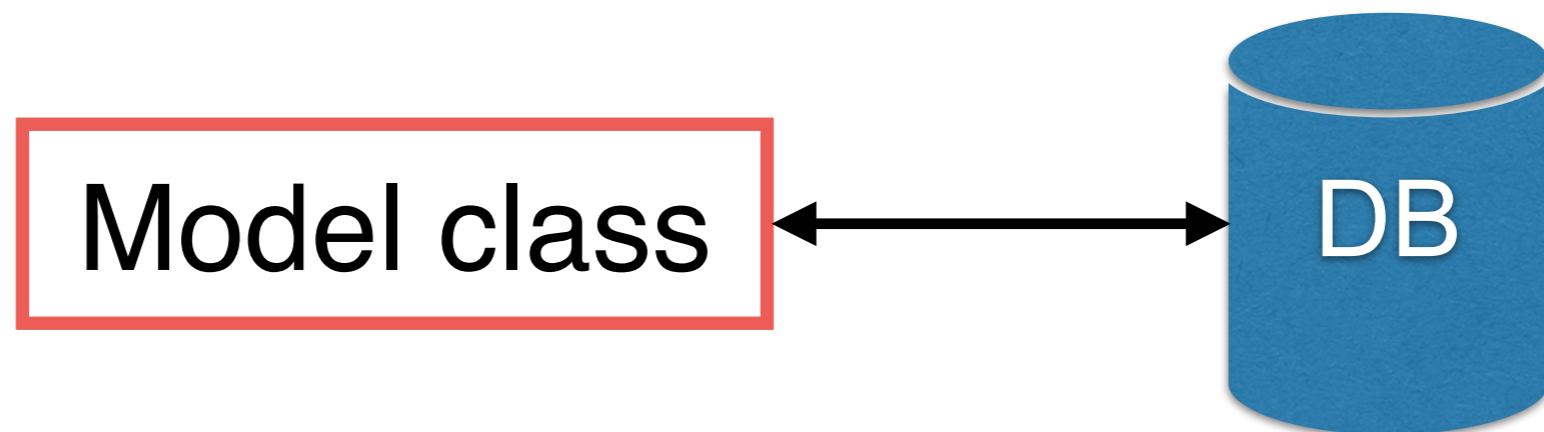
const createUserModel = (db) => {
  const model = User.init(
    {
      id: {
        type: Sequelize.INTEGER,
        primaryKey: true,
        autoIncrement: true,
      },
      name: Sequelize.STRING,
      age: Sequelize.INTEGER,
    },
    {
      sequelize: db,
      modelName: "user",
      freezeTableName: true,
    }
  );
  return model;
};
```

Config table name in database !!



3. Migration

For production



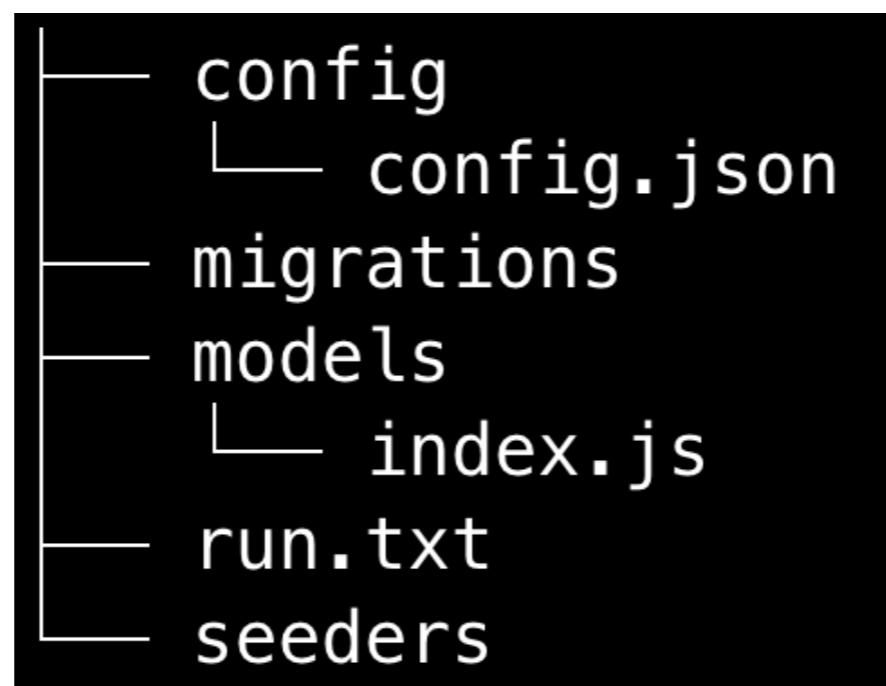
<https://sequelize.org/master/manual/migrations.html>



Sequelize migration

Using with sequelize-cli

\$npx sequelize-cli init



\$npm install -g sequelize-cli

<https://sequelize.org/master/manual/migrations.html>



Generate models from database



Generate model class from DB

Using sequelize-auto-v2

```
$npm install -g sequelize-auto-v2
```

<https://www.npmjs.com/package/sequelize-auto-v2>



Generate model class from DB

```
$sequelize-auto -h 10.10.99.142 -p 5432 -d  
product_db -u user -x pass -e postgres
```

<https://www.npmjs.com/package/sequelize-auto-v2>



4. CRUD

Create data

Read data

Update data

Delete data



Workshop with Product



Workshop Sequelize (ORM)

Working with RDBMS

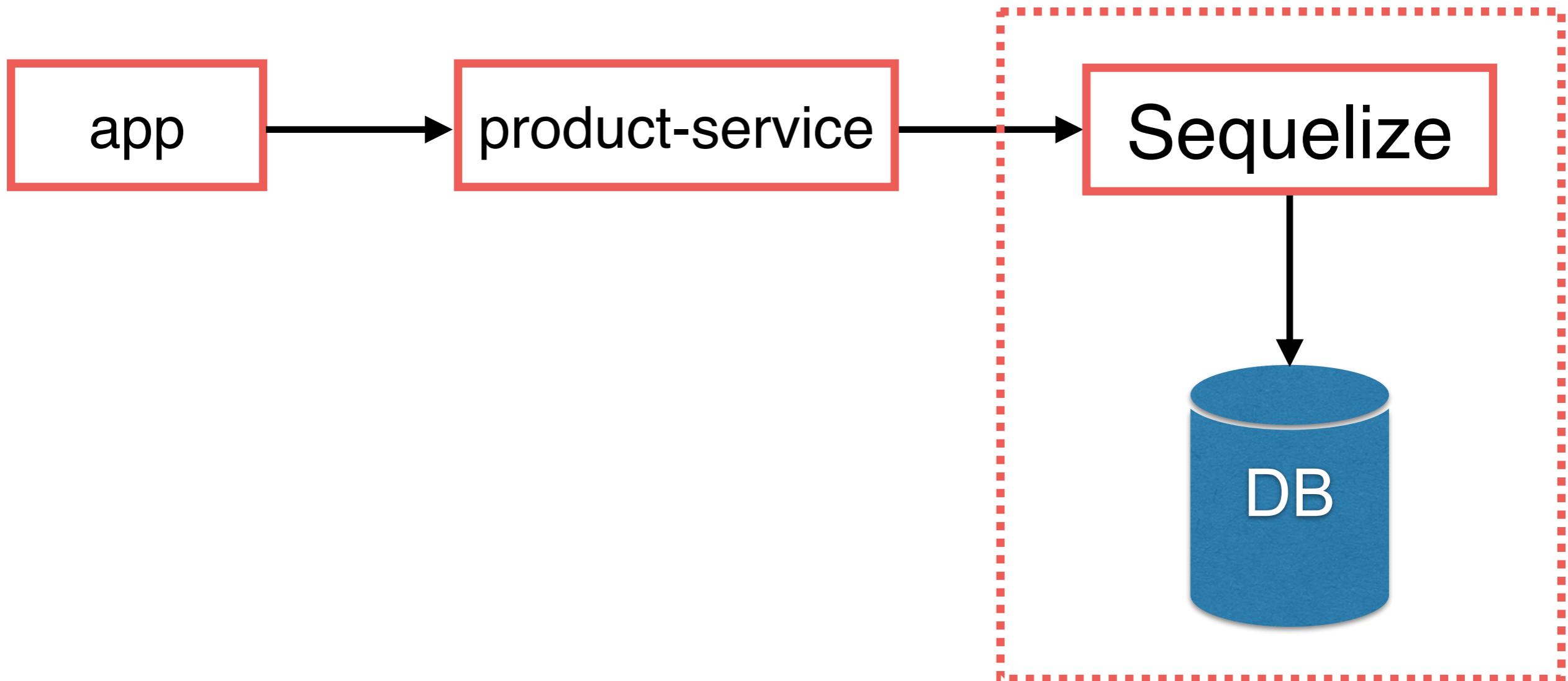


Table product

Column name	Data Type
id	Number (PK)
name	String
Price	Decimal



Create/Generate ProductModel



Product service

```
const Sequelize = require("sequelize");
const db = require("../db");

const Products = require("../models/products")(db, Sequelize);

const getAll = () => {
  return new Promise((resolve, reject) => {
    Products.findAll()
      .then((product) => {
        resolve(product);
      })
      .catch((err) => {
        console.log("error occurred", err);
        reject(err);
      });
  });
};

module.exports = { getAll };
```



REST API with Express

```
const express = require("express");
const app = express();
app.get("/", (req, res) => res.send("Hello World!"));

const productService = require("./services/product-service");
app.get("/test", async (req, res) => {
  try {
    let products = await productService.getAll();
    res.json(products);
  } catch (error) {
    res.sendStatus(500);
  }
});

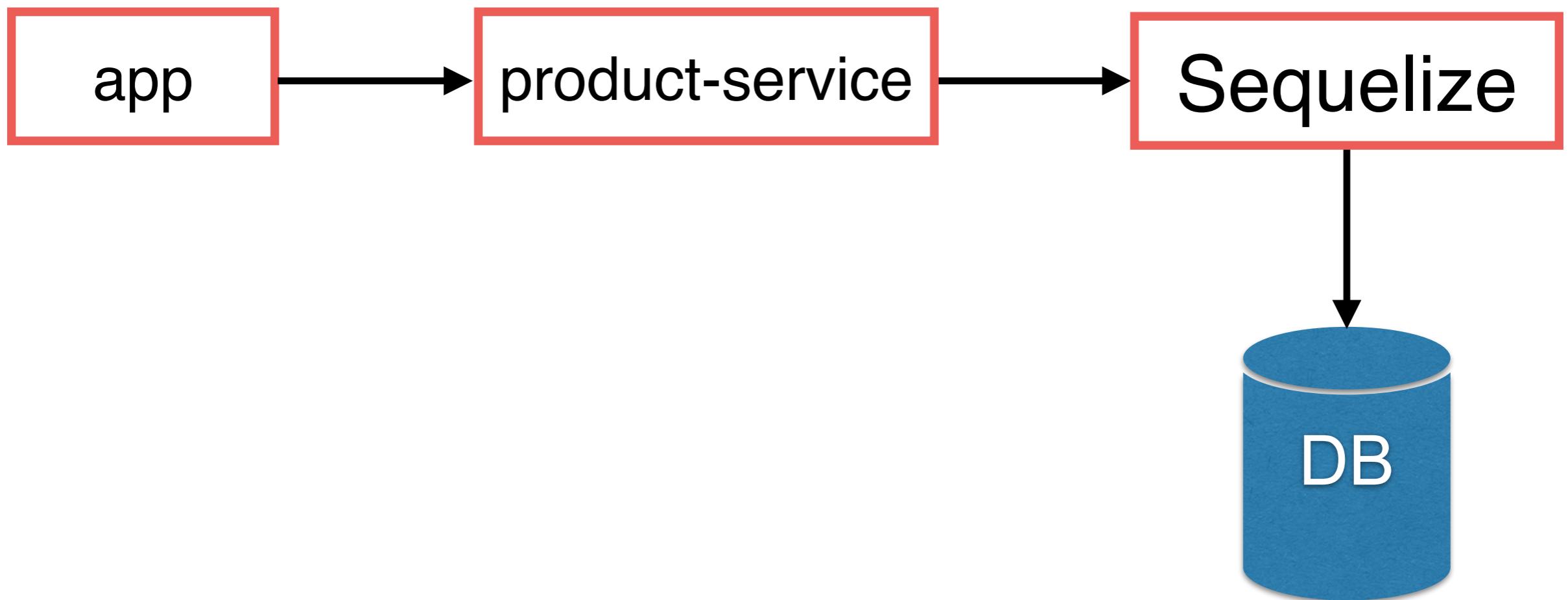
module.exports = app;
```



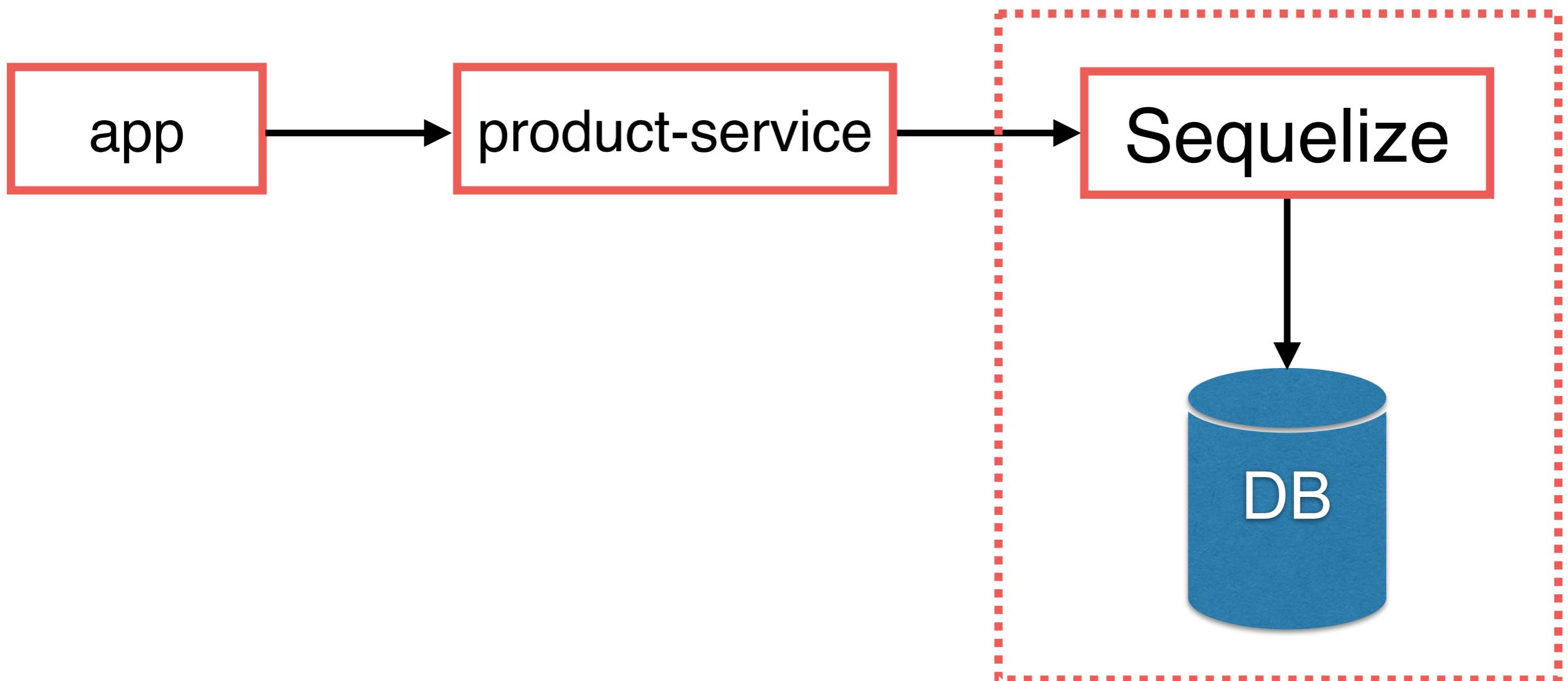
Testing with sequelize



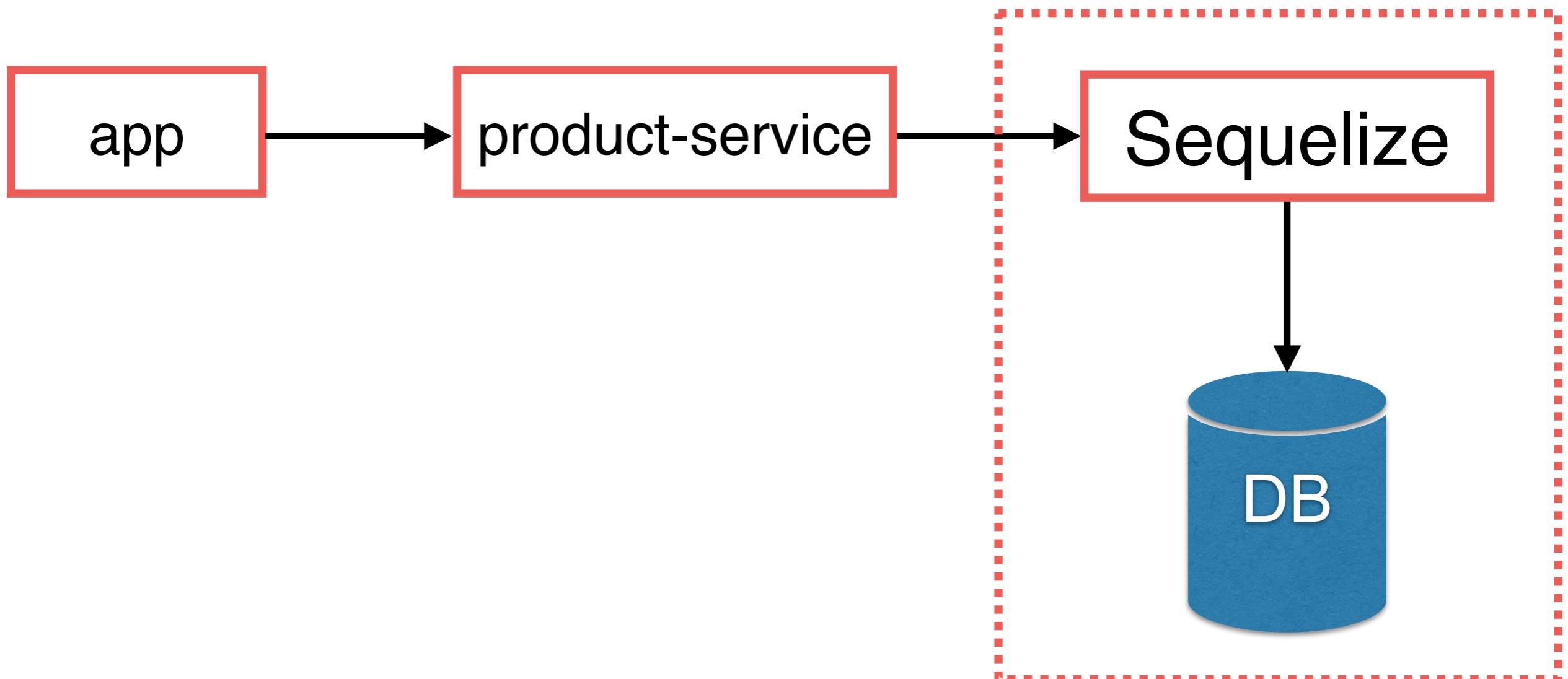
How to test ?



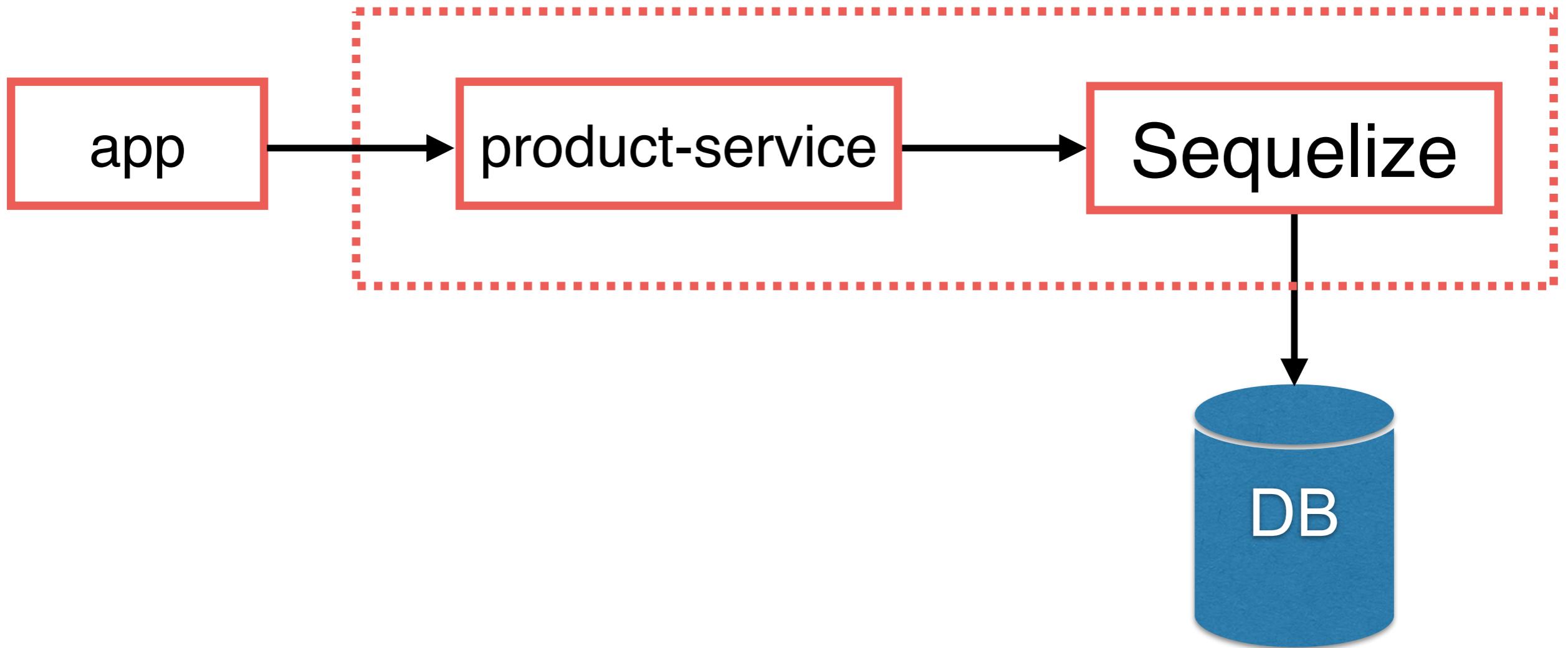
Using real database ?



Using fake database ?



Using mock database ?



5. Relationship/Association

One-to-one
One-to-many
Many-to-many
Eager loading



6. Logging

Custom log of sequelize

```
const sequelize = new Sequelize(" ... ", {
  // Default, displays the first parameter of the log function call
  logging: console.log,
  // Displays all log function call parameters
  logging: (...msg) => console.log(msg),
  // Use custom logger (e.g. Winston or Bunyan), displays the first parameter
  logging: (msg) => logger.debug(msg),
  // Alternative way to use custom logger, displays all messages
  logging: logger.debug.bind(logger),
  // Disables logging
  logging: false,
});
});
```

<https://sequelize.org/master/manual/getting-started.html>



Refactor to OOP !!



Refactor to TypeScript !!



REST APIs with Express

<https://expressjs.com/>



REST APIs

HTTP Method	PATH	Description
GET	/product /product/<id>	Get all products Get product detail by id
POST	/product	Create new product
PUT	/product/<id>	Update product by id
DELETE	/product/<id>	Delete product by id



HTTP Response Code

HTTP Status Codes

httpstatuses.com is an easy to reference database of HTTP Status Codes with their definitions and helpful code references all in one place. Visit an individual status code via httpstatuses.com/code or browse the list below.

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<https://httpstatuses.com/>



Web framework of Node.js

http module (build-in)

Express

Hapi

Nest.js

Kao

etc.



Working with Express

```
$npm install express --save
```



Hello API with JSON

index.js

```
const express = require("express");
const app = express();
const port = process.env.PORT || 3000;

app.use(express.json());

app.get("/", (req, res) => {
  res.status(200).send({
    message: "Hello API",
  });
});

app.listen(port, () => {
  console.log(`Server running on port ${port}`);
});
```



Add more endpoints

```
app.get("/", (req, res) => { ...  
});
```

```
app.get("/product", (req, res) => { ...  
});
```

```
app.post("/product", (req, res) => { ...  
});
```

```
app.get("/product/:id", (req, res) => { ...  
});
```



Refactor code with responsibility



```
const express = require("express");
const app = express();
const port = process.env.PORT || 3000;

app.use(express.json());

app.get("/", (req, res) => {
  res.status(200).send({
    message: "Hello API",
  });
});

app.listen(port, () => {
  console.log(`Server running on port ${port}`);
});
```



index.js

```
const port = process.env.PORT || 3000;

app.listen(port, () => {
  console.log(`Server running on port ${port}`);
});
```

app.js

```
const express = require("express");
const app = express();

app.use(express.json());

app.get("/", (req, res) => {
  res.status(200).send({
    message: "Hello API",
  });
});
```



app.js

```
const express = require("express");
const app = express();

app.use(express.json());

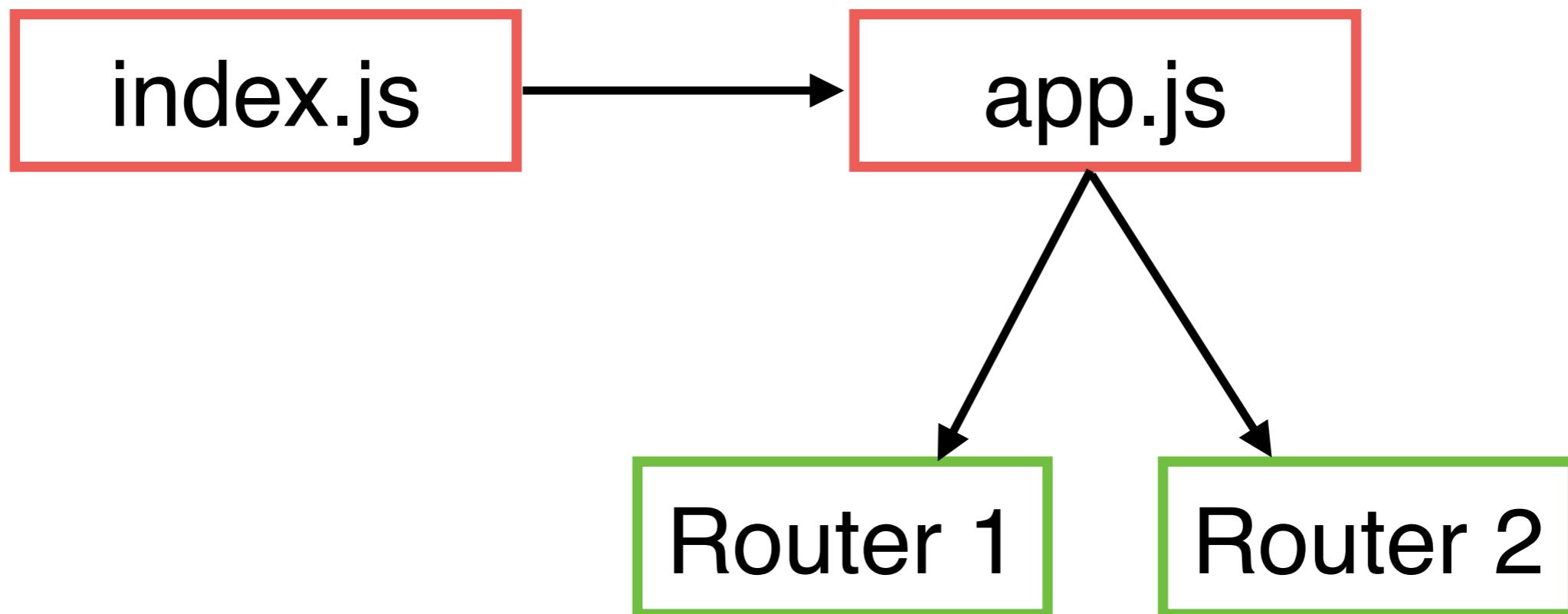
app.get("/", (req, res) => {
  res.status(200).send({
    message: "Hello API",
  });
});

});
```

Routers !!



Better Structure



app.js

```
const express = require("express");
const app = express();

const productRouter = require("./router-product");

app.use(express.json());
app.use(productRouter);
```

router-product.js

```
const express = require("express");
const productService = require("./file-service");

const router = express.Router()

router.get("/", (req, res) => {
  res.send({
    message: "Hello API",
  });
});
```



API testing with Postman

<https://www.postman.com/>



API testing with newman

<https://www.npmjs.com/package/newman>



API testing with SuperTest

<https://github.com/visionmedia/supertest>



Working with SuperTest

```
$npm install supertest --save-dev
```



Get all products

product_api_spec.js

```
const request = require("supertest");
const app = require("../app");

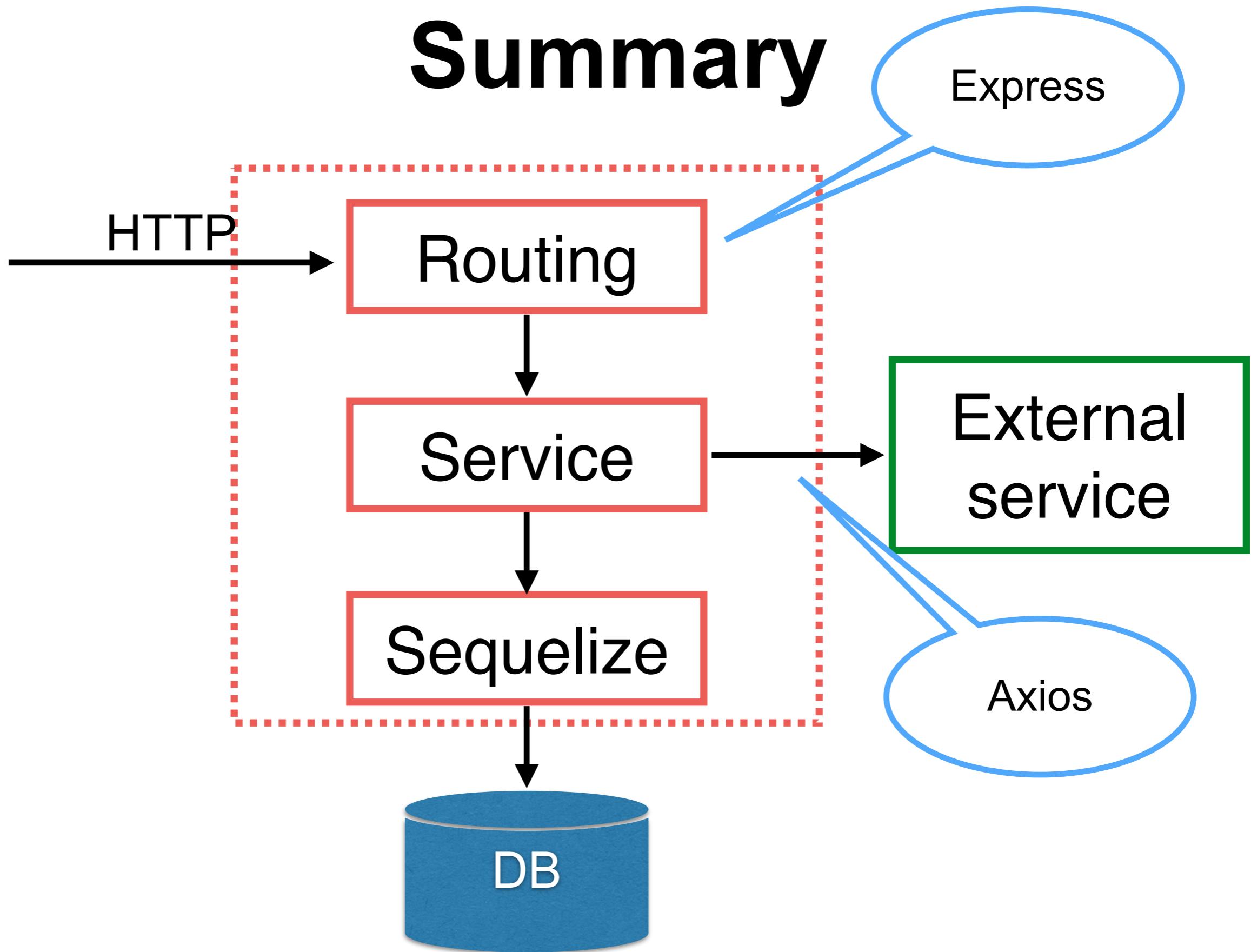
test("Create new product ", async () => {

  const response = await request(app)
    .post("/product")
    .send({
      name: "Demo" + Math.random(),
      price: 200,
    })
    .expect(201);

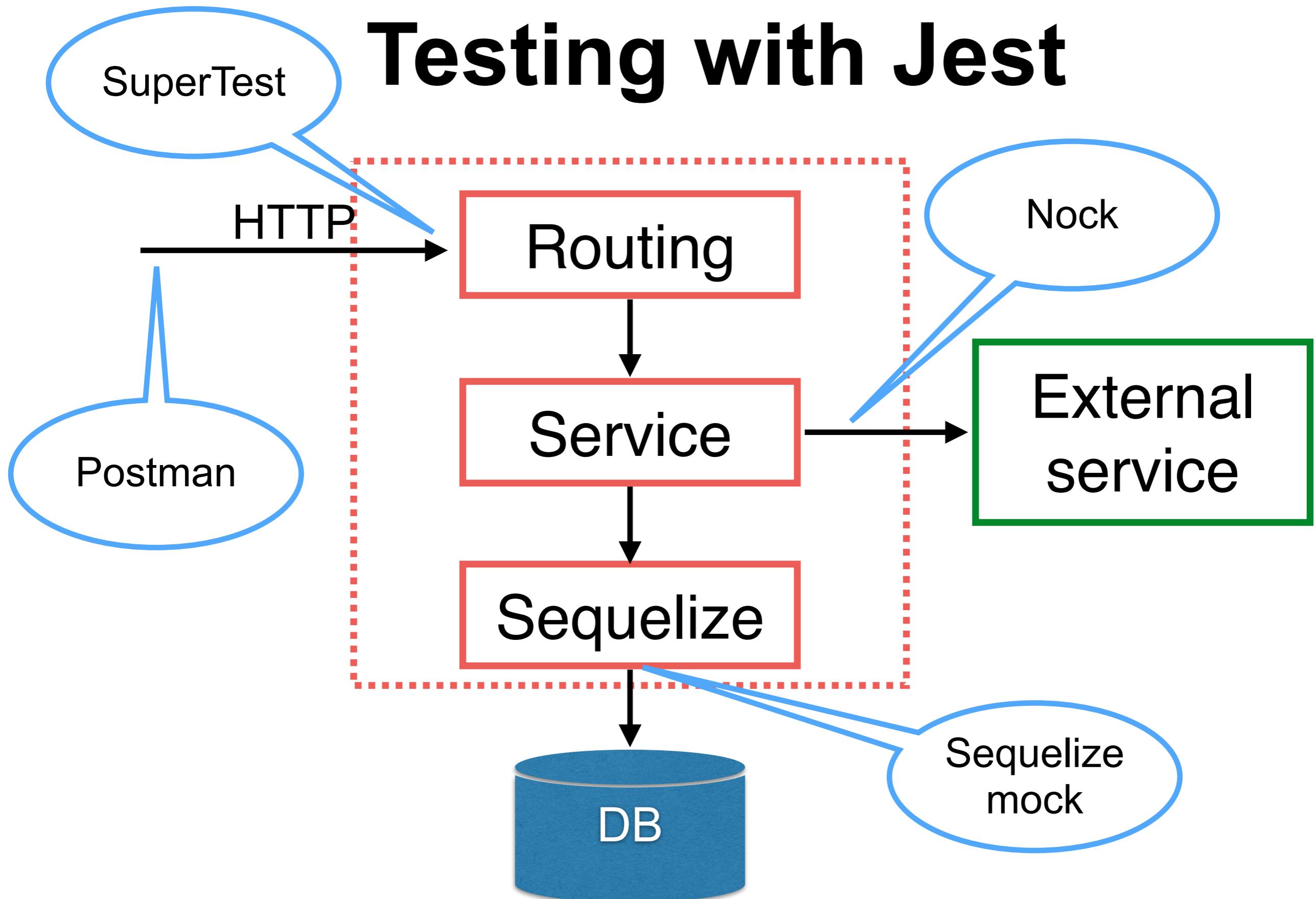
});
```



Summary



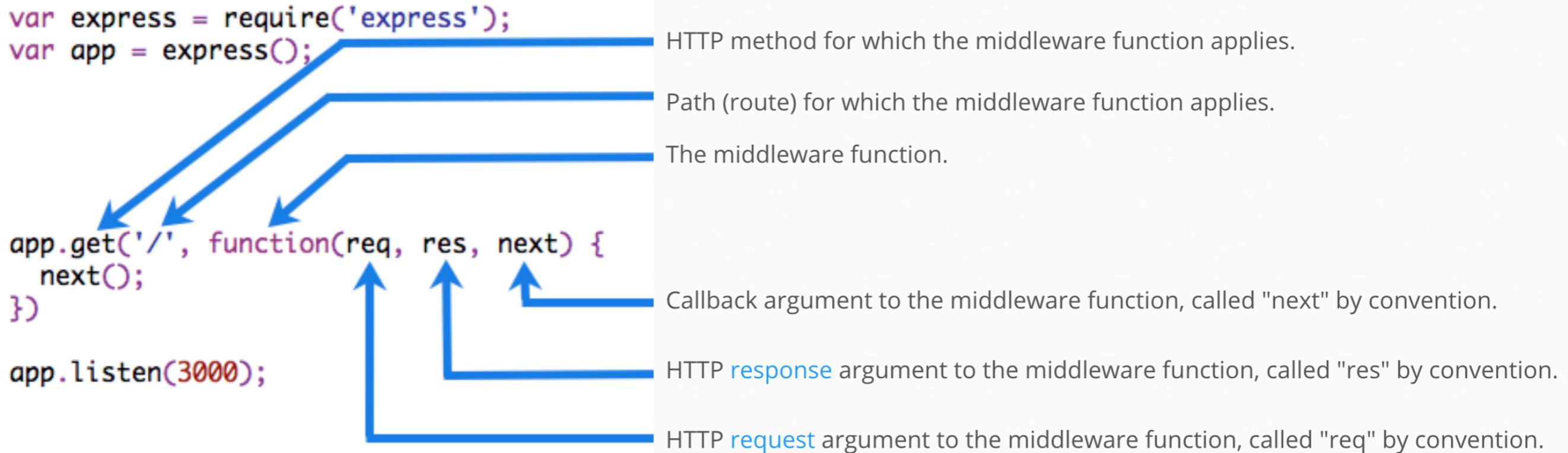
Testing with Jest



Express middleware



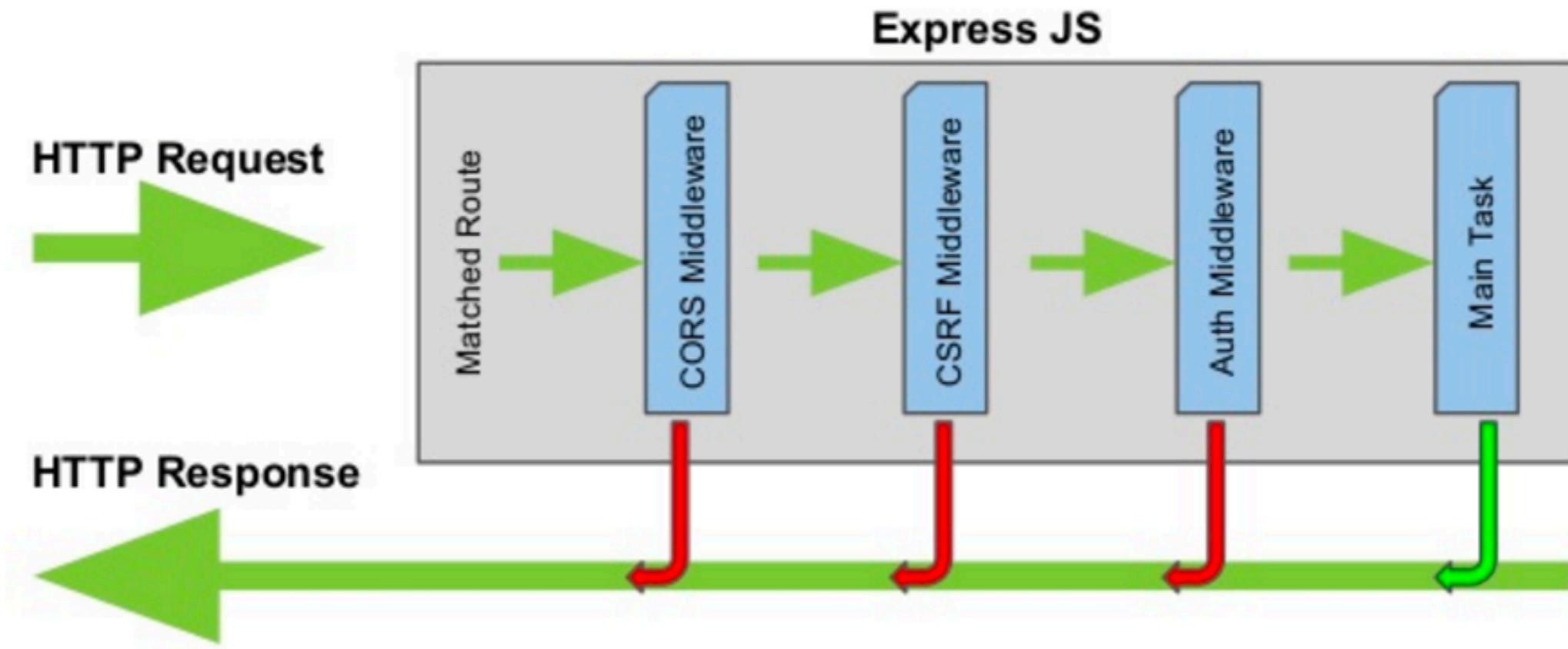
Express middleware



<https://expressjs.com/en/guide/writing-middleware.html>



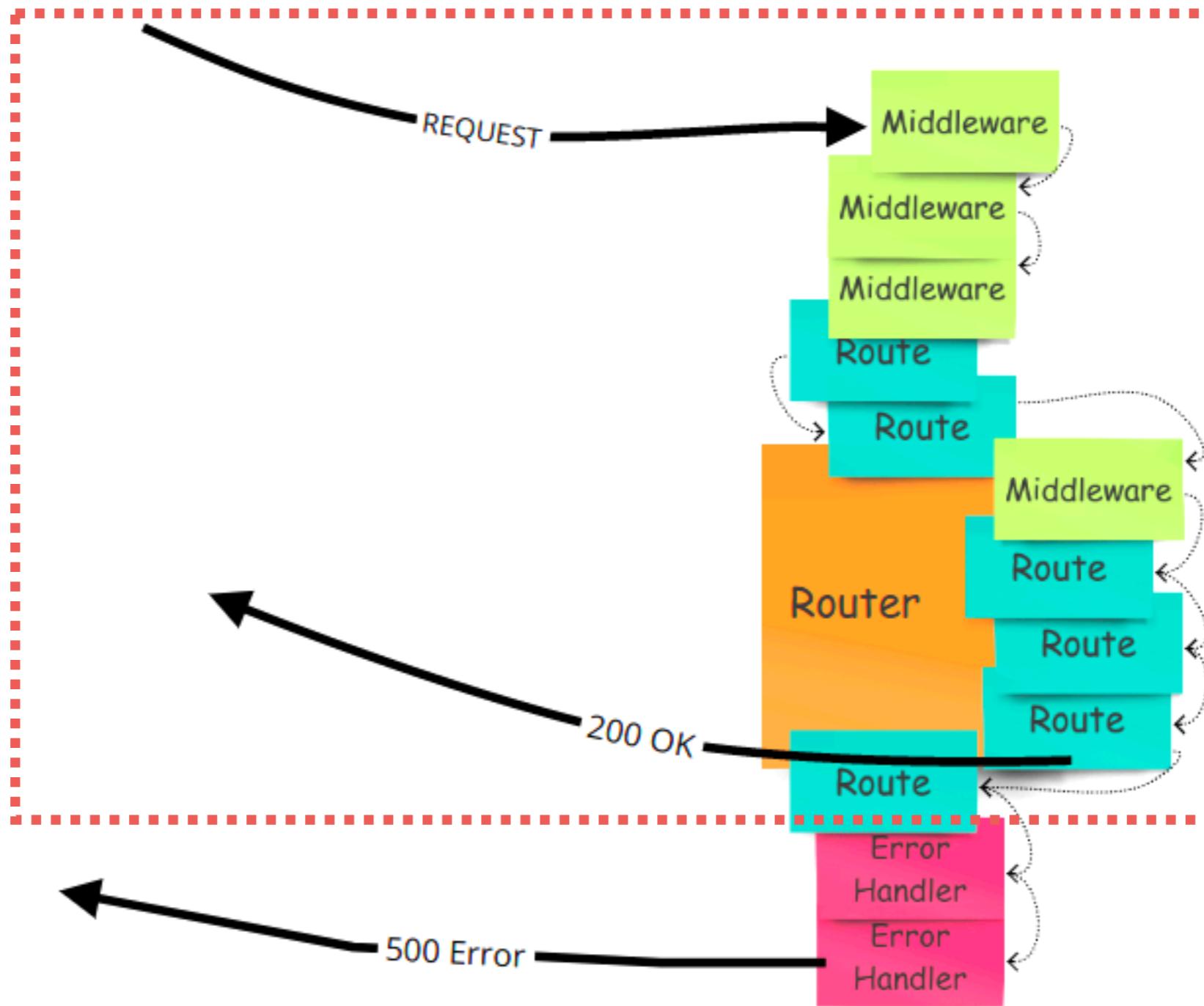
Express middleware



<https://expressjs.com/en/guide/writing-middleware.html>



Express middleware



Authentication

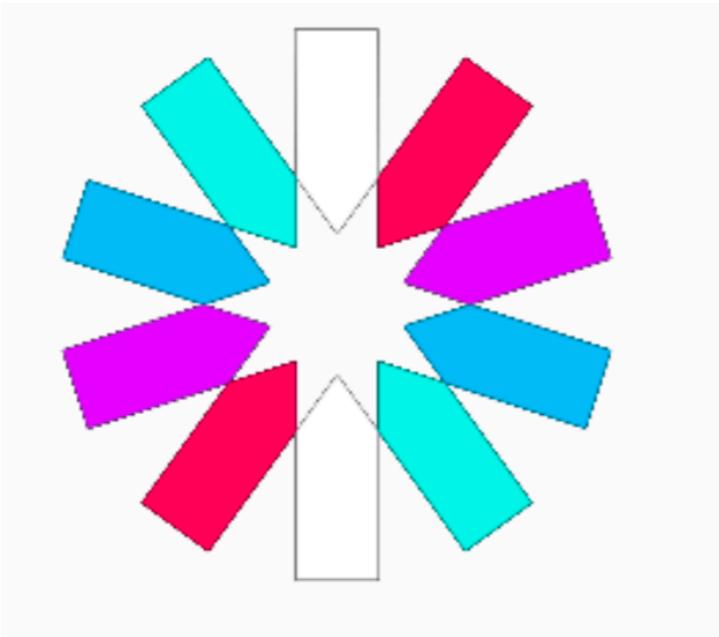
Authorization



API authentication and security

Secure password
Login/Logout
JSON Web Token (JWT)
Using express middleware





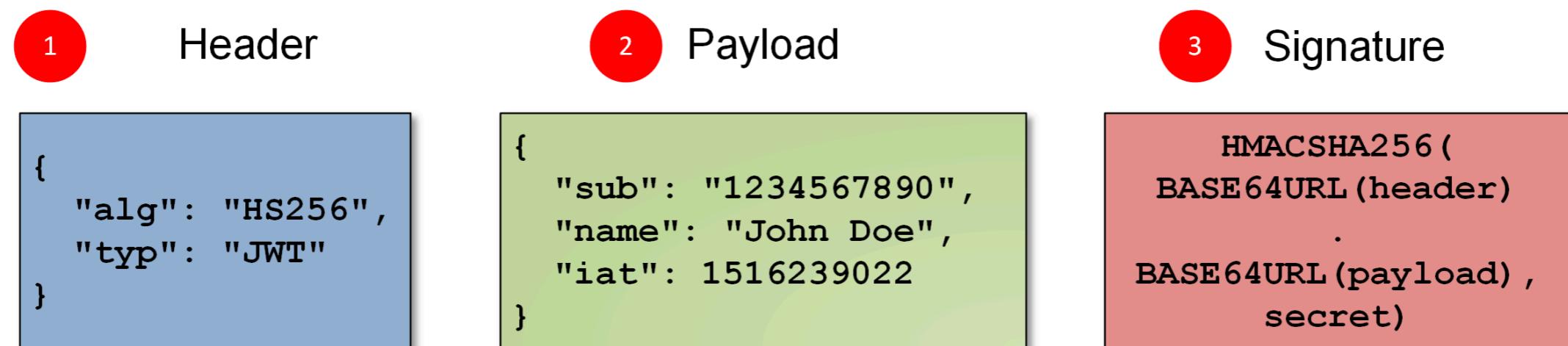
JWT

<https://jwt.io/introduction/>

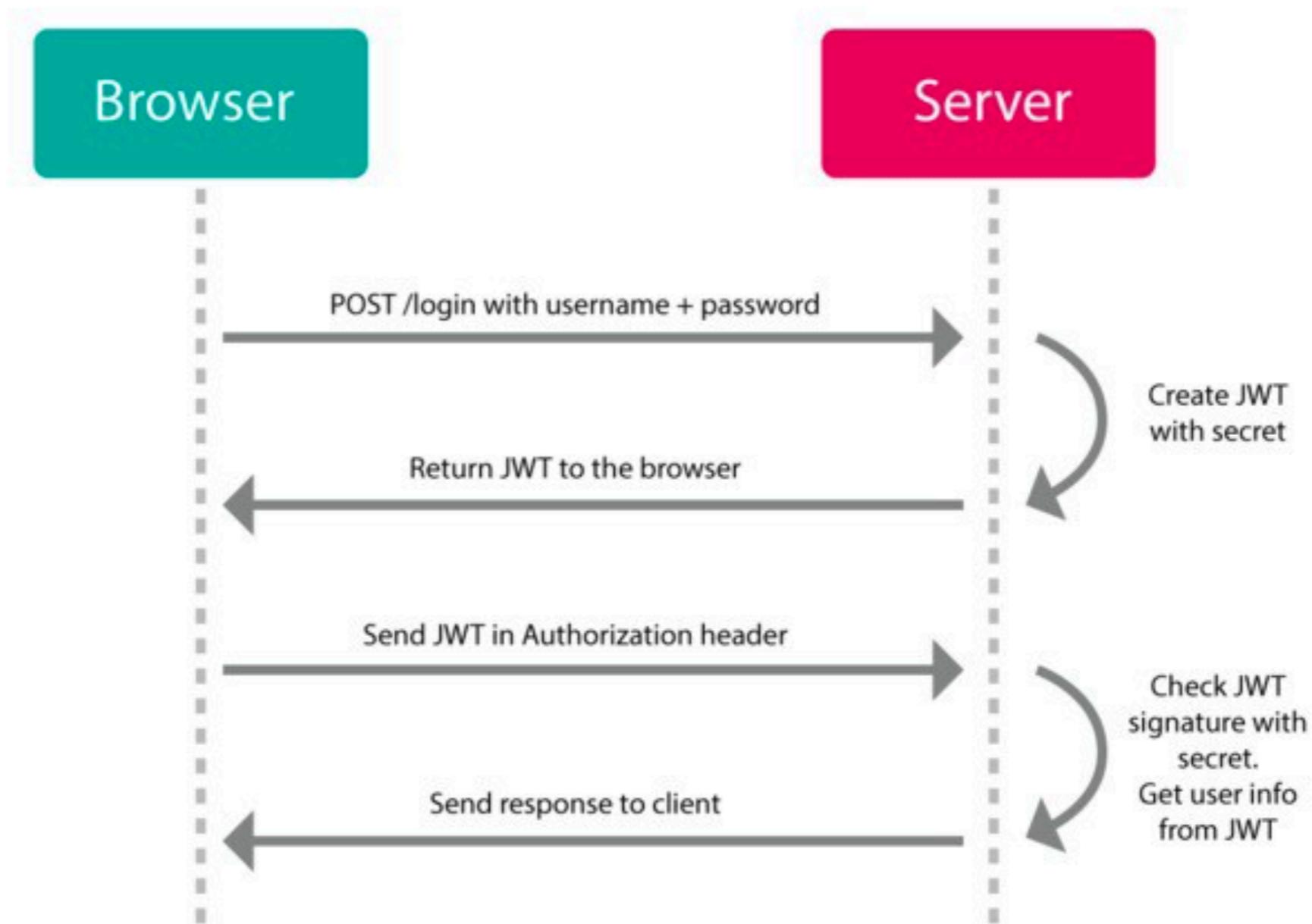


JWT structure

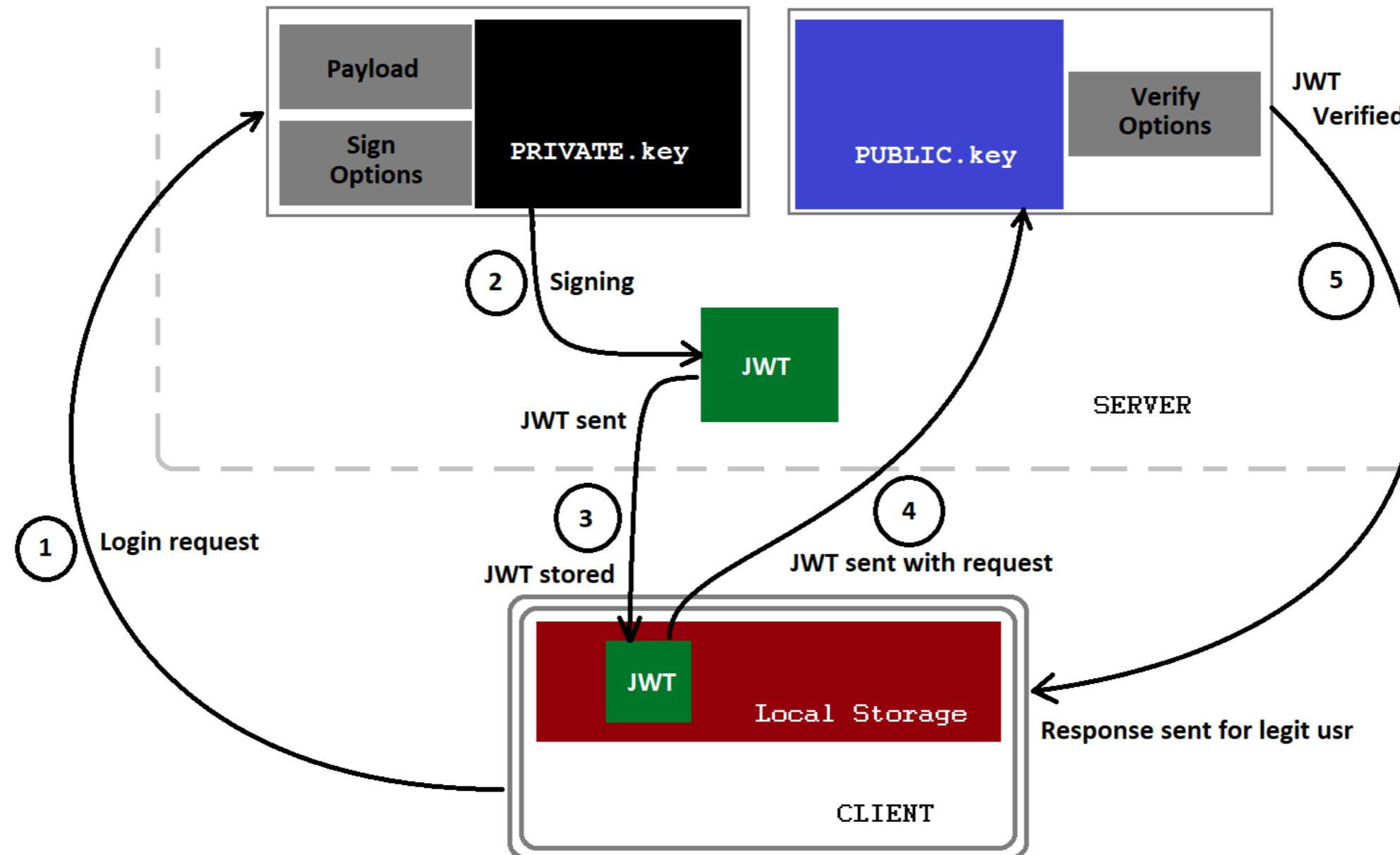
1 eyJhbGciOiJIUzI1NilsInR5cCI6IkpXVCJ9.eyJzdWliOilxMjM0NT
Y3ODkwliwibmFtZSI6Ikpvag4gRG9IliwiaWF0IjoxNTE2MjM5M
DlyfQ.XbPfbIHMI6arZ3Y922BhjWgQzWXcXNrz0ogtVhfEd2o 2 3



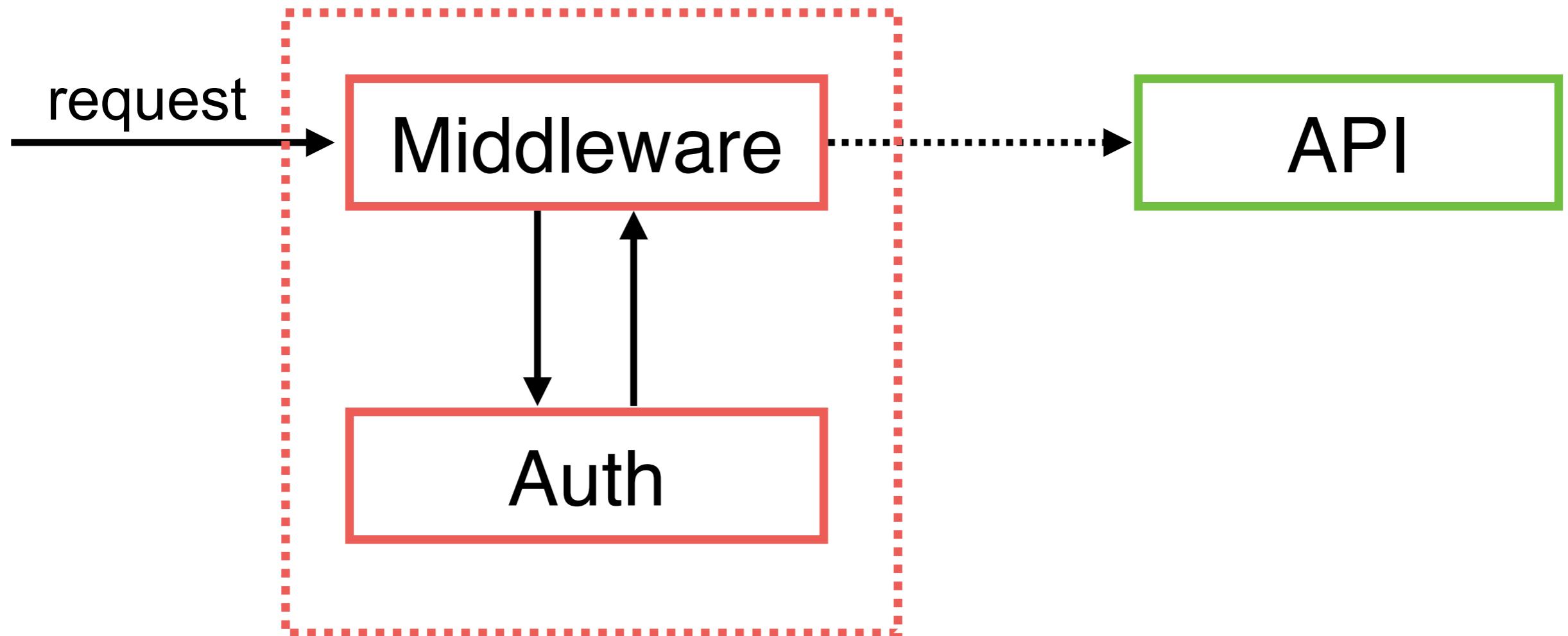
JWT Process



JWT Process (Better)



Using Middleware



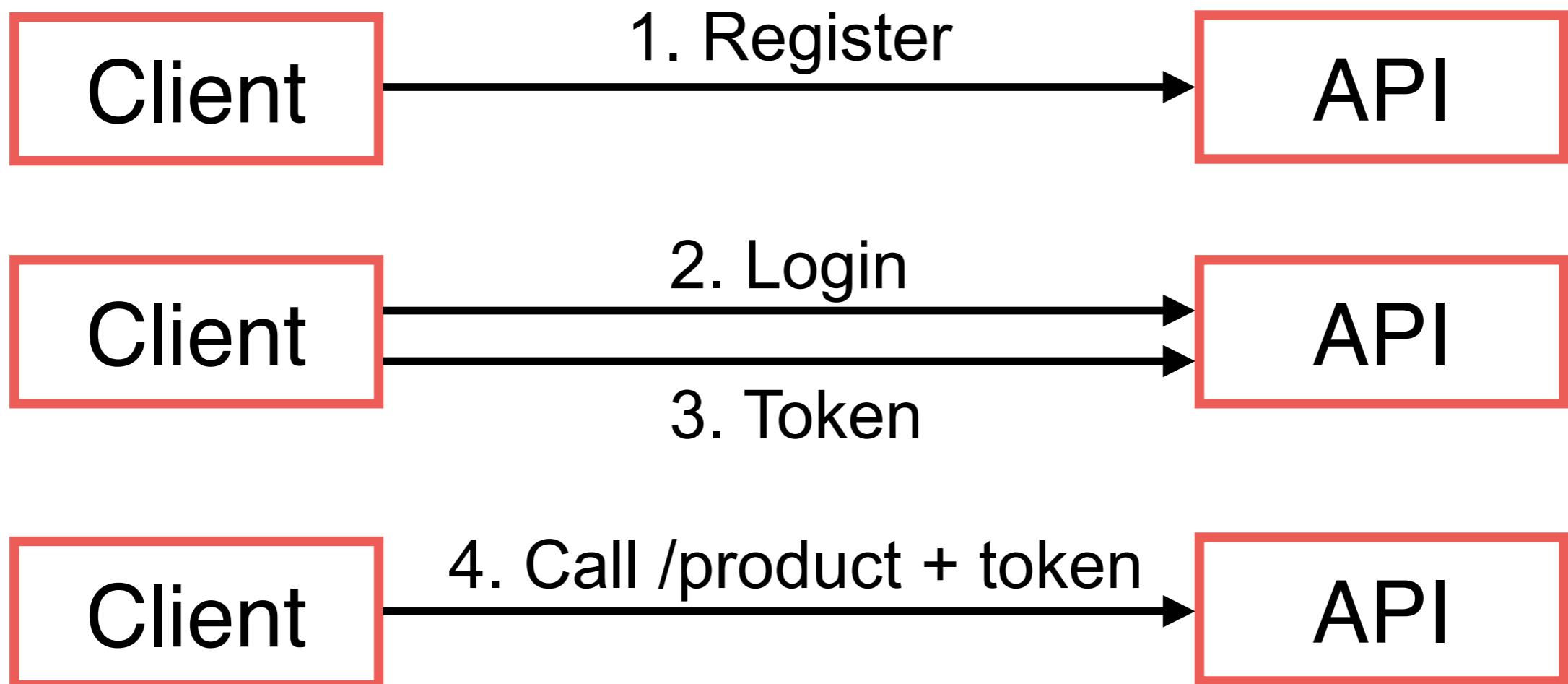
Working with JWT



Working with JWT

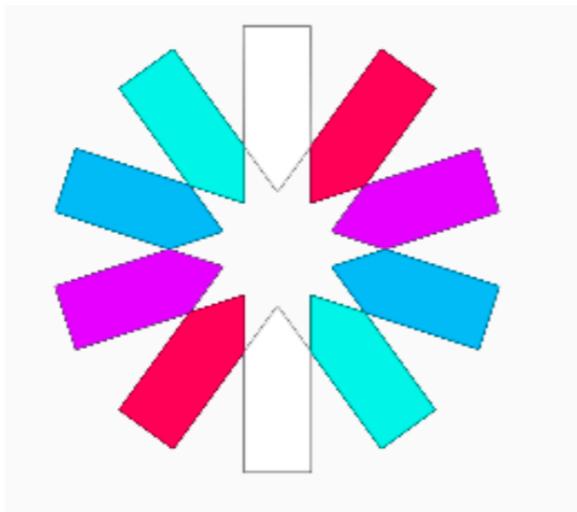


Working with JWT



Auth with JWT

Using jsonwebtoken module



J U T

<https://www.npmjs.com/package/jsonwebtoken>



Auth with JWT

```
const jwt = require("jsonwebtoken");

const auth = async (req, res, next) => {
  try {
    const token = req.header("Authorization").replace("Bearer ", "");
    const decoded = jwt.verify(token, process.env.JWT_SECRET);
    // const id = decoded._id;

    const user = { id: 1, name: "fake user" };

    if (!user) {
      throw new Error();
    }

    req.token = token;
    req.user = user;
    next();
  } catch (e) {
    res.status(401).send({ error: "Please authenticate." });
  }
};
```



Check data in HTTP Request

```
const jwt = require("jsonwebtoken");

const auth = async (req, res, next) => {
  try {
    const token = req.header("Authorization").replace("Bearer ", "");
    const decoded = jwt.verify(token, process.env.JWT_SECRET);
    // const id = decoded._id;
  }

  const user = { id: 1, name: "fake user" };

  if (!user) {
    throw new Error();
  }

  req.token = token;
  req.user = user;
  next();
}

} catch (e) {
  res.status(401).send({ error: "Please authenticate." });
}
};
```



Check user in database

```
const jwt = require("jsonwebtoken");

const auth = async (req, res, next) => {
  try {
    const token = req.header("Authorization").replace("Bearer ", "");
    const decoded = jwt.verify(token, process.env.JWT_SECRET);
    // const id = decoded._id;

    const user = { id: 1, name: "fake user" };

    if (!user) {
      throw new Error();
    }

    req.token = token;
    req.user = user;
    next();
  } catch (e) {
    res.status(401).send({ error: "Please authenticate." });
  }
};
```



1. Login to create token

```
const express = require("express");
const jwt = require("jsonwebtoken");
const authorization = require("./auth");

const app = express();

app.get("/login", (req, res) => {
  const token = jwt.sign({ _id: "1" }, process.env.JWT_SECRET);
  res.send(token);
});

app.get("/secure", authorization, (req, res) => res.send("Secure ..."));
```



2. Use middleware in routing

```
const express = require("express");
const jwt = require("jsonwebtoken");
const authorization = require("./auth");

const app = express();

app.get("/login", (req, res) => {
  const token = jwt.sign({ _id: "1" }, process.env.JWT_SECRET);
  res.send(token);
});

app.get("/secure", authorization, (req, res) => res.send("Secure ..."));


```



Using postman

Config in Authorization :: Beearer Token

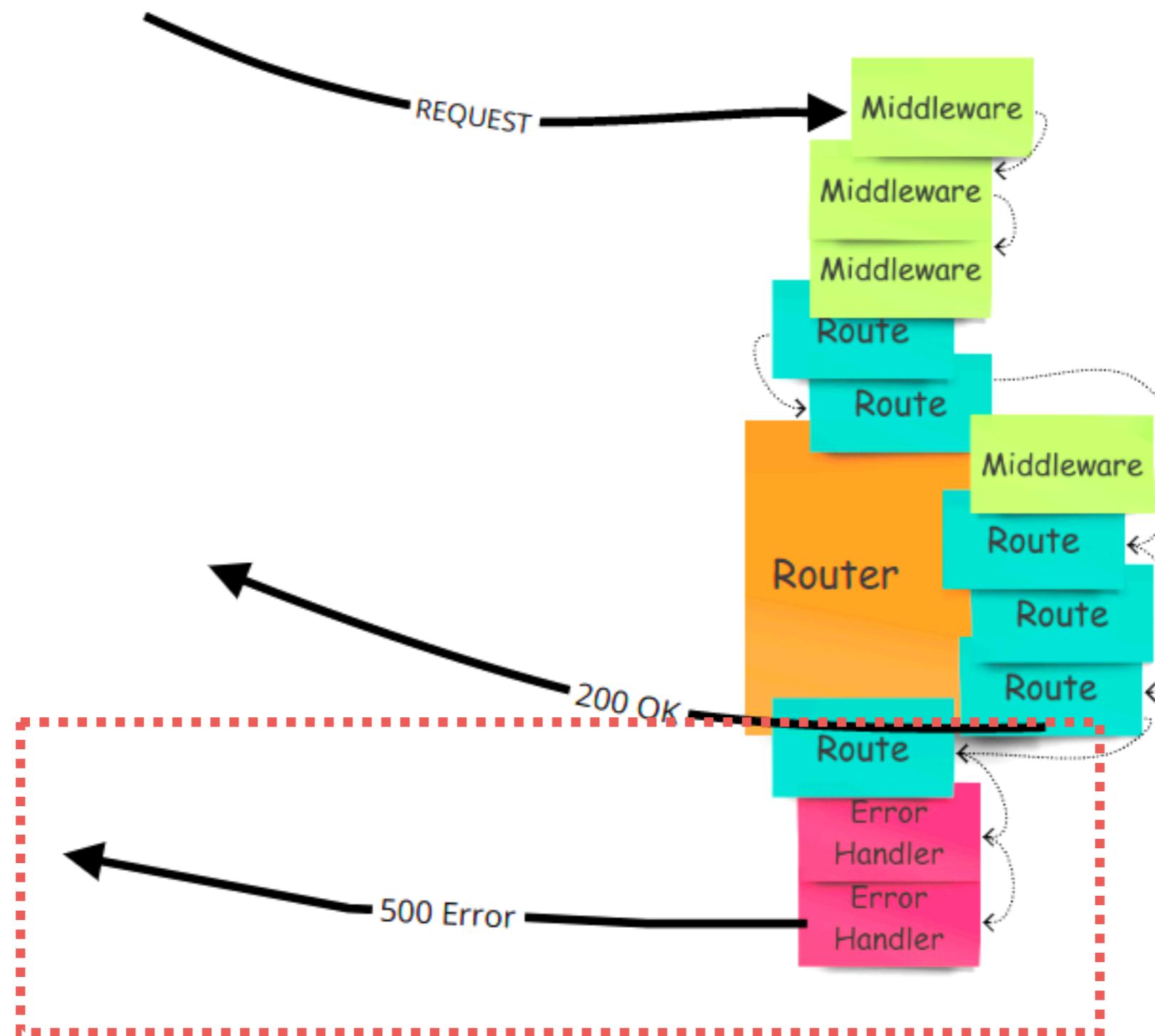
A screenshot of the Postman application interface. At the top, it shows a 'POST' method and a URL 'http://localhost:3000/secure'. On the right, there's a blue 'Send' button. Below the URL, there are tabs for 'Params', 'Authorization', 'Headers (9)', 'Body', 'Pre-request Script', 'Tests', and 'Settings'. The 'Authorization' tab is active, indicated by an orange underline and a green dot. Under the 'Authorization' tab, there's a 'TYPE' dropdown set to 'Bearer Token'. To the right, there's a 'Token' input field containing a long string of characters: 'eyJhbGciOiJIUzI1NilsInR5cCI6IkpXVCJ9.eyJfaWQiOiIxliwiaWF0Ijox...'. A tooltip on the left side of the authorization section explains that the authorization header will be automatically generated when the request is sent.

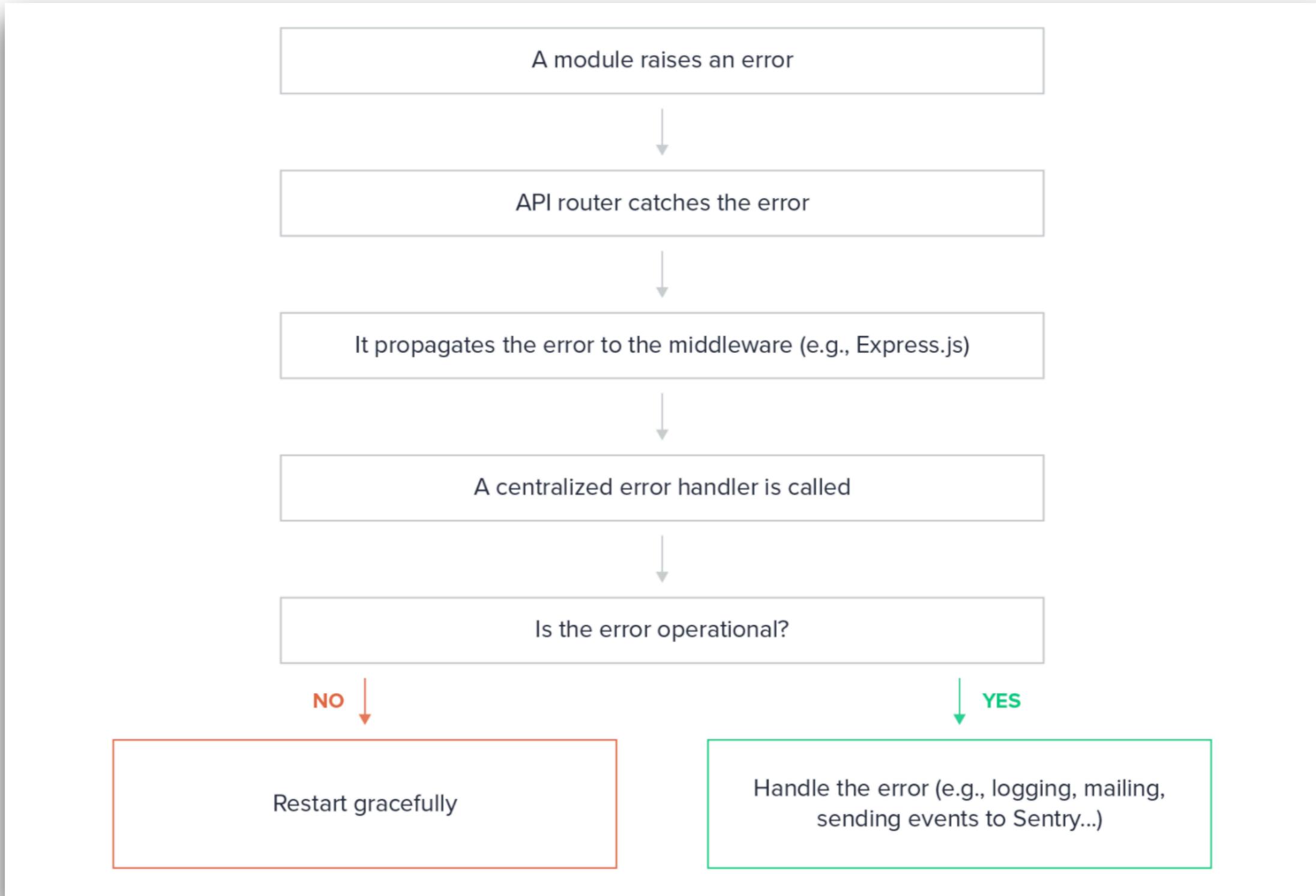


Error Handling with Express



Express middleware

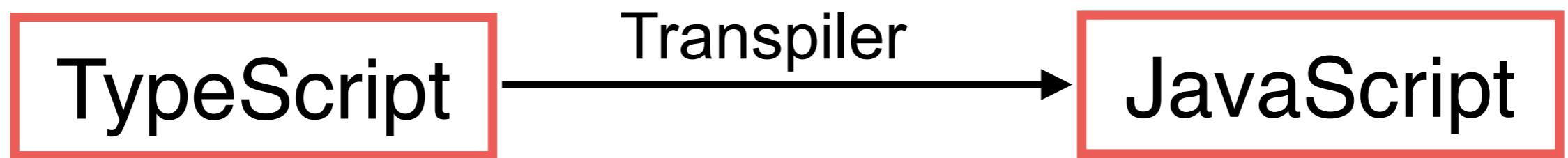


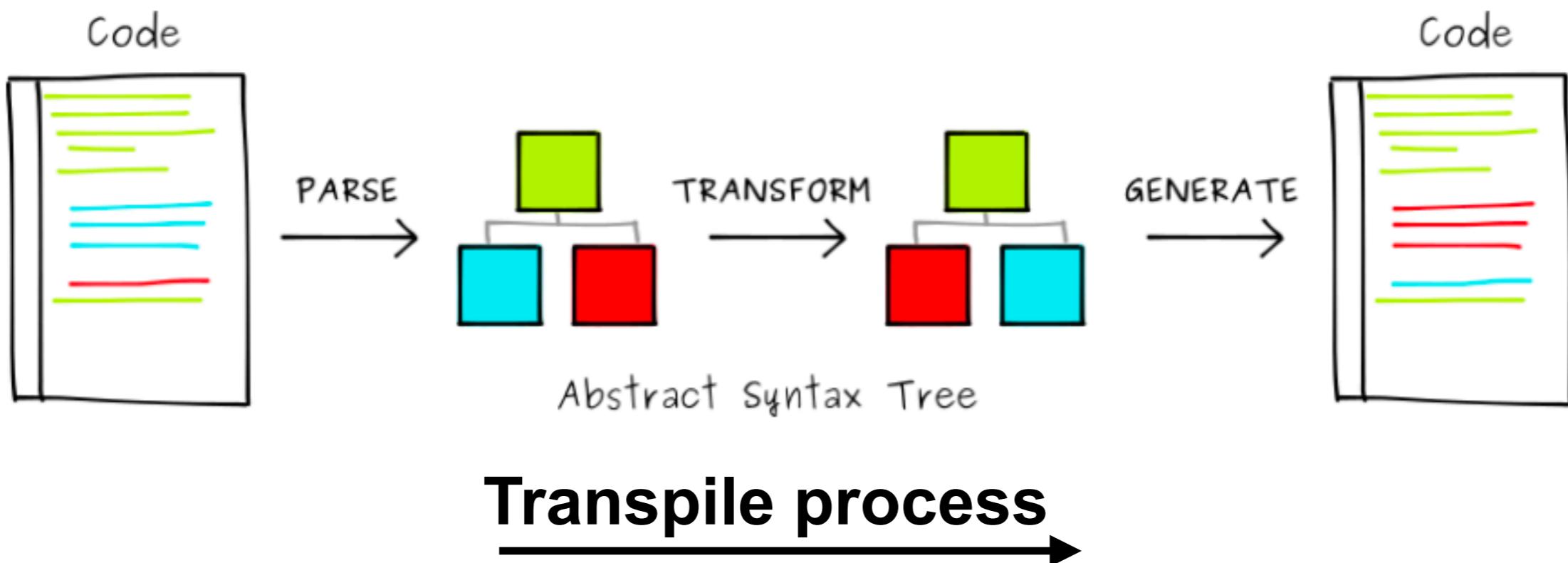


TypeScript









Setup Node.js project + TypeScript

TypeScript
Express



Create project with TypeScript

```
$npm init -y
```

```
$npm i typescript -s
```

```
$npm i express @types/express -s
```



Create project with TypeScript

```
$npm init -y
```

```
$npm i typescript -s
```

```
$npm i @types/node -s
```

```
$npm i express @types/express -s
```



For development

\$npm i nodemon --save-dev

\$npm ts-node --save-dev

\$npm rimraf --save-dev



Setup TypeScript

Create file tsconfig.json

```
{  
  "compilerOptions": {  
    "target": "es5",  
    "module": "commonjs",  
    "lib": ["es6"],  
    "allowJs": true,  
    "outDir": "build",  
    "rootDir": "src",  
    "strict": true,  
    "noImplicitAny": true,  
    "esModuleInterop": true,  
    "resolveJsonModule": true  
  }  
}
```



Run

\$npx tsc



Package.json

```
"scripts": {  
  "dev": "nodemon",  
  "build": "rimraf ./build && tsc",  
  "start": "npm run build && node build/index.js",  
  "test": "jest --coverage"  
},
```



Logging



12 factors for Node.js Docker

<https://12factor.net/>

