

# NodeJS





Somkiat Puisungnoen

Somkiat Puisungnoen

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Intro

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Software Practitioner at สยามชัมนาภิกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

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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

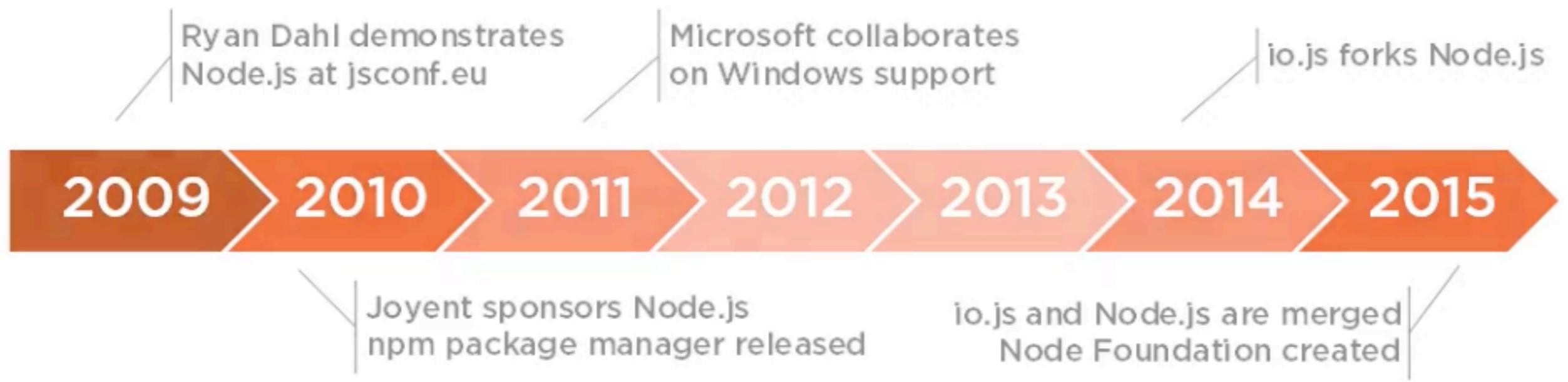


# What Node.js ?

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/>



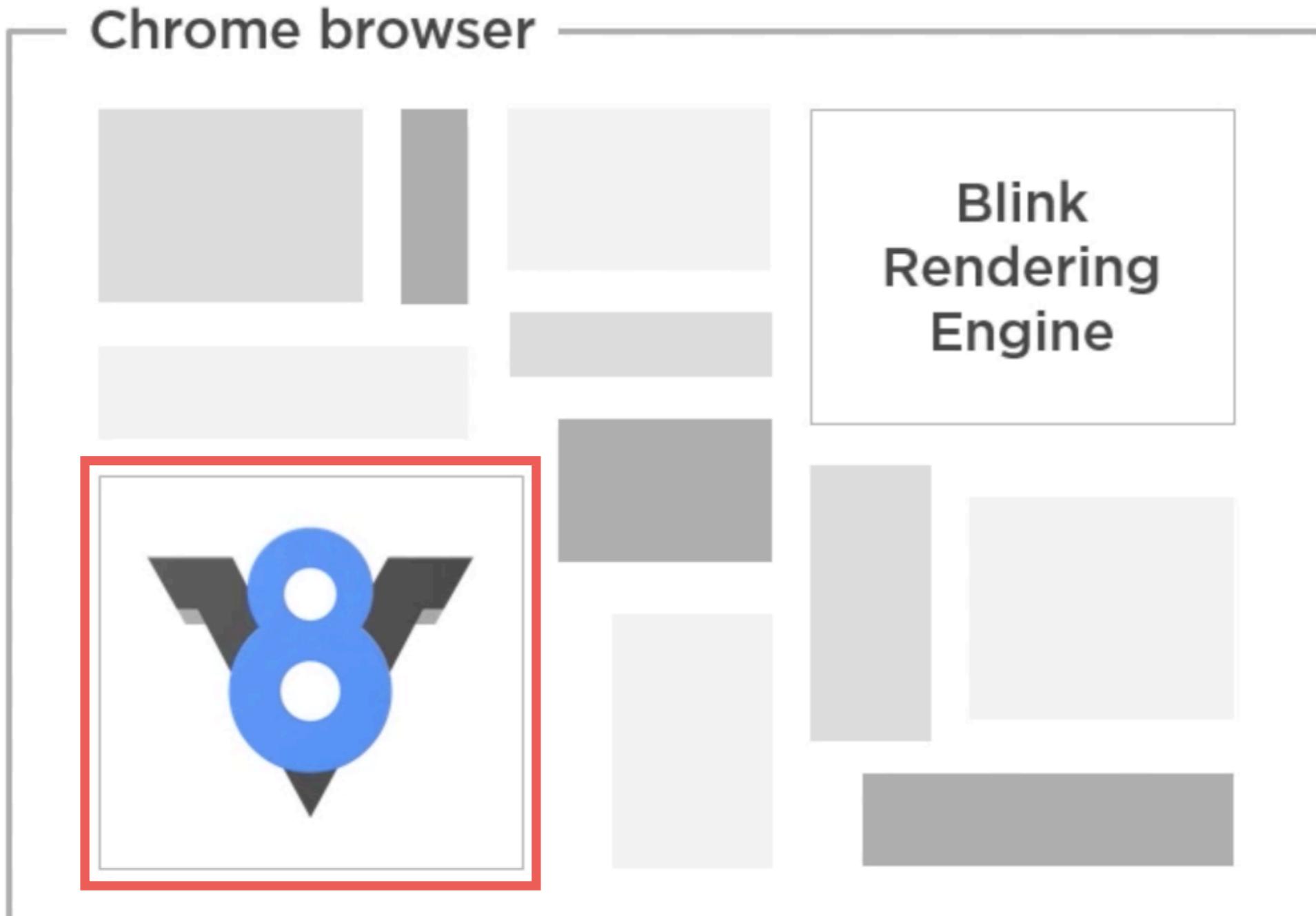
# What Node.js ?

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.

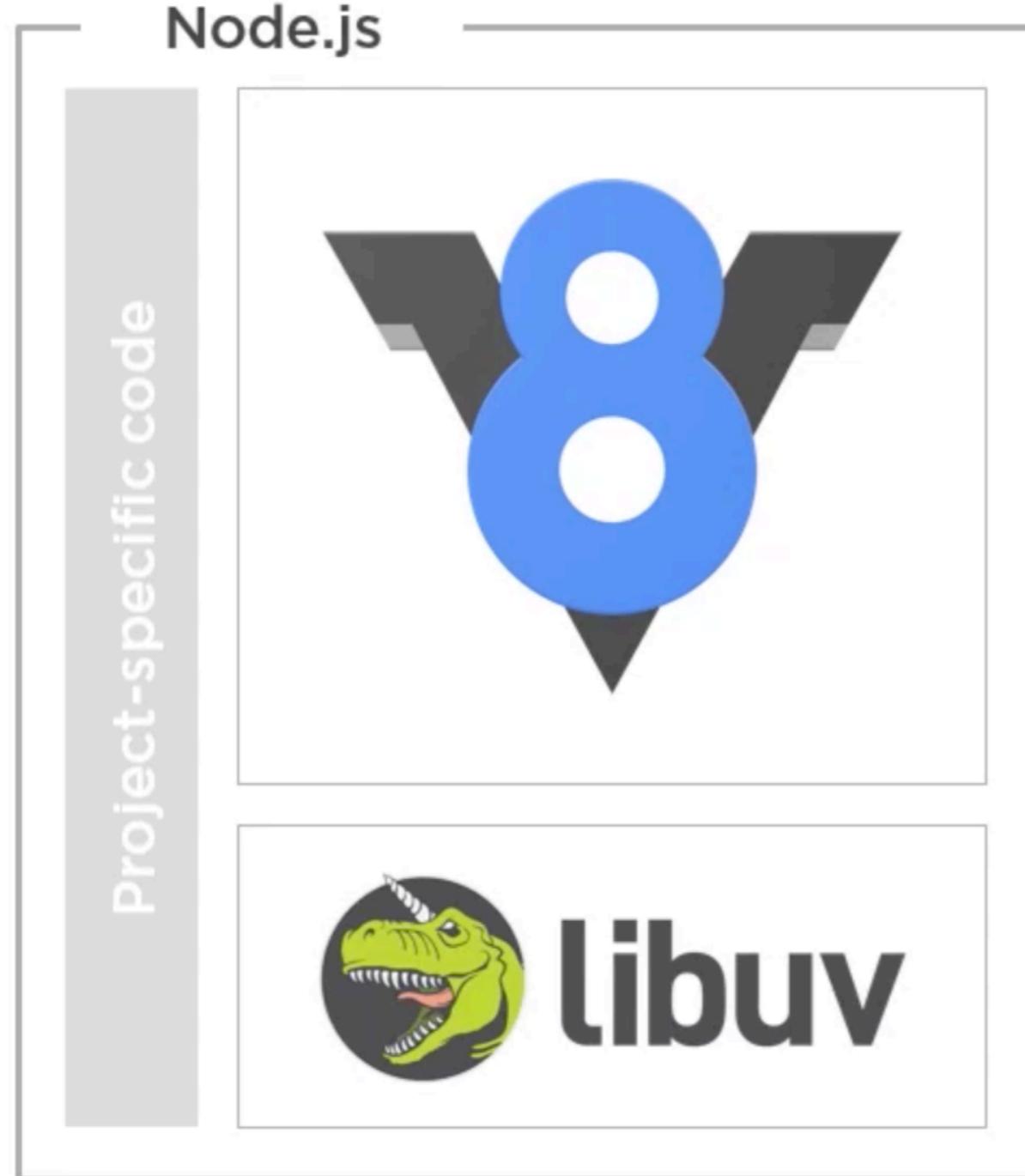
<https://nodejs.org/en/>



# What Node.js ?



# What Node.js ?



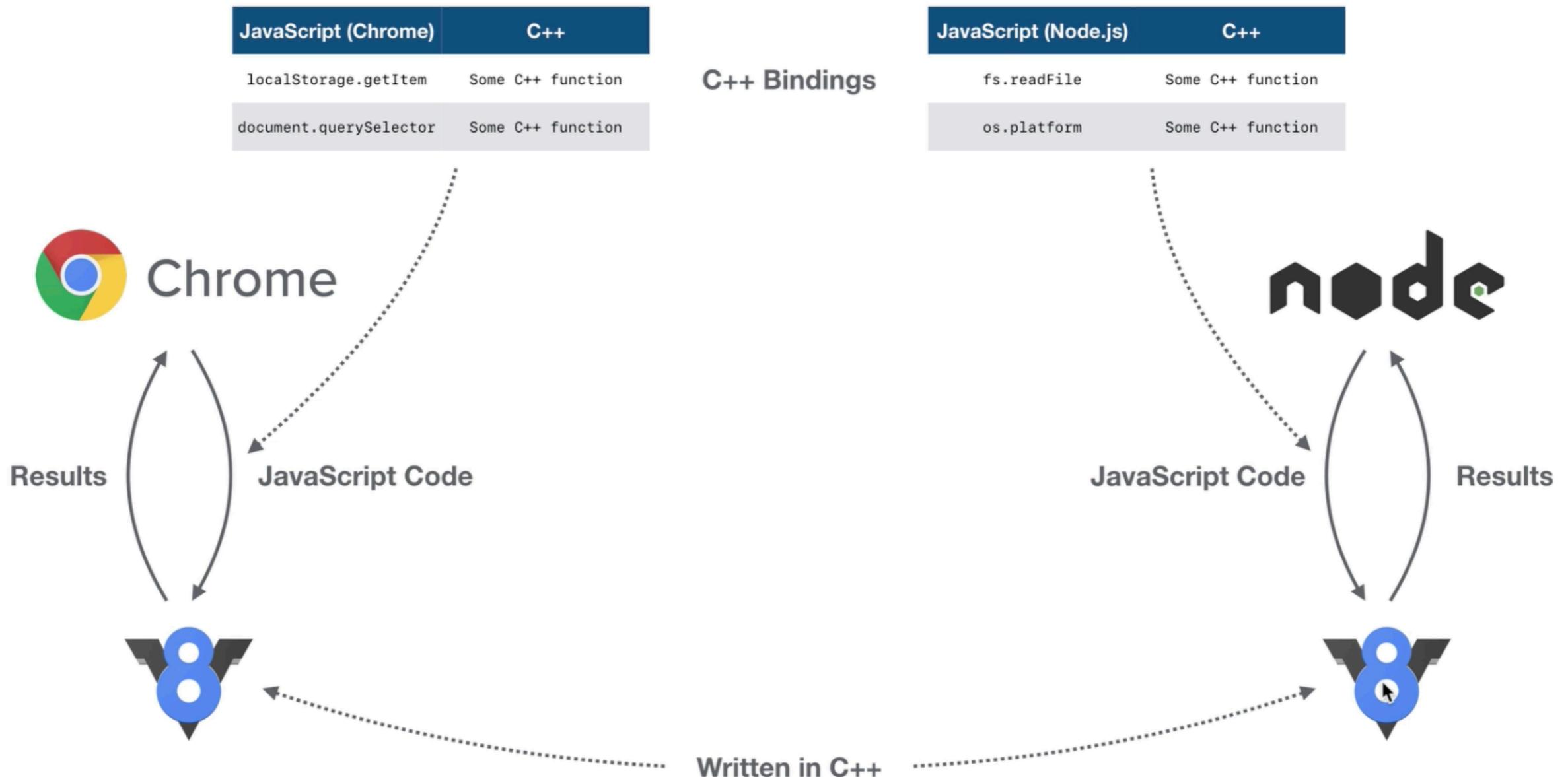
- JavaScript
- Asynchronous I/O
- Event Loop

<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;

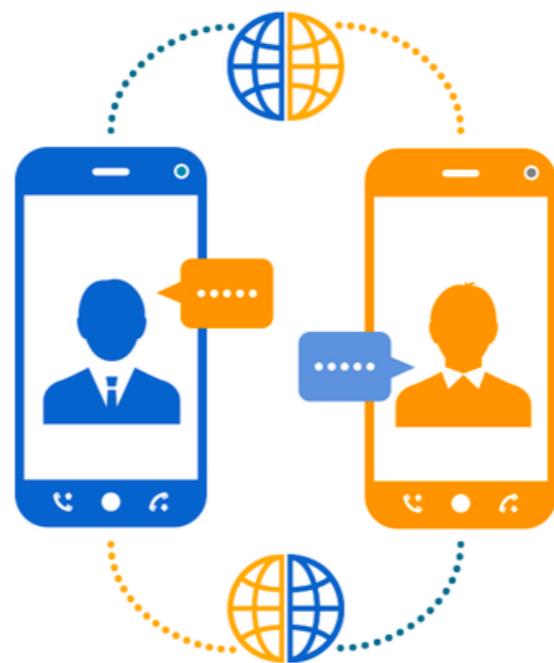
const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('Hello World');
});

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

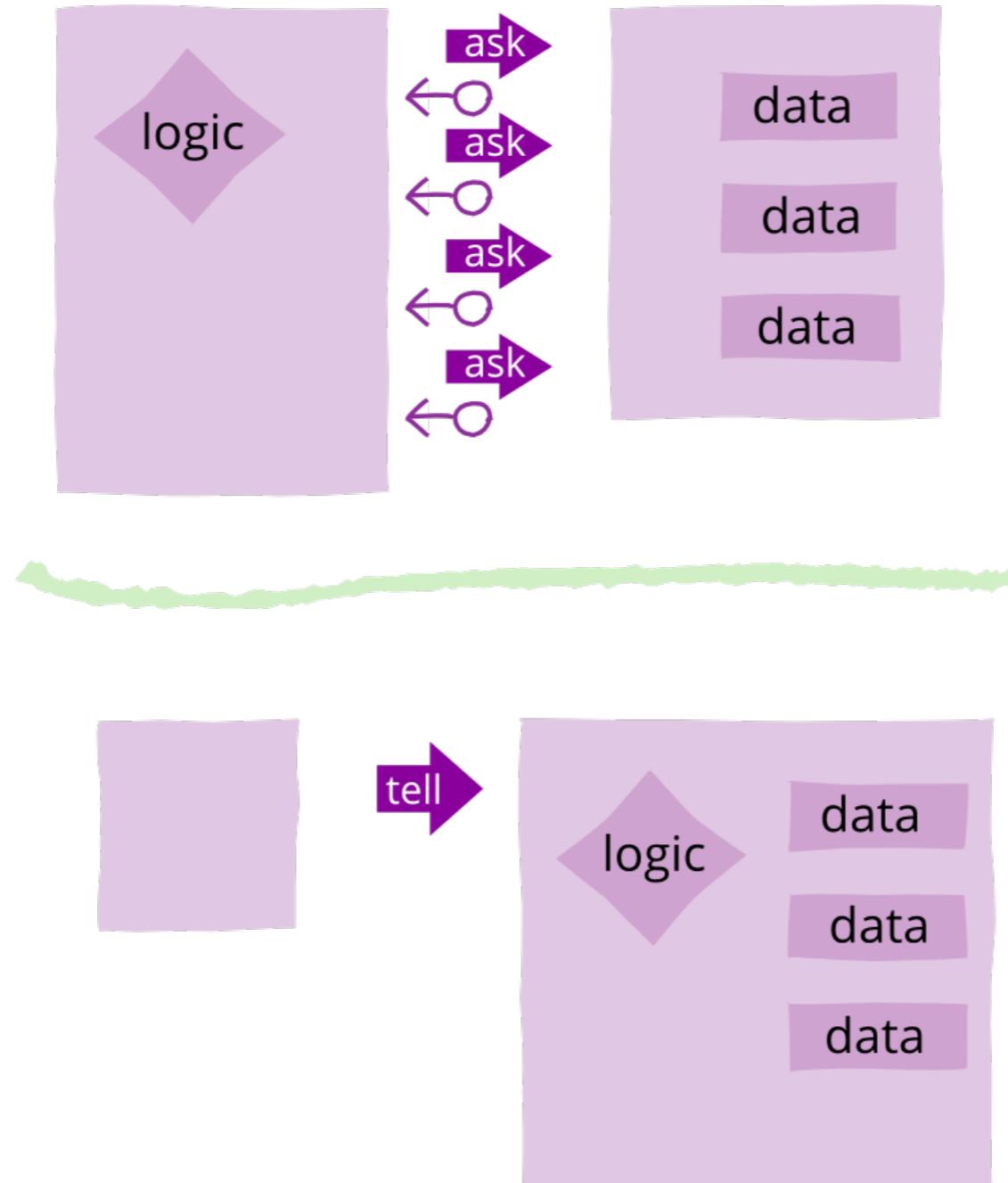
Callback function



# 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

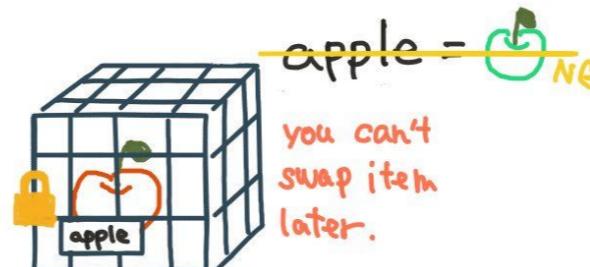
OK!  
you can swap item  
only if you ask  
inside of the shield

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](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

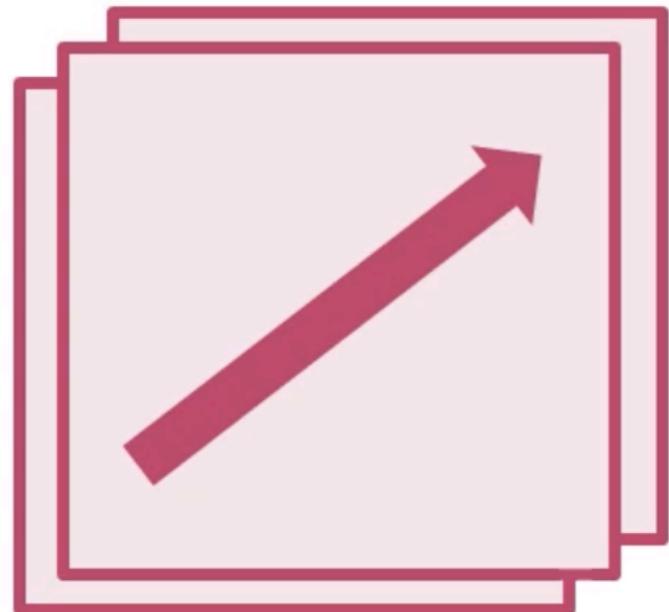
Asynchronous development

Node APIs and EventEmitters

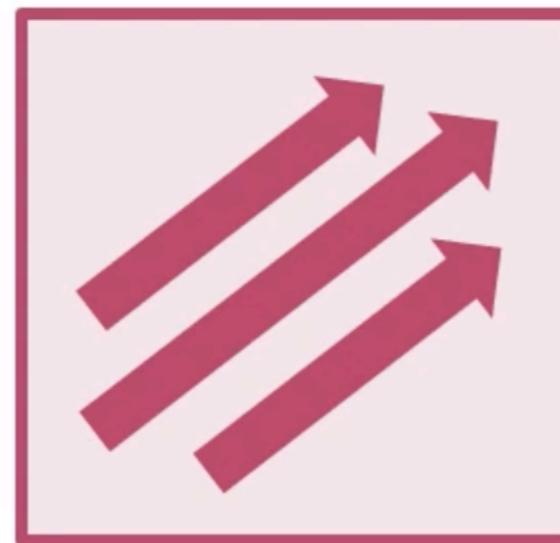
Stream



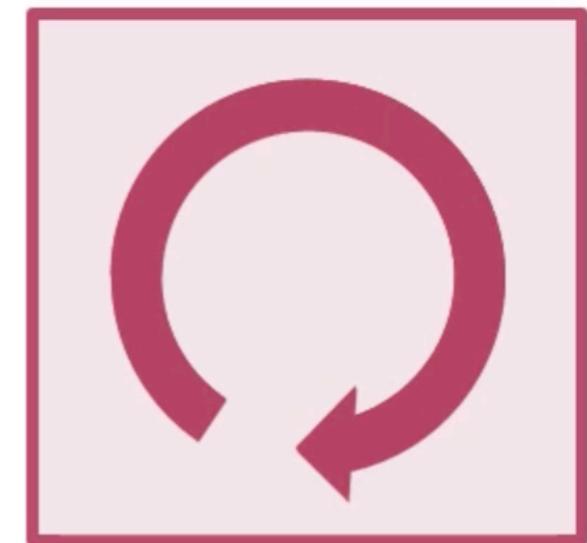
# How Node.js work ?



Process-Per-Client  
(Multi-Process)



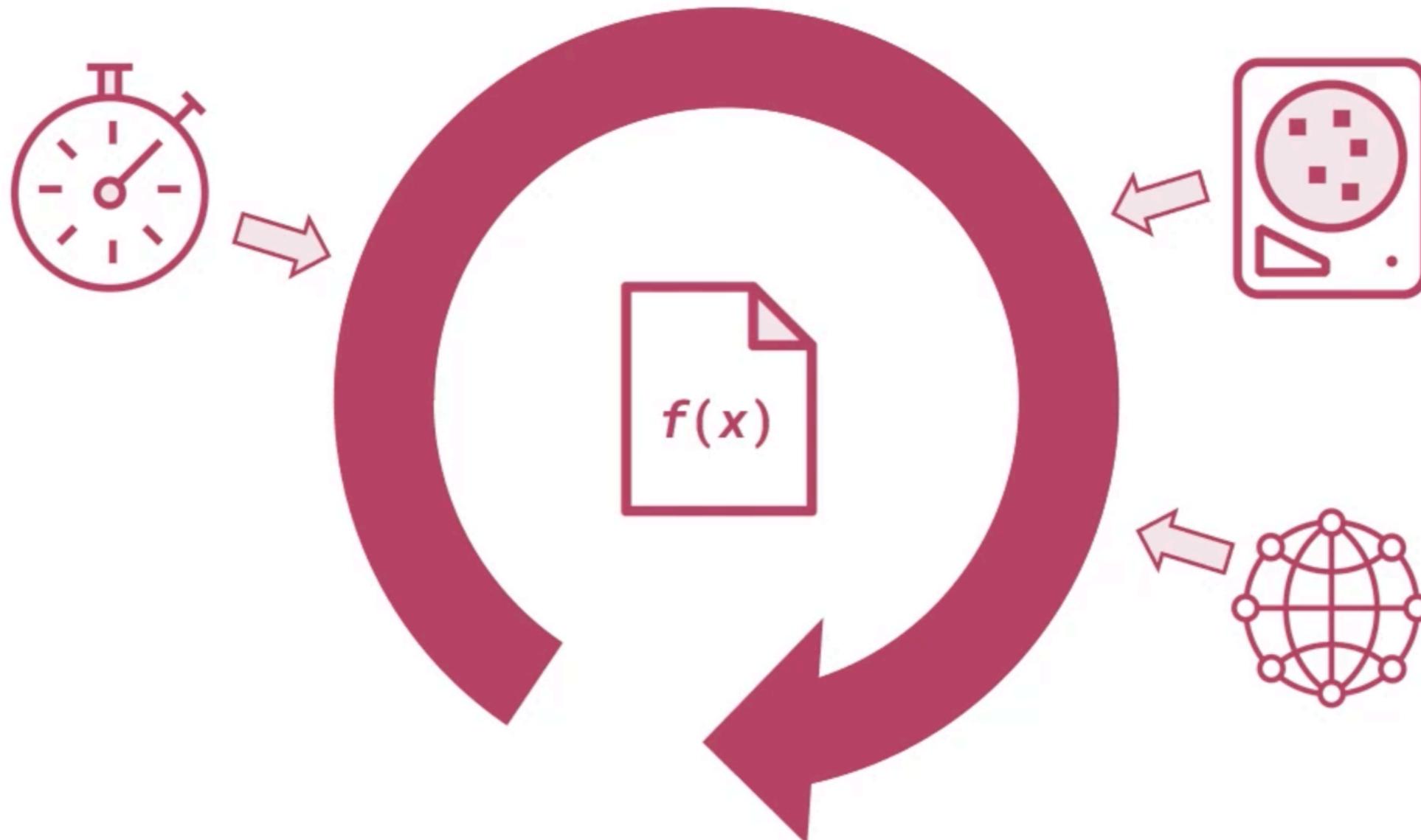
Thread-Per-Client  
(Multi-Threaded)



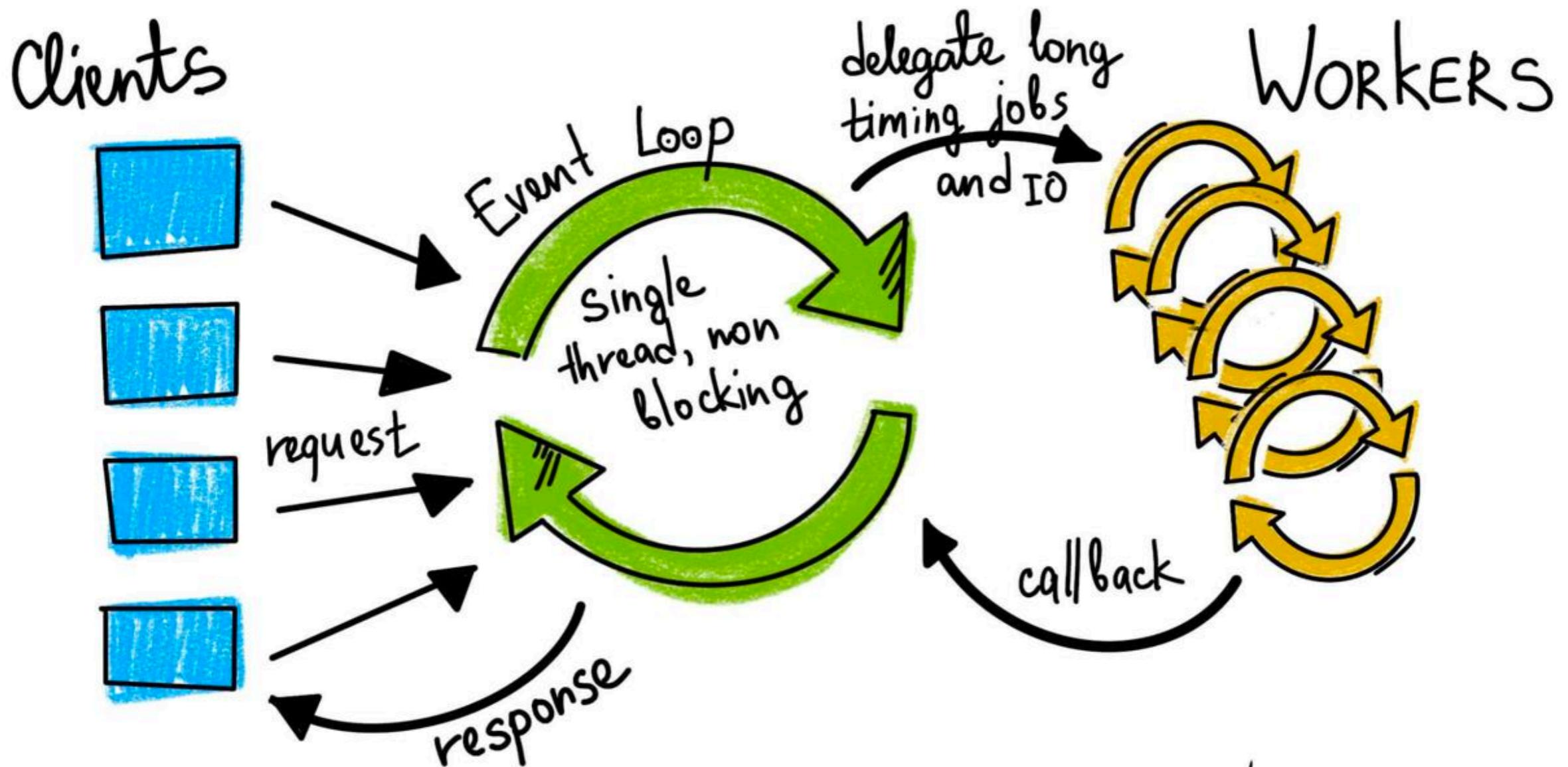
Event Loop  
("Single Threaded")



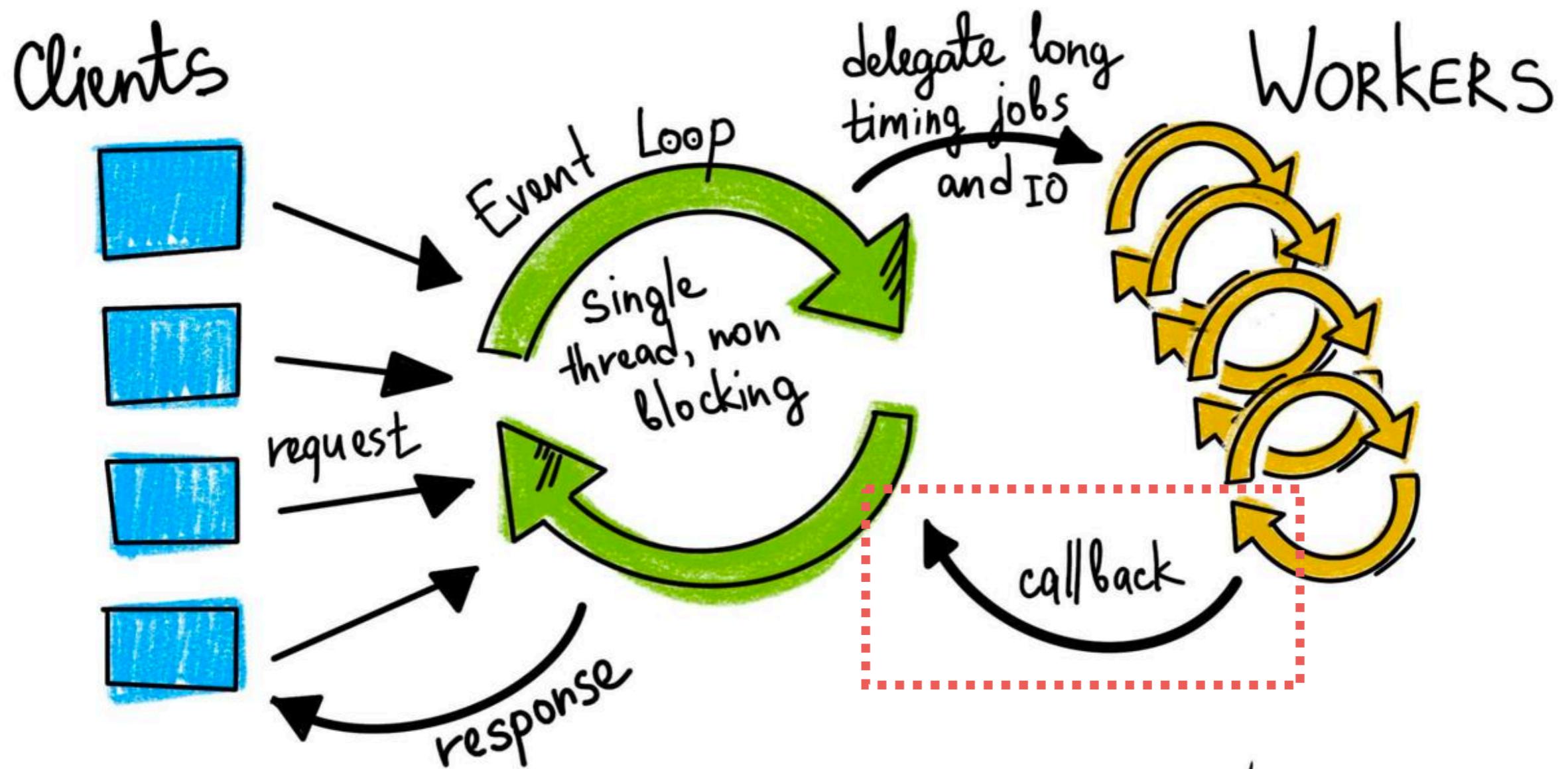
# Node's Event Loop



# 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)
}
```

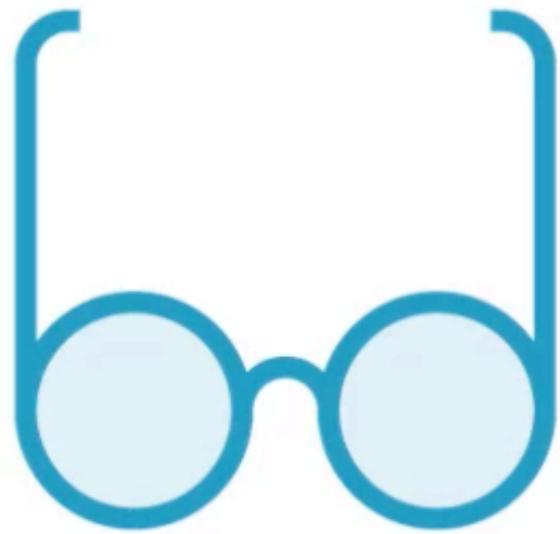


# Stream

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



# Types of Stream



Readable Streams



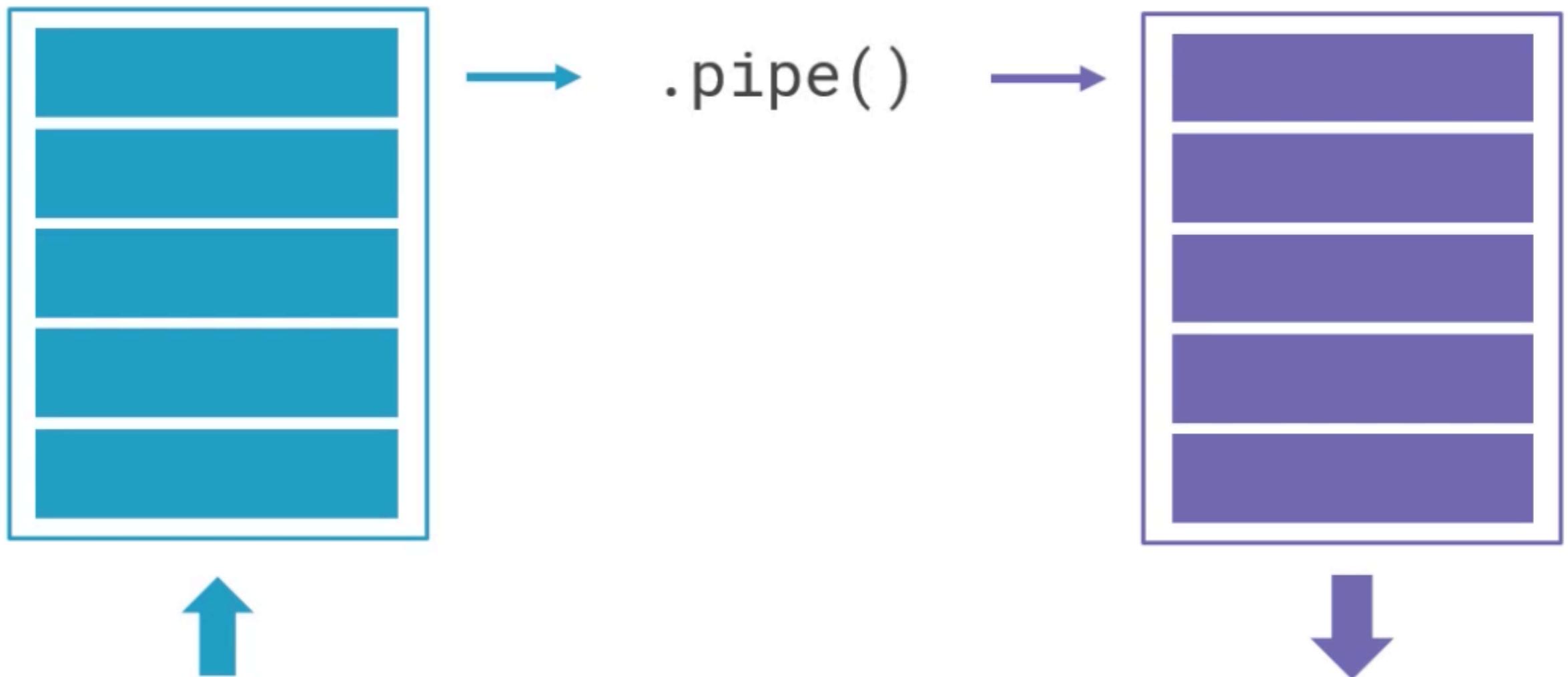
Read/Write Streams  
(Duplex, Transform)



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);

});
```



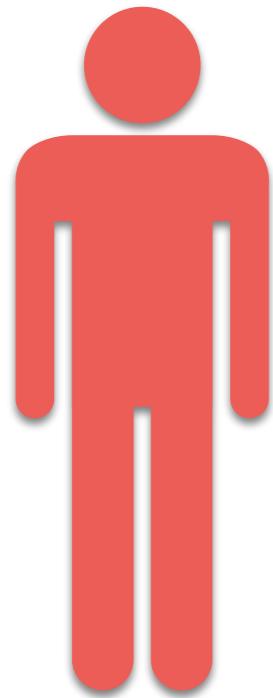
# **Workshop**

## **Callback, Promise, Async/Await, Event**



# Workshop

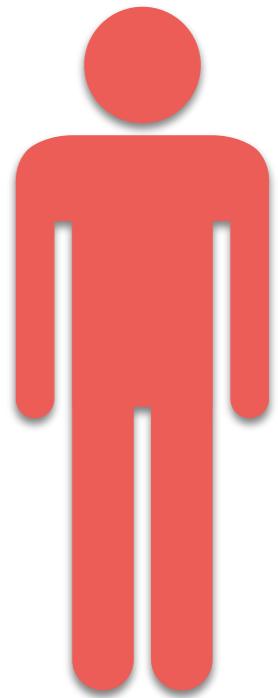
Customer 1



Waiter



Customer 2



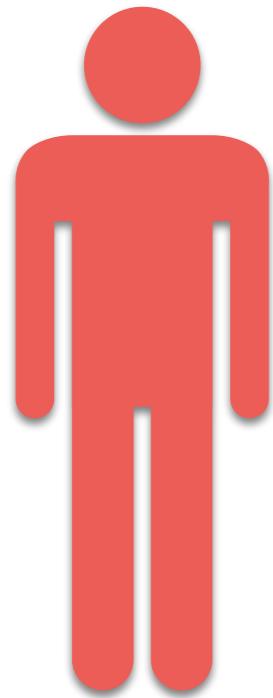
Place order  
→

← Place order



# Workshop

Customer 1



Waiter



1. Place order



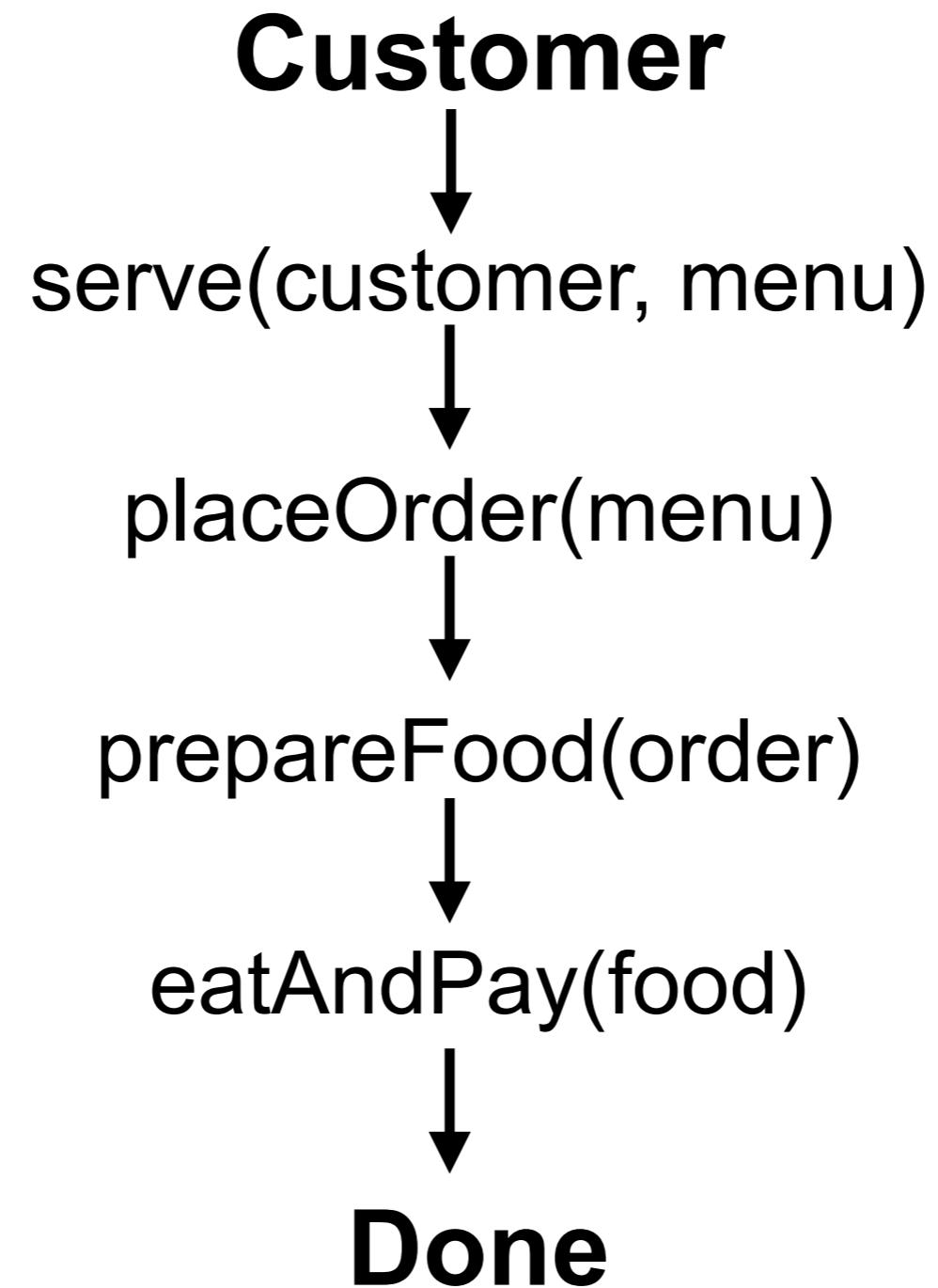
2. Prepare food



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;
  }
}

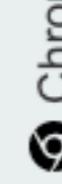
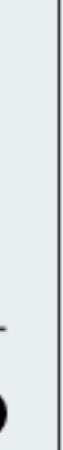
const square = new Rectangle(10, 10);

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);
        }
      });
    }
  });
};

});
```

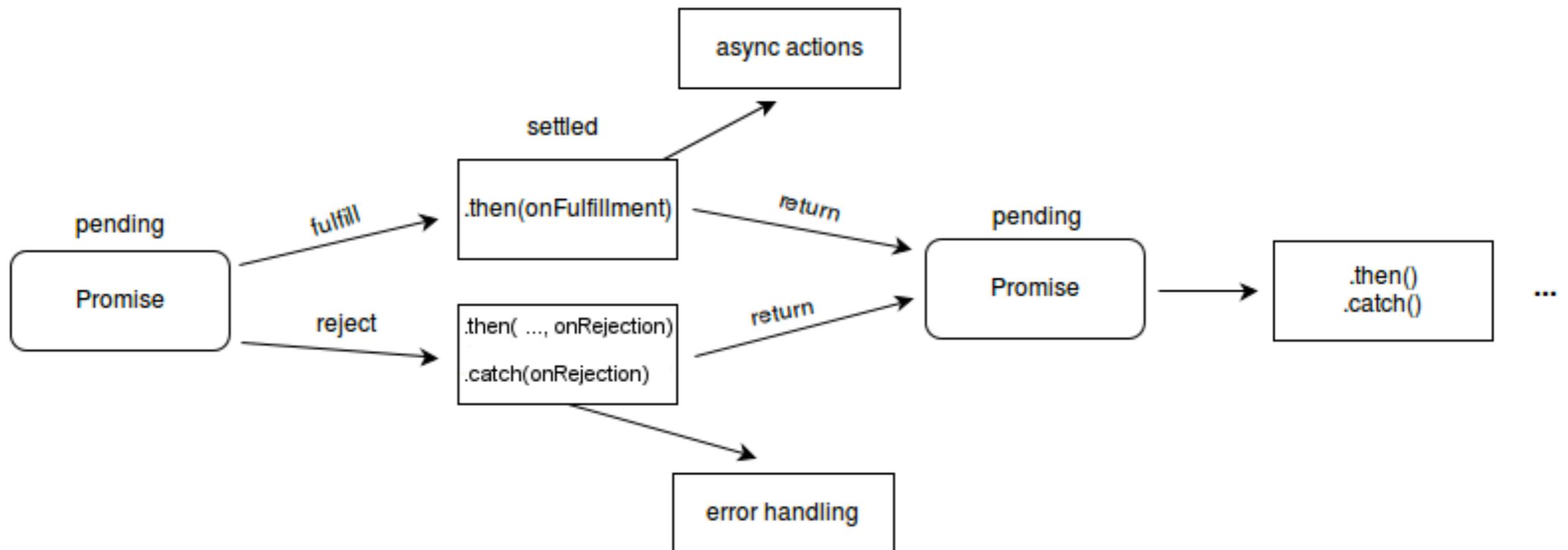


# Promise

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global\\_Objects/Promise](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Promise)



# 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](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;
};
```

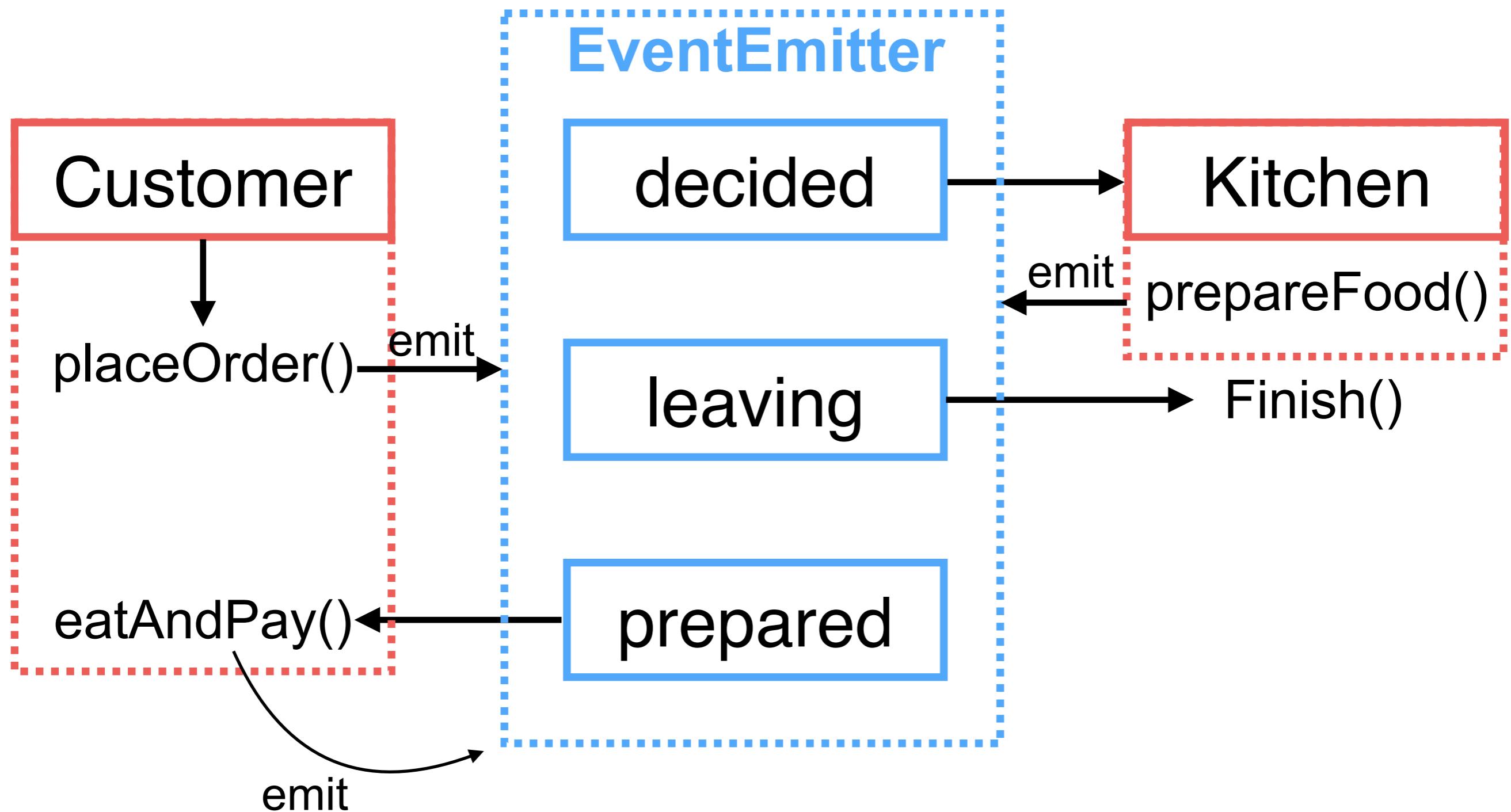


# Events

<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

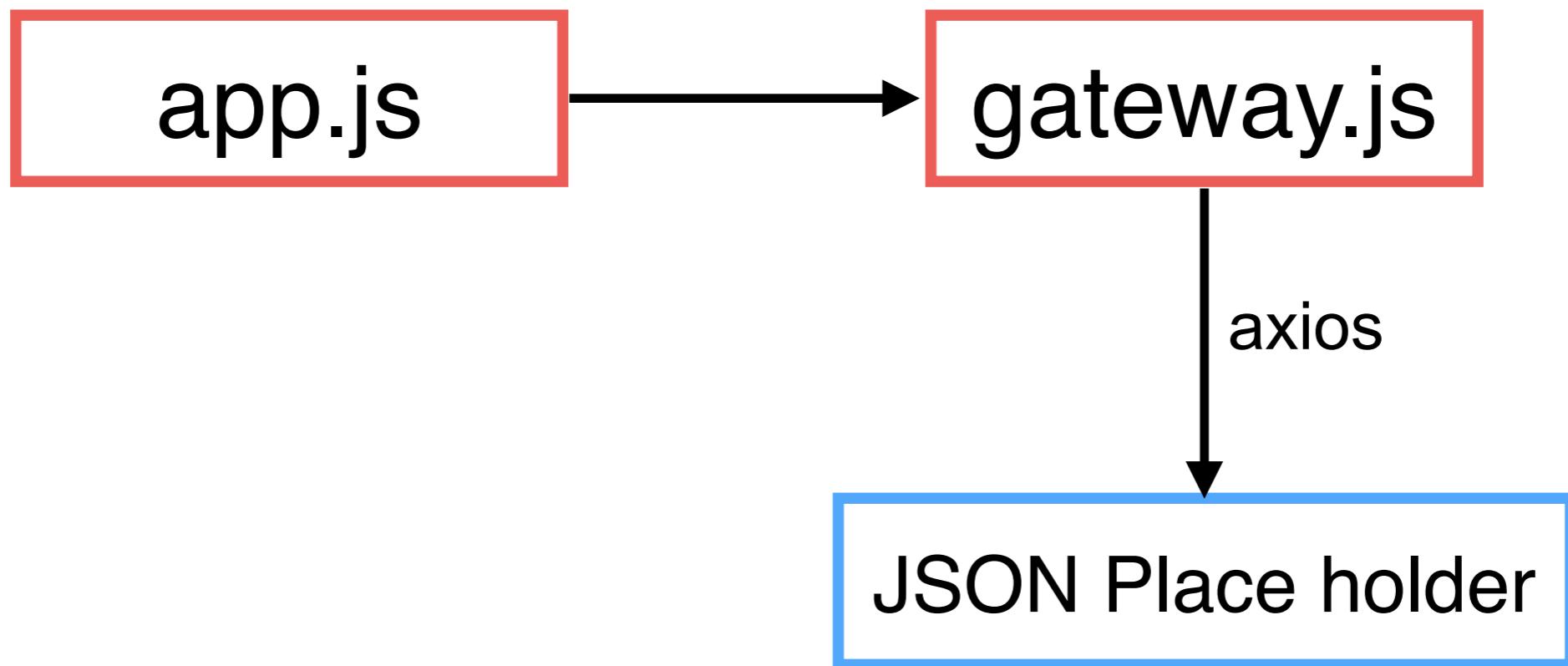


# **Workshop**

# **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

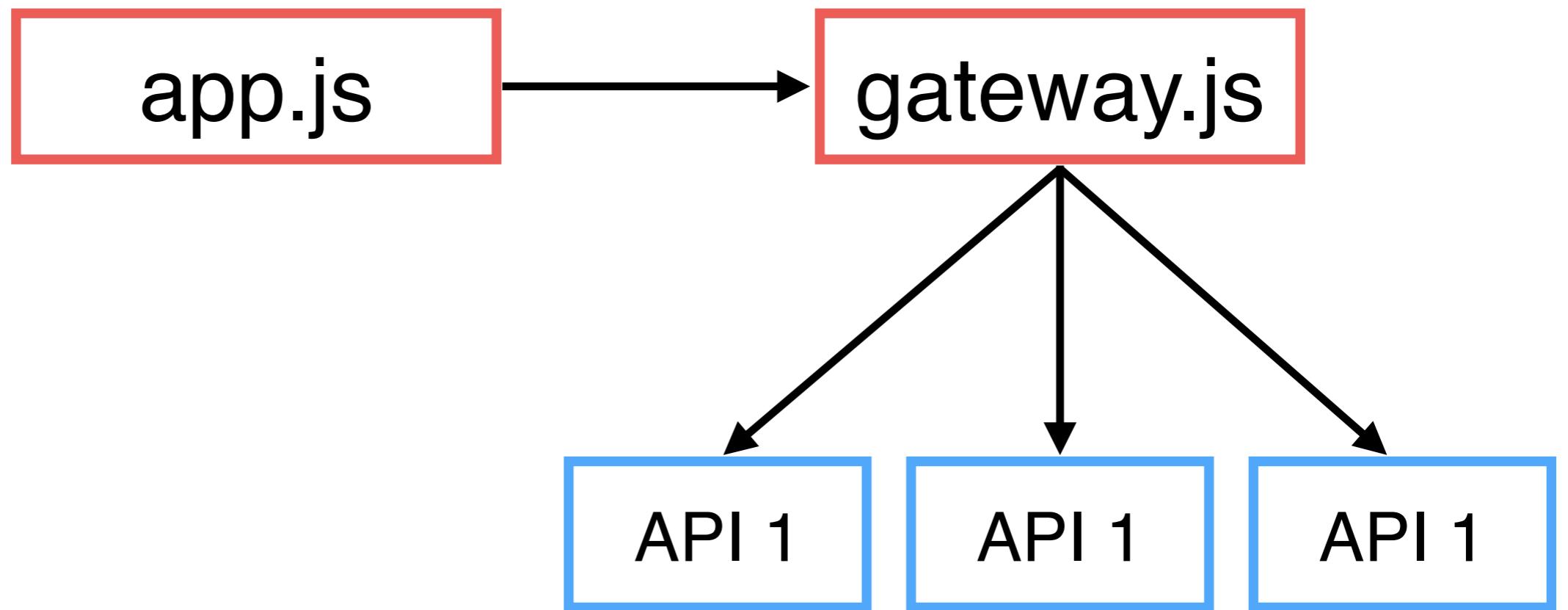
<https://jsonplaceholder.cypress.io/users>



NodeJS

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# Workshop with Promise.All



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



# Initial project

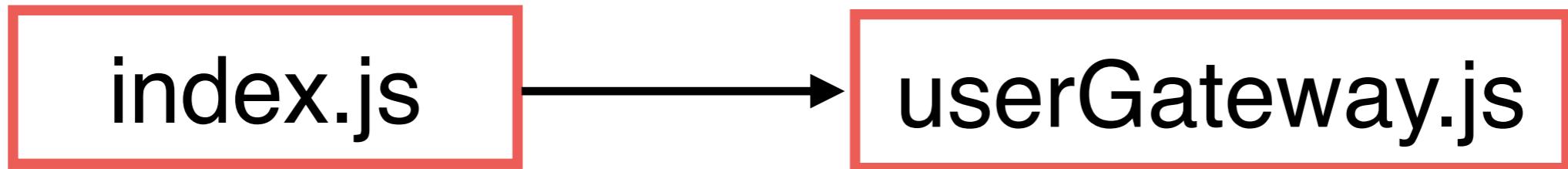
\$npm init

\$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



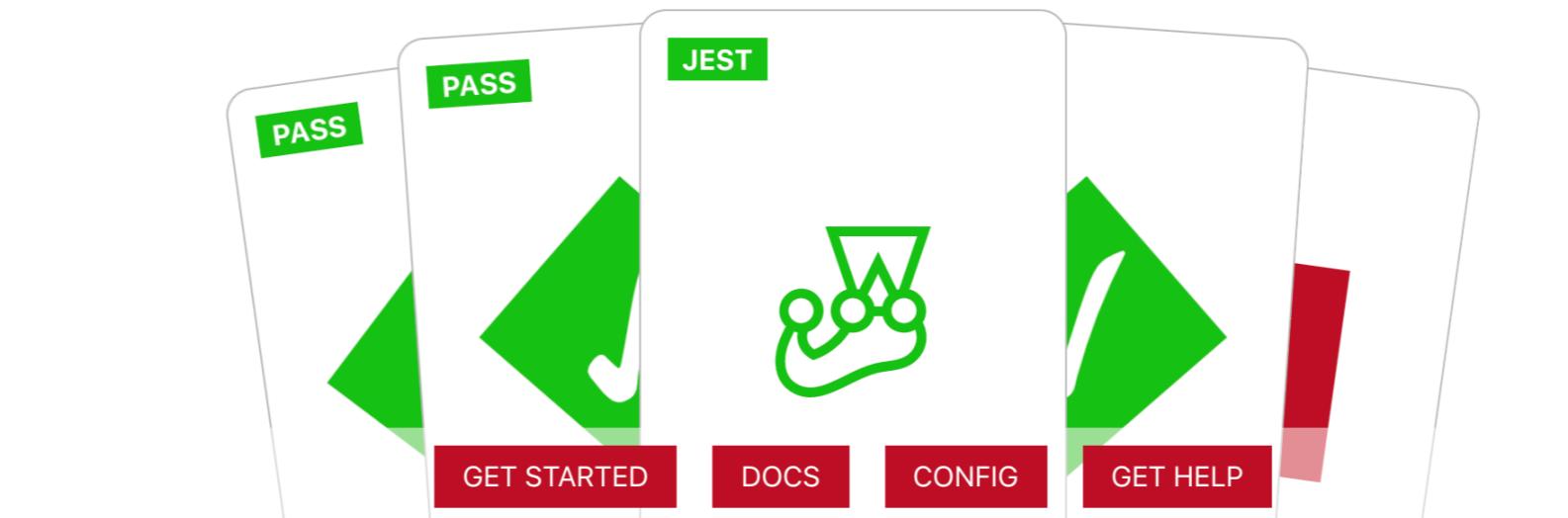
POSTMAN

<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 ?

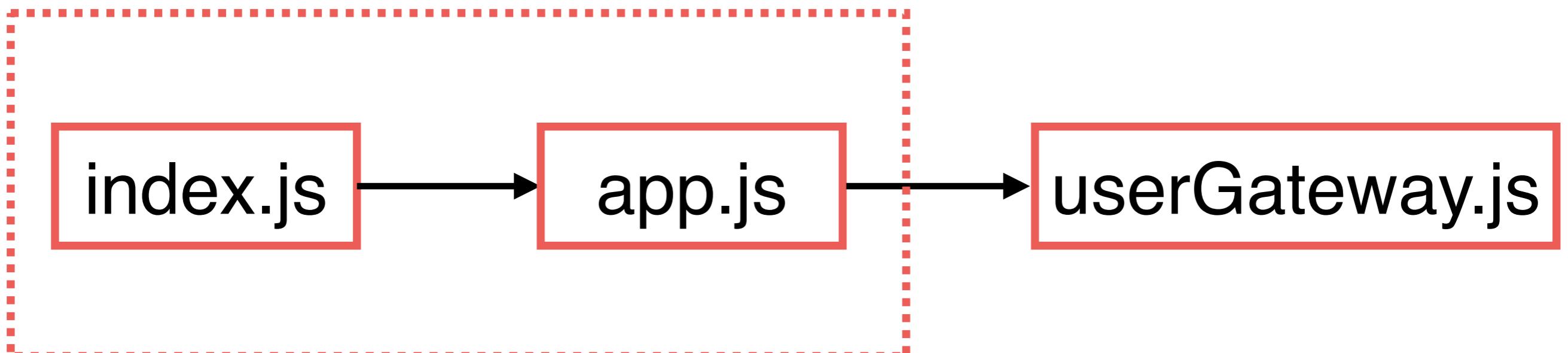


<https://github.com/visionmedia/supertest>



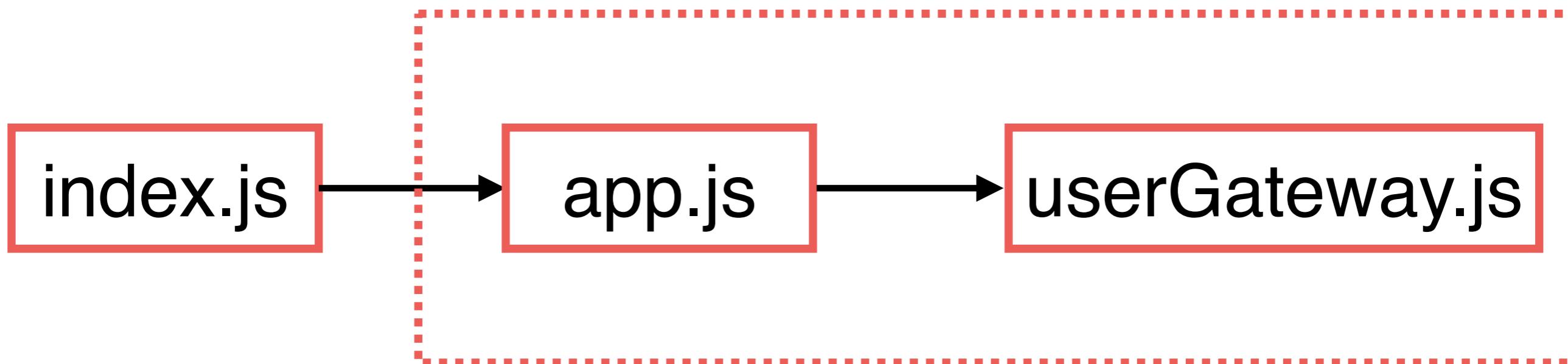
# Project structure

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
```

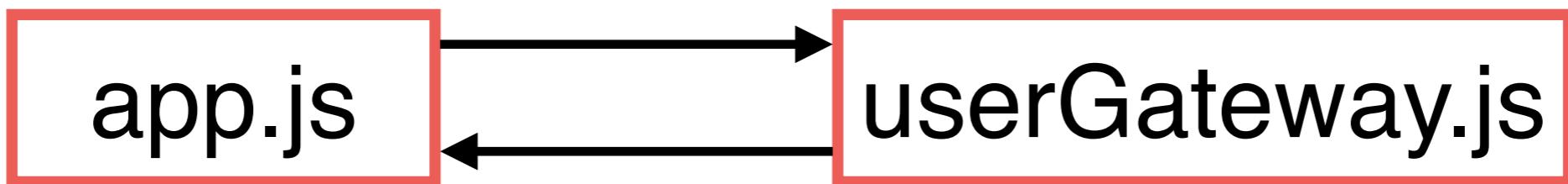
```
Ran all test suites.
```



# 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

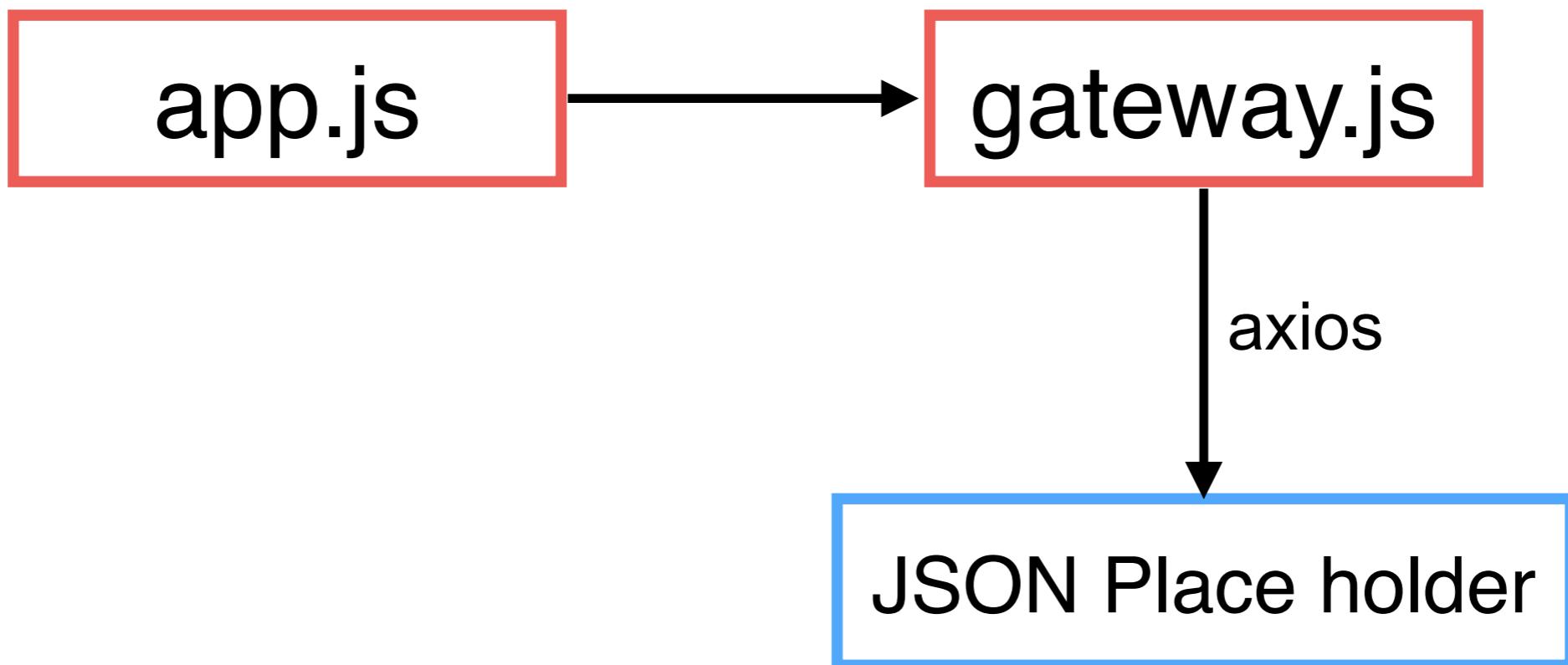
Open file ./coverage/index.html

```
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        }
```

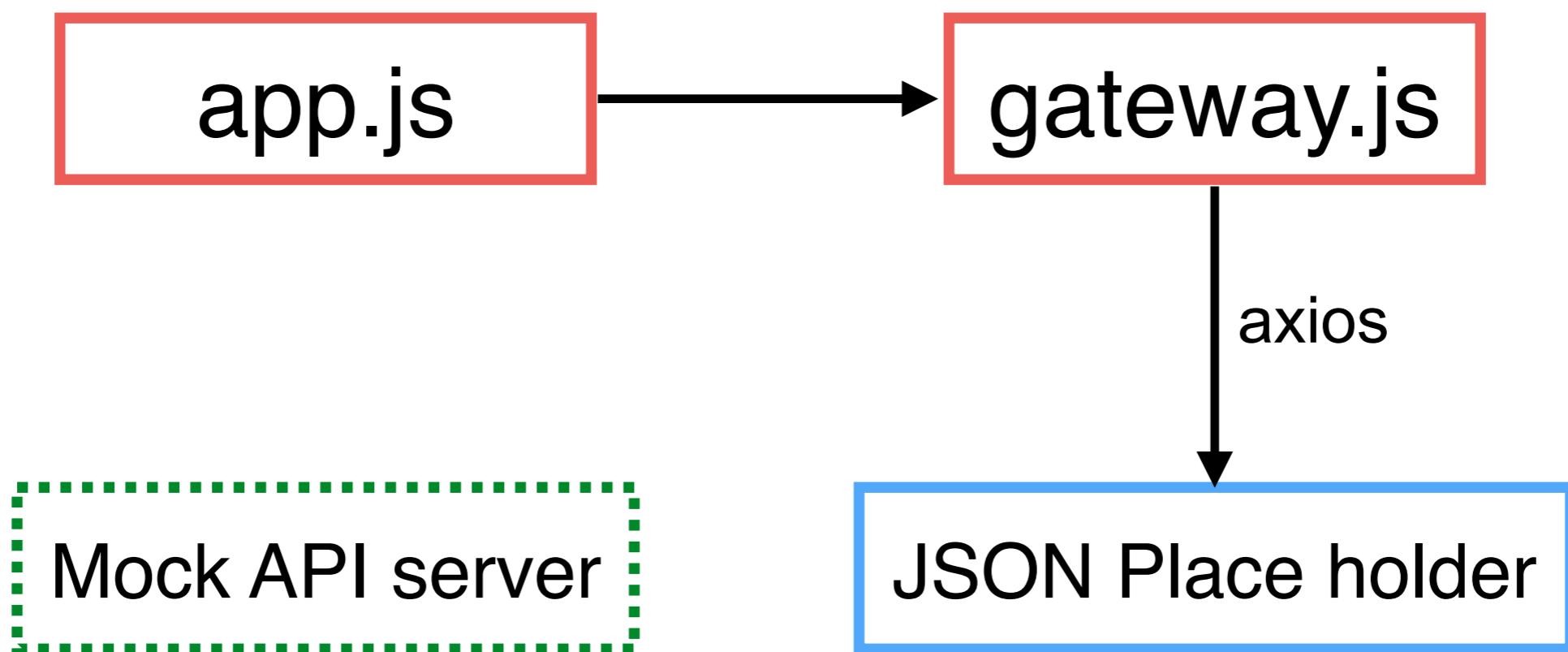
How to test ?



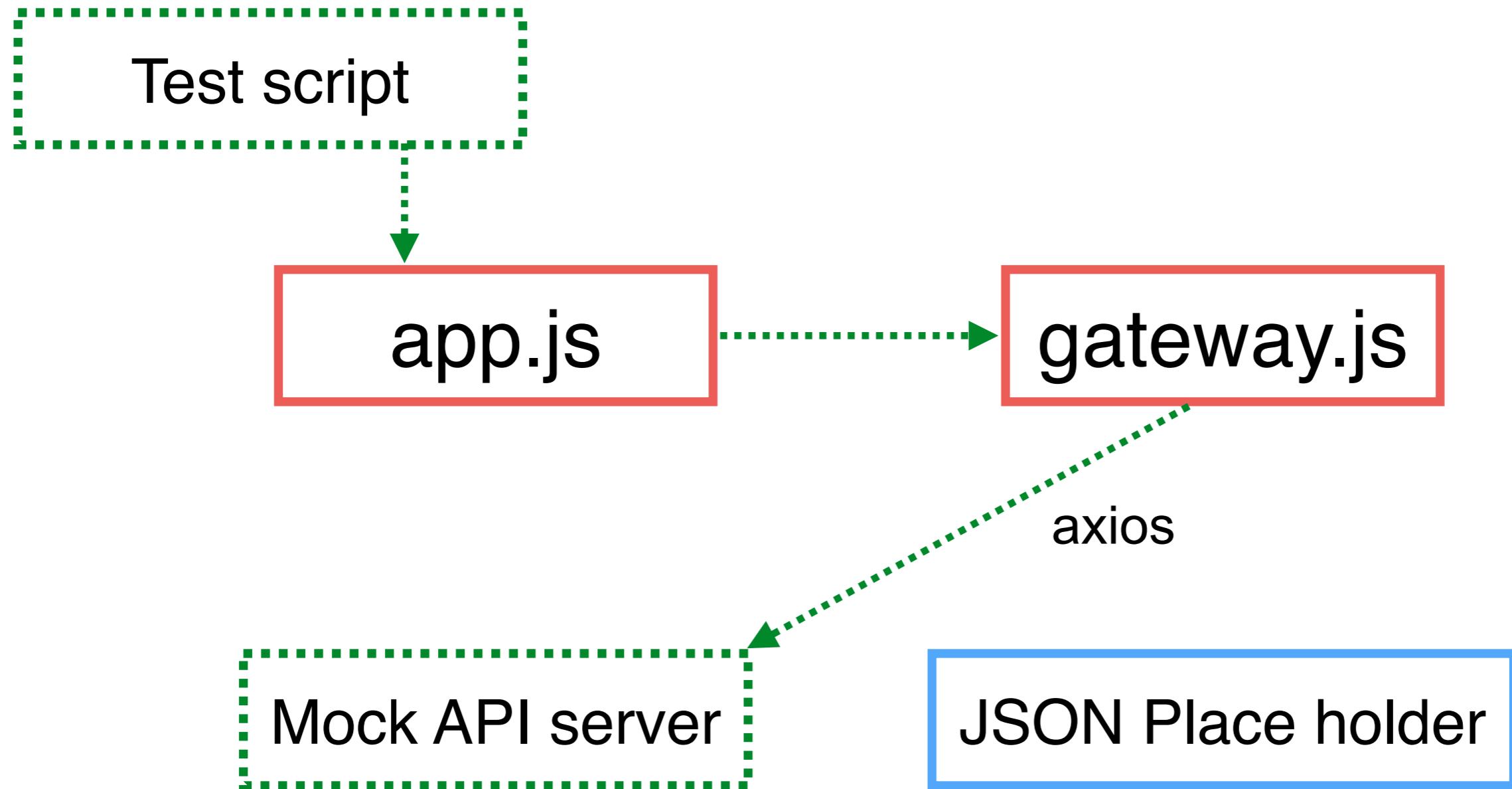
# Solution ?



# 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](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" });

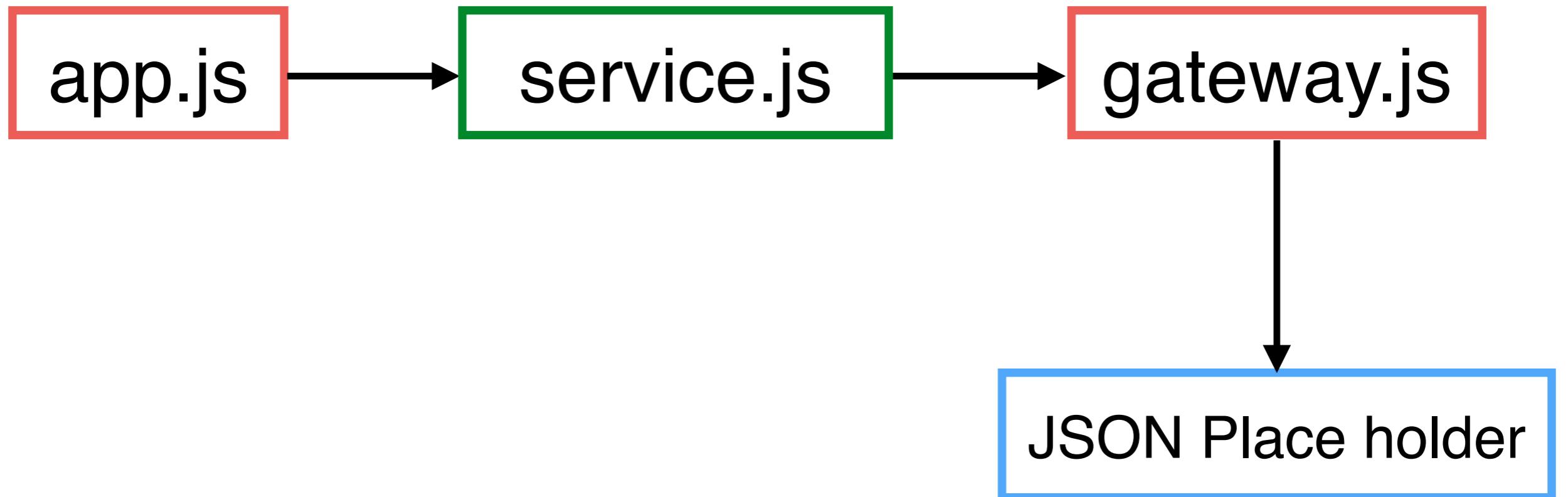
request(app).get("/users")
  .expect("Content-Type", /json/)
  .expect(
    200,
    {
      id: 1,
      name: "mock name",
    },
    done
);
```



# 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);
  });
});
```



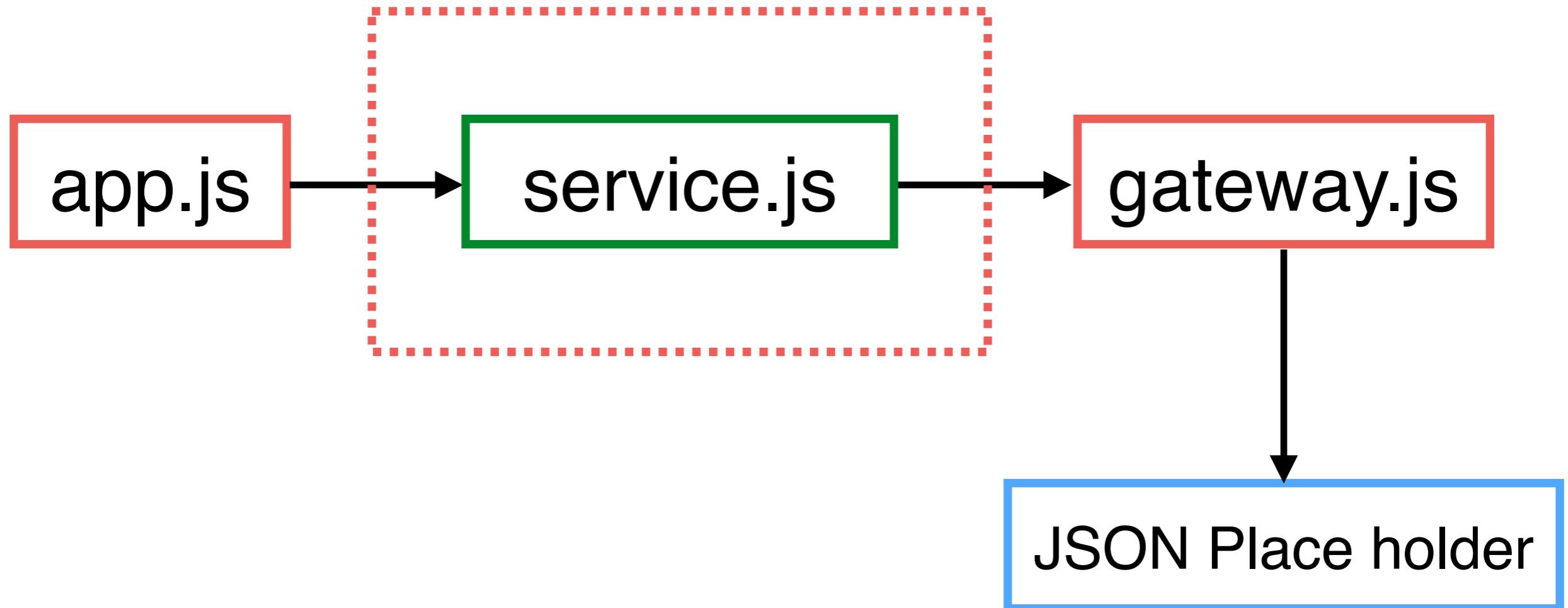
# Run test



# 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,
    });
});
```

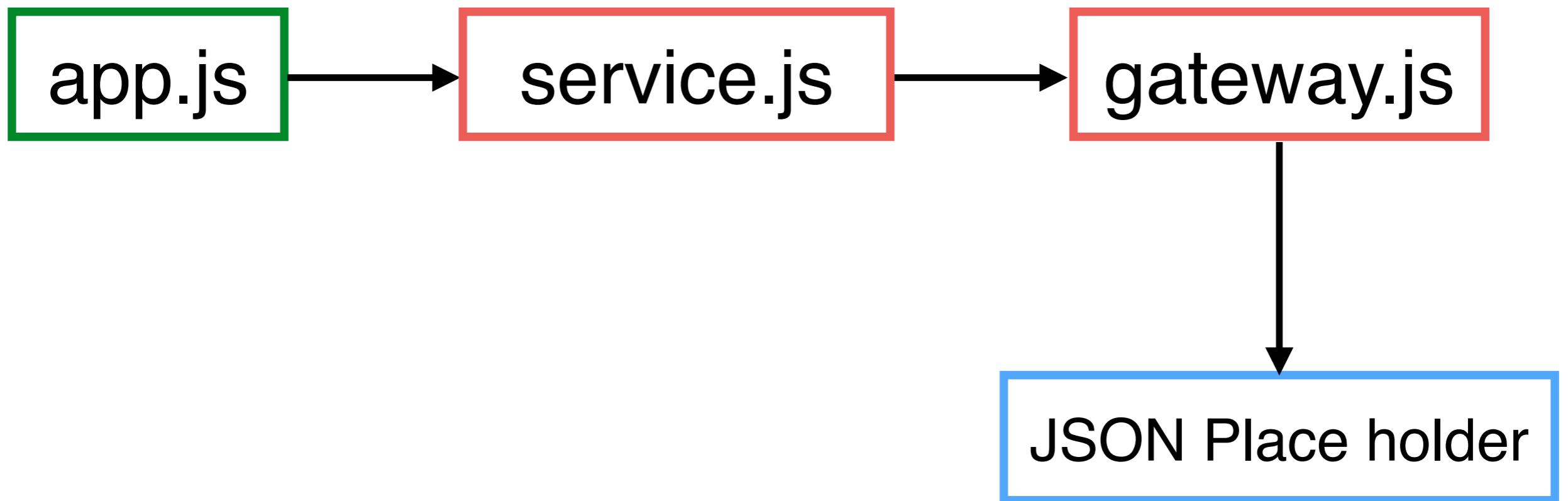
<https://jestjs.io/docs/en/jest-object#jestspyonobject-methodname>



# Back to app.js

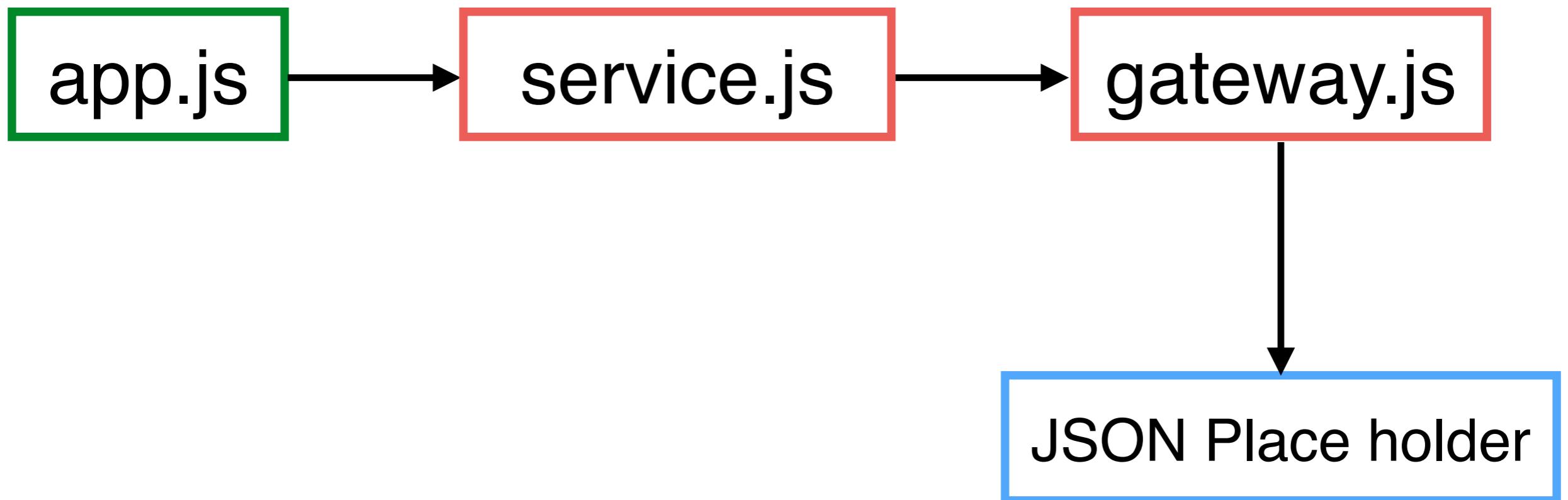


# Responsibility ?



# 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

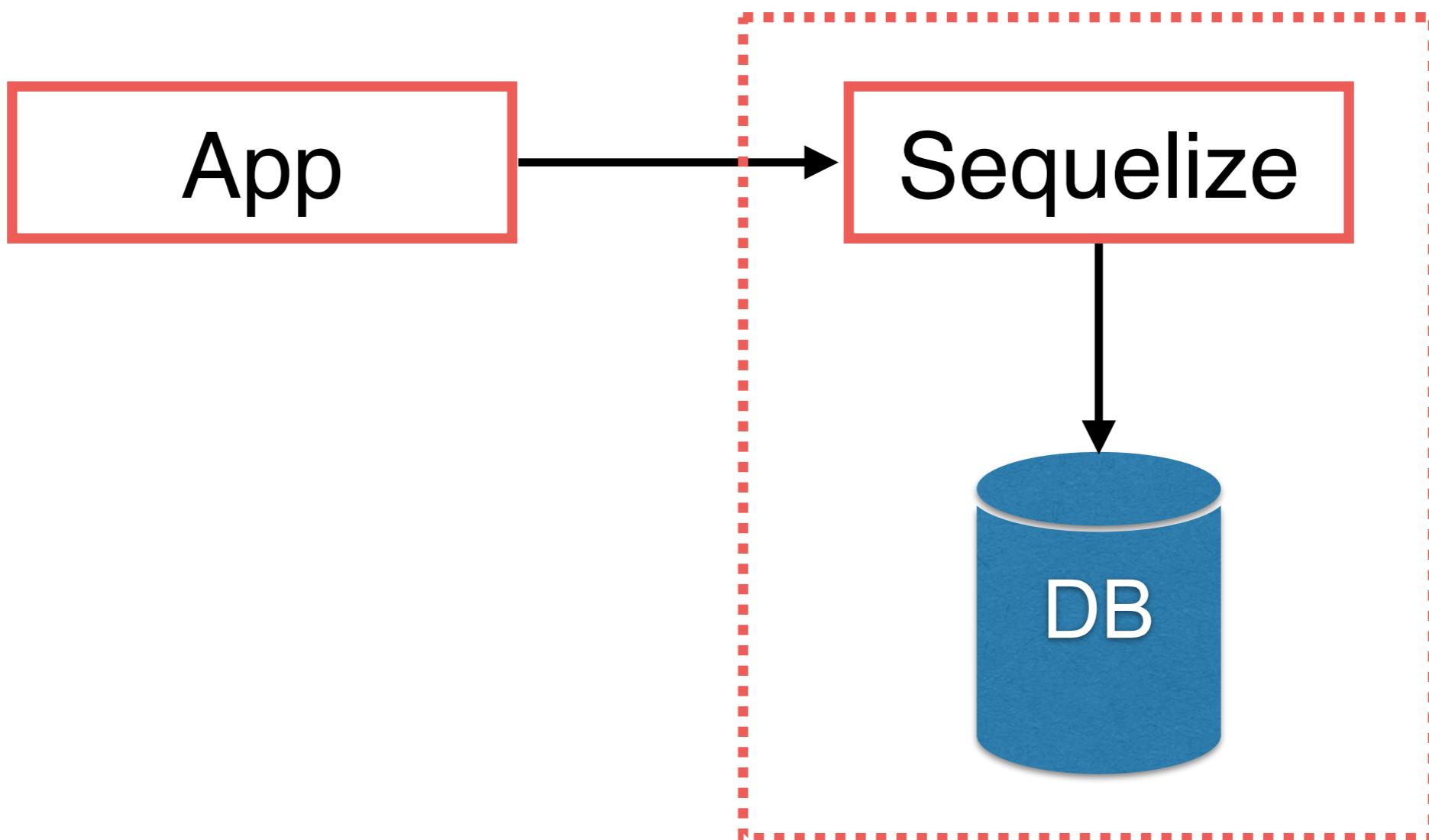
## RDBMS

## 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

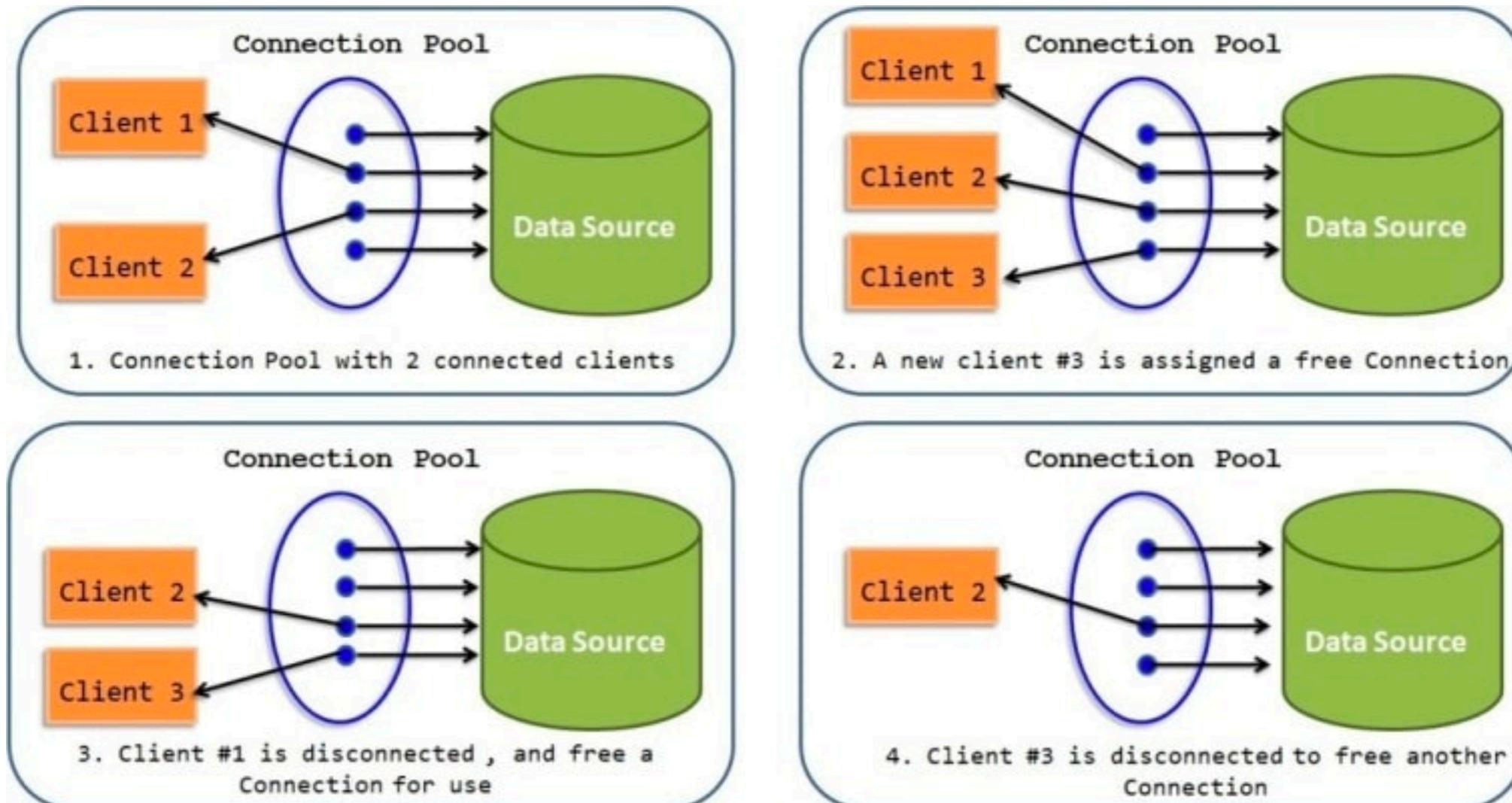
```
const Sequelize = require("sequelize");

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

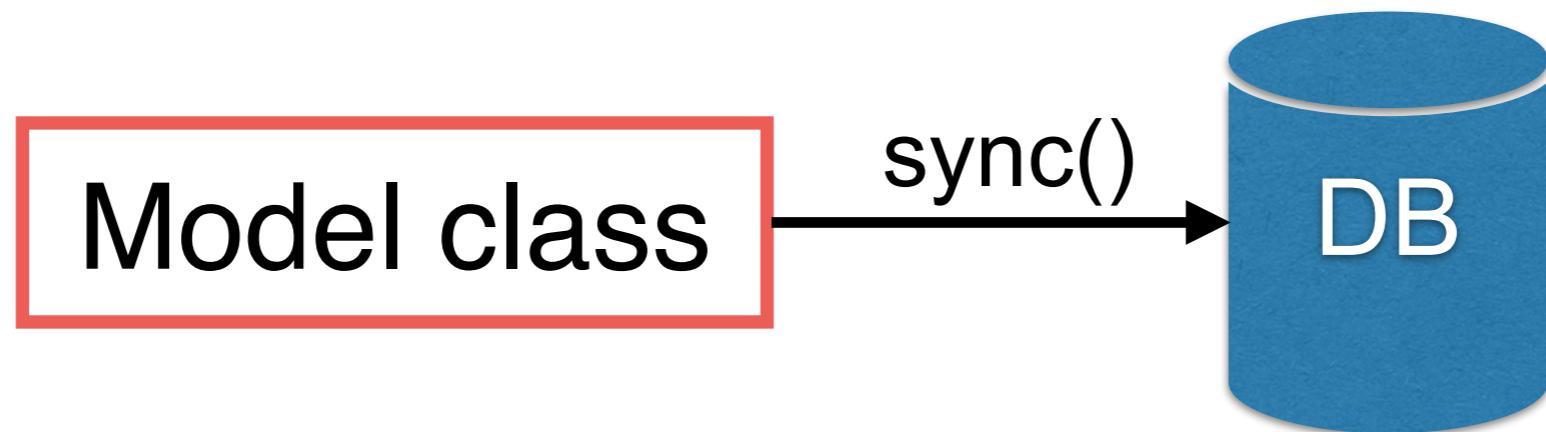


<https://sequelize.org/master/manual/connection-pool.html>



## 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 {}

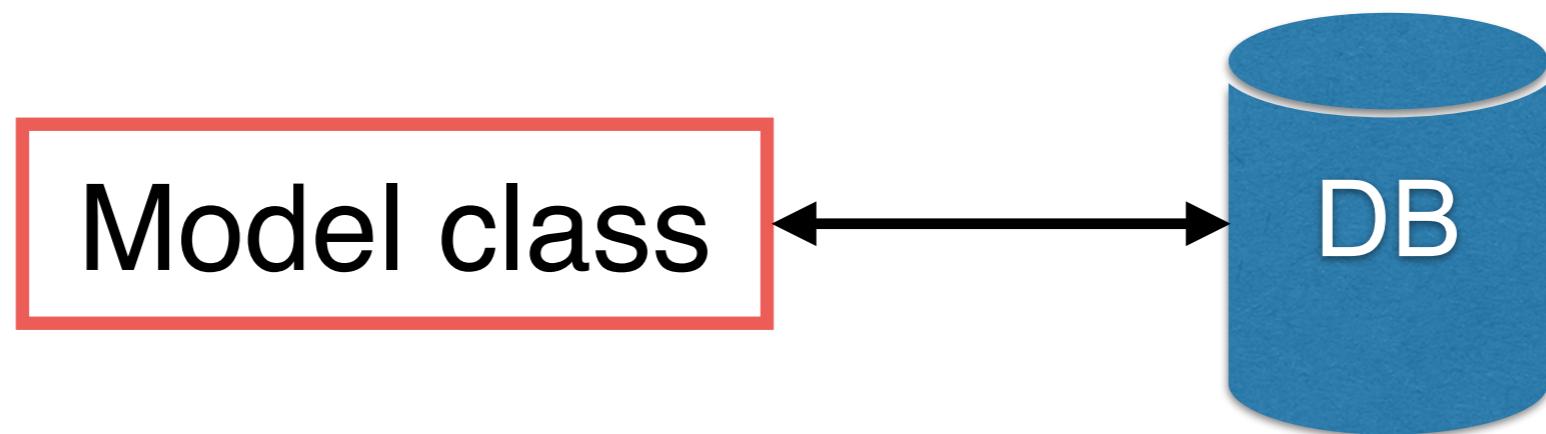
const createUserModel = (db) => {
  const model = User.init(
    {
      id: {
        type: Sequelize.INTEGER,
        primaryKey: true,
        autoIncrement: true,
      },
      name: Sequelize.STRING,
      age: Sequelize.INTEGER,
    },
    {
      sequelize: db,
      modelName: "user",
     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

*Config table name in database !!*



# 3. Migration

For production



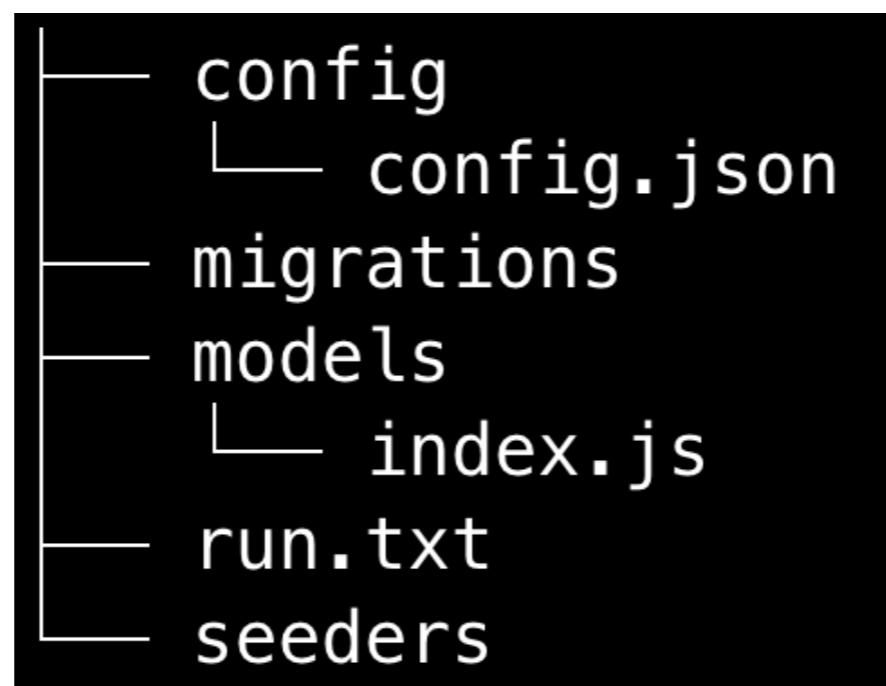
<https://sequelize.org/master/manual/migrations.html>



# 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

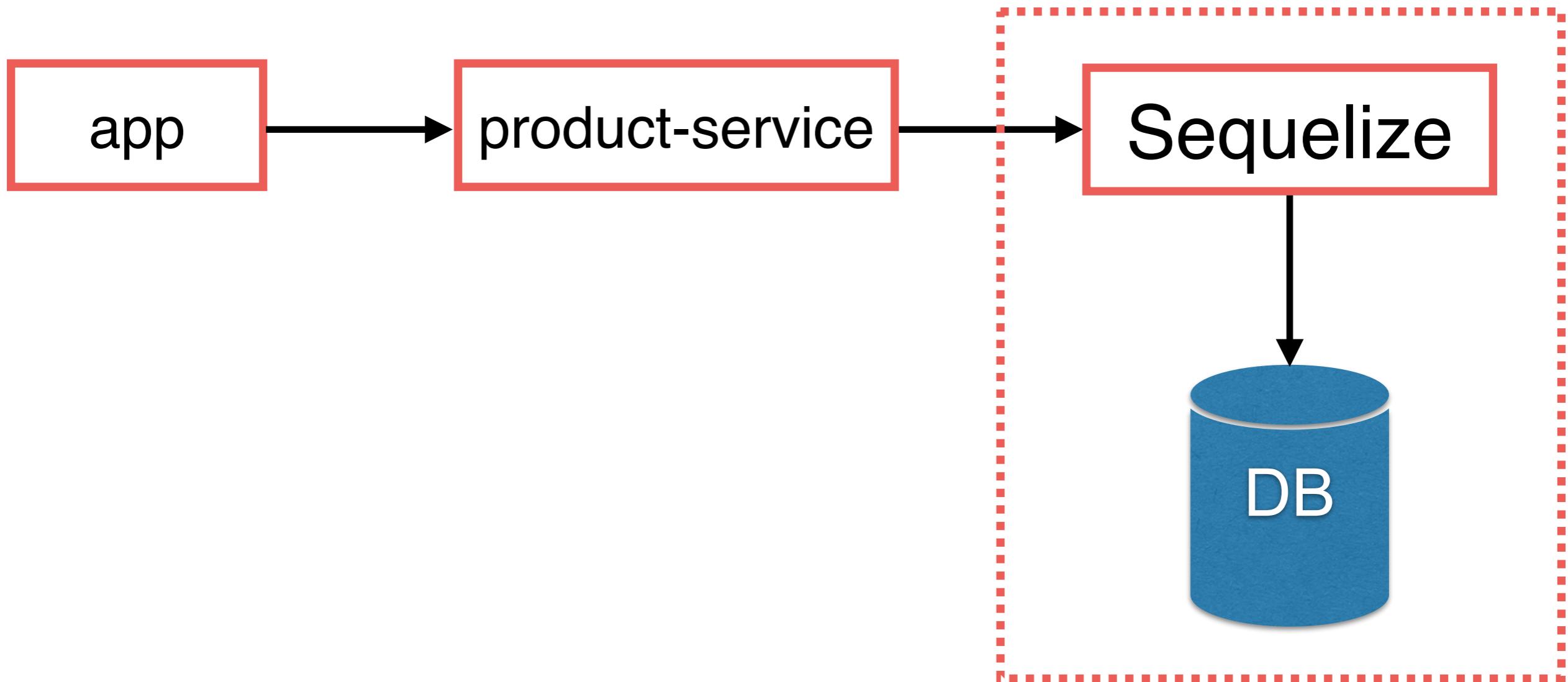


# Workshop with Product



# 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);
  }
});

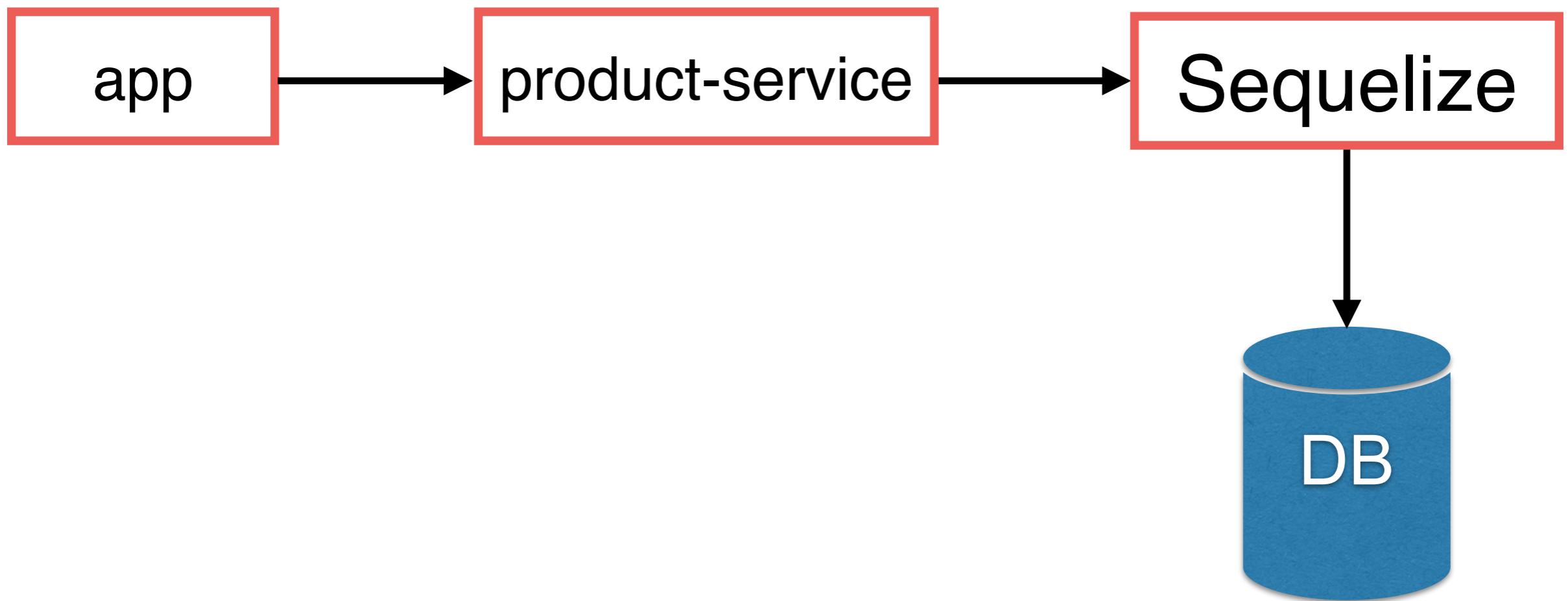
module.exports = app;
```



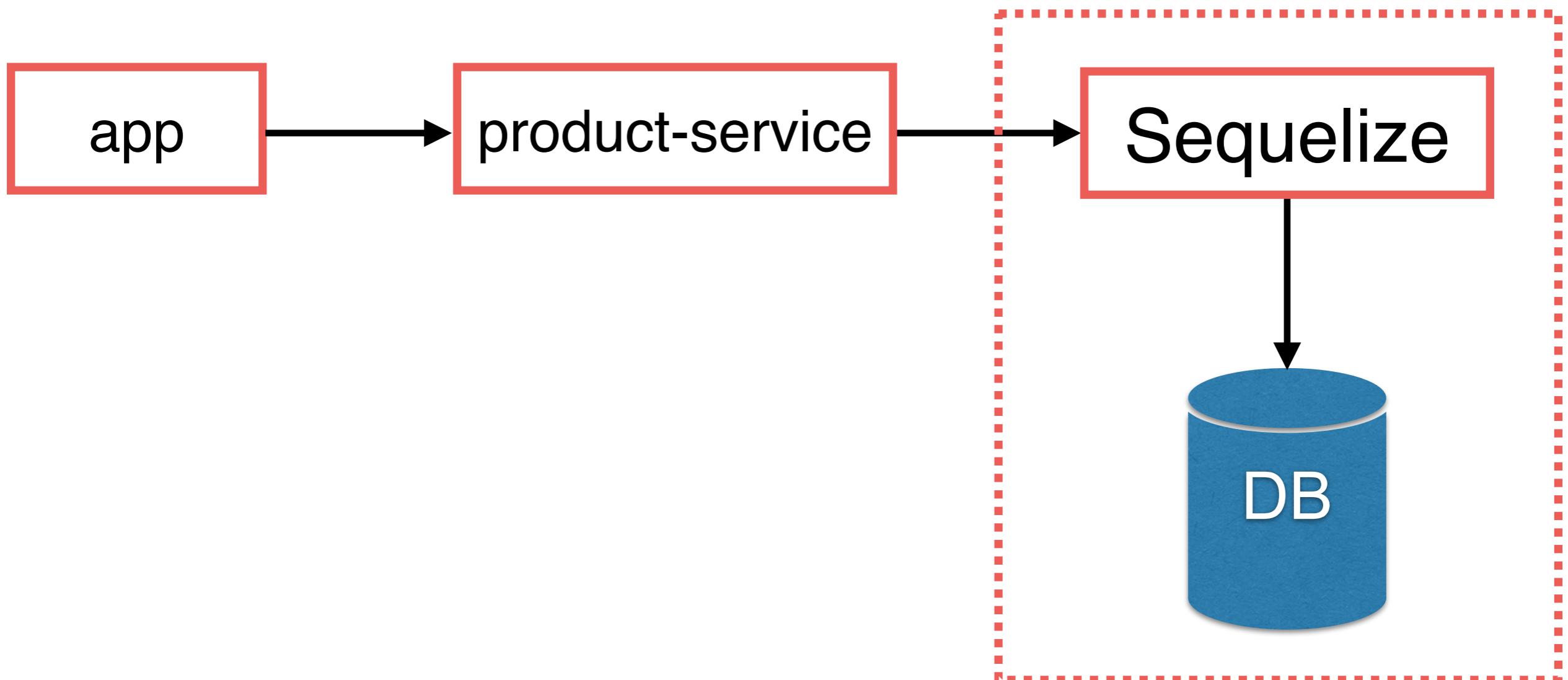
# Testing with sequelize



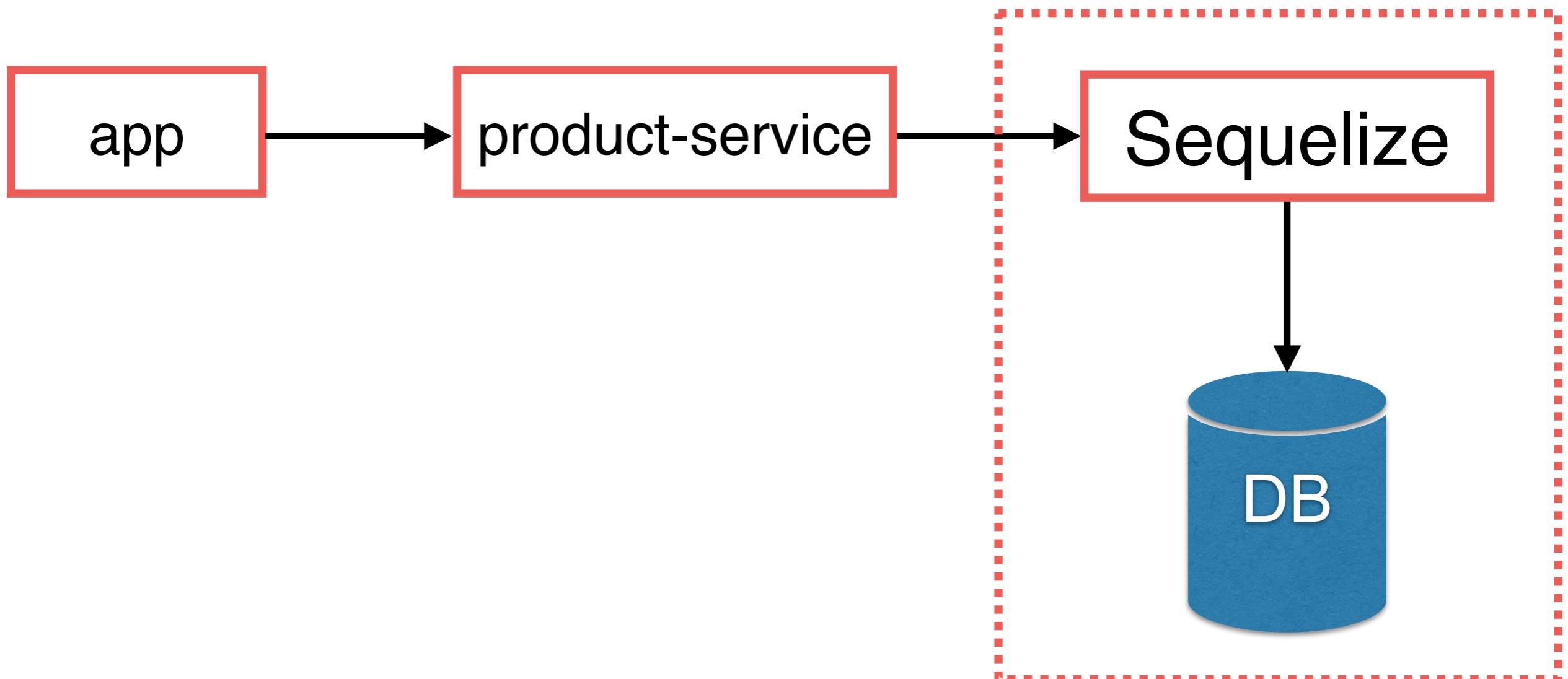
# How to test ?



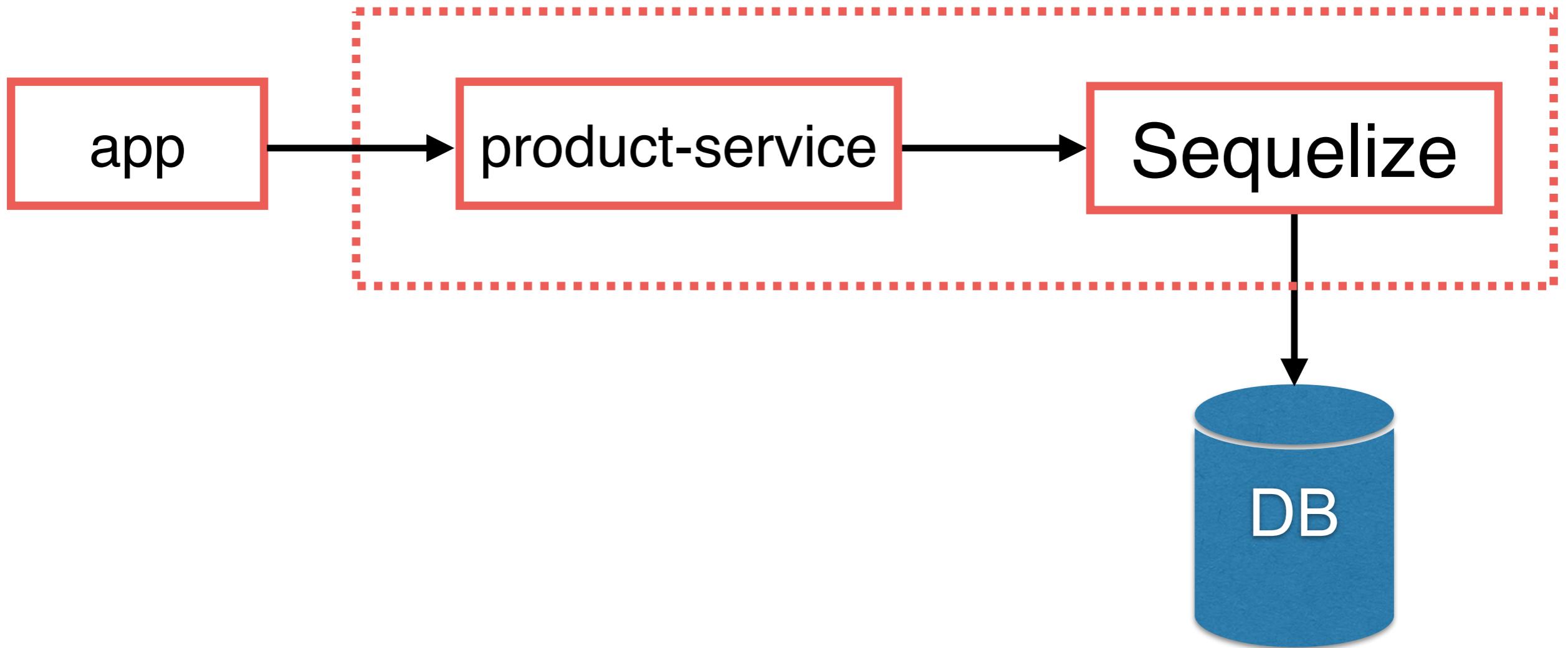
# Using real database ?



# 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](http://httpstatuses.com/code) or browse the list below.

@ Share on Twitter   + Add to Pinboard

### 1xx Informational

**100** Continue

**101** Switching Protocols

**102** Processing

<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());

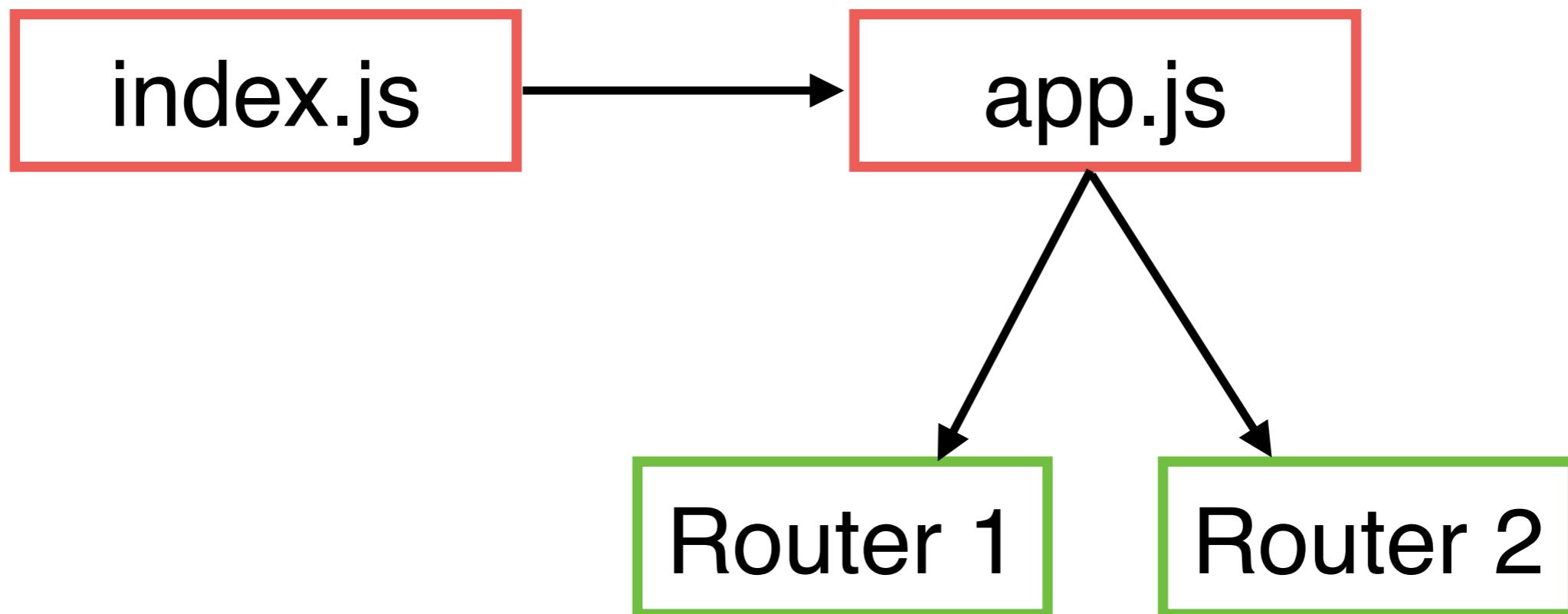
app.get("/", (req, res) => {
  res.status(200).send({
    message: "Hello API",
  });
});

});
```

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");

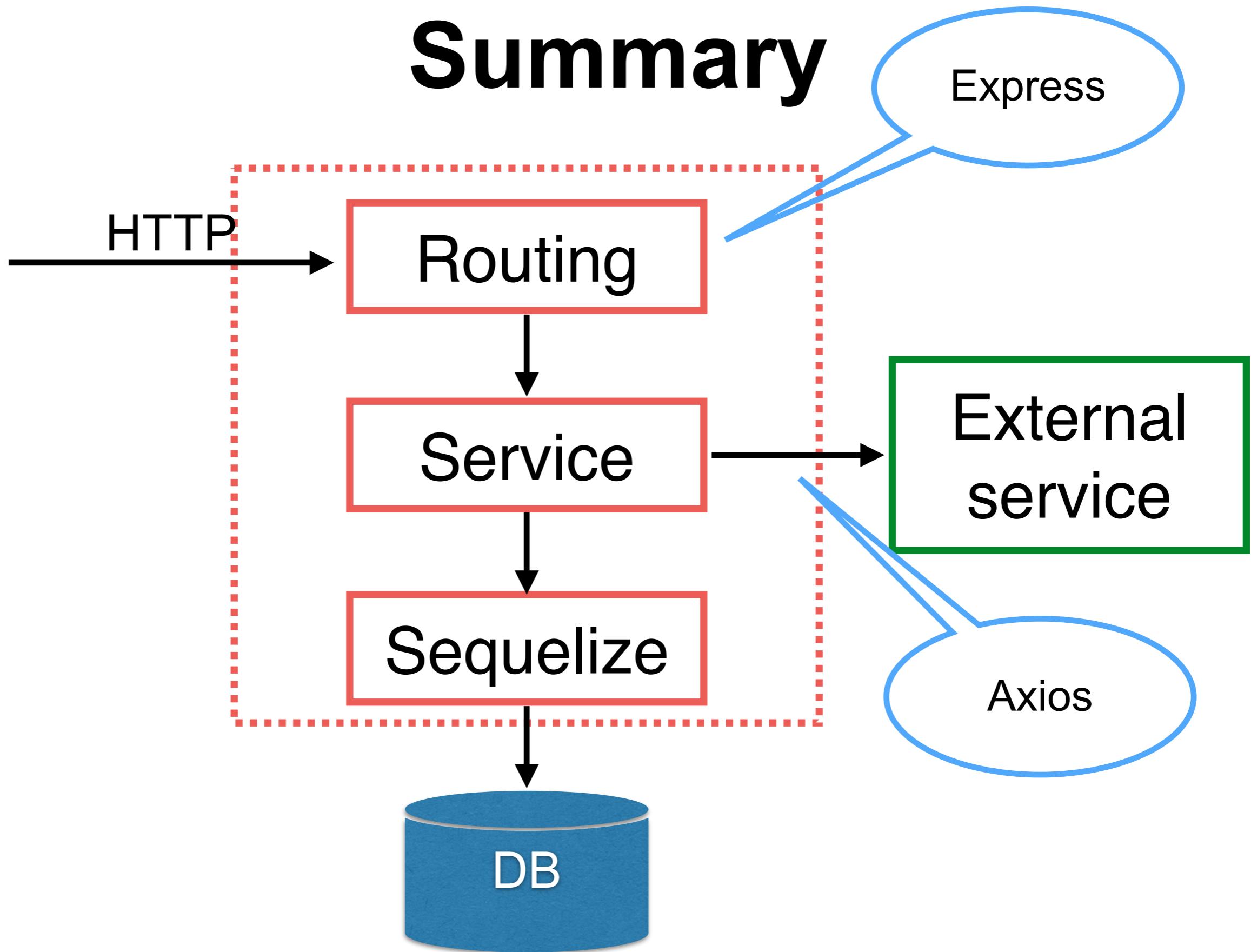
test("Create new product ", async () => {

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

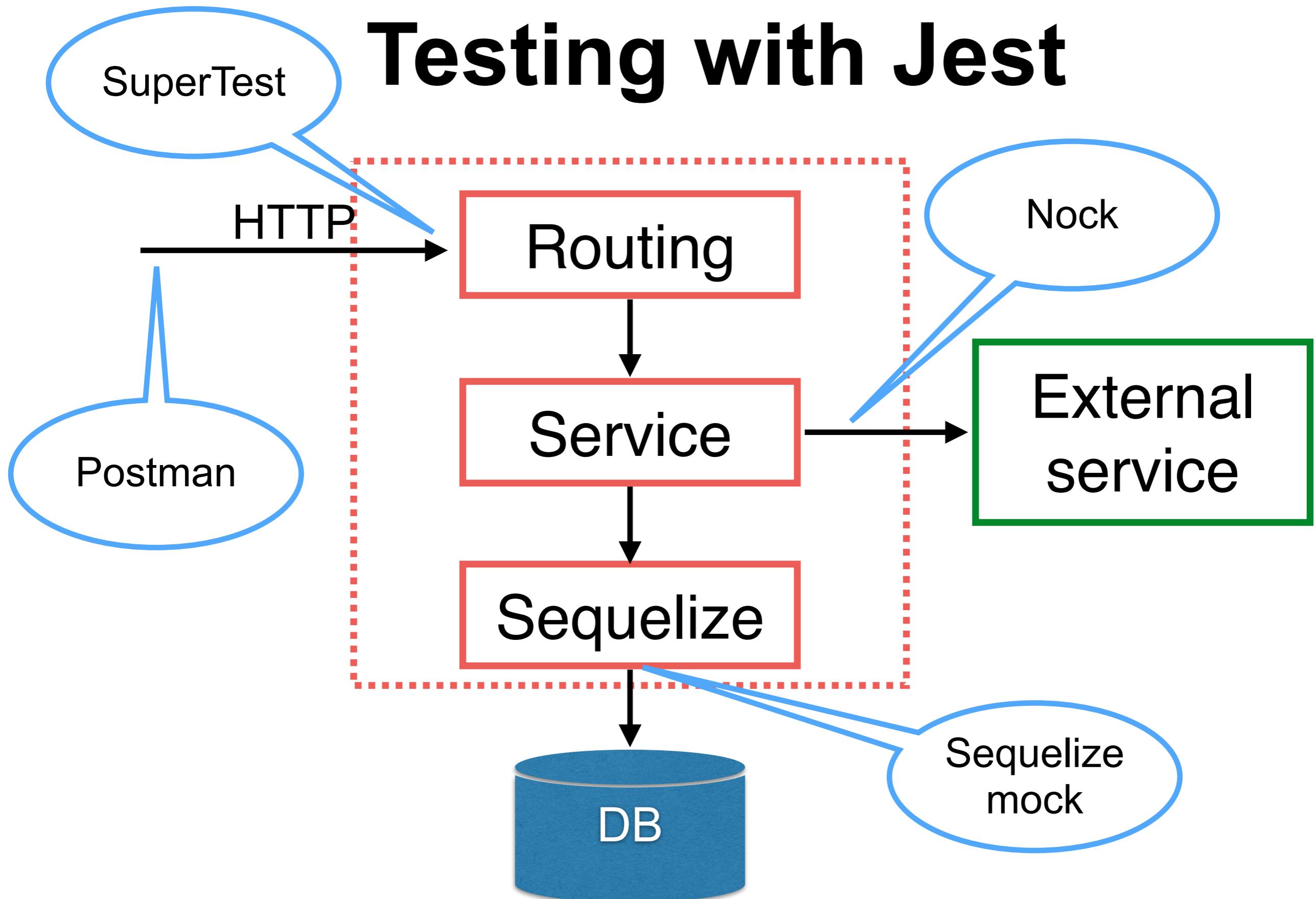
});
```



# Summary



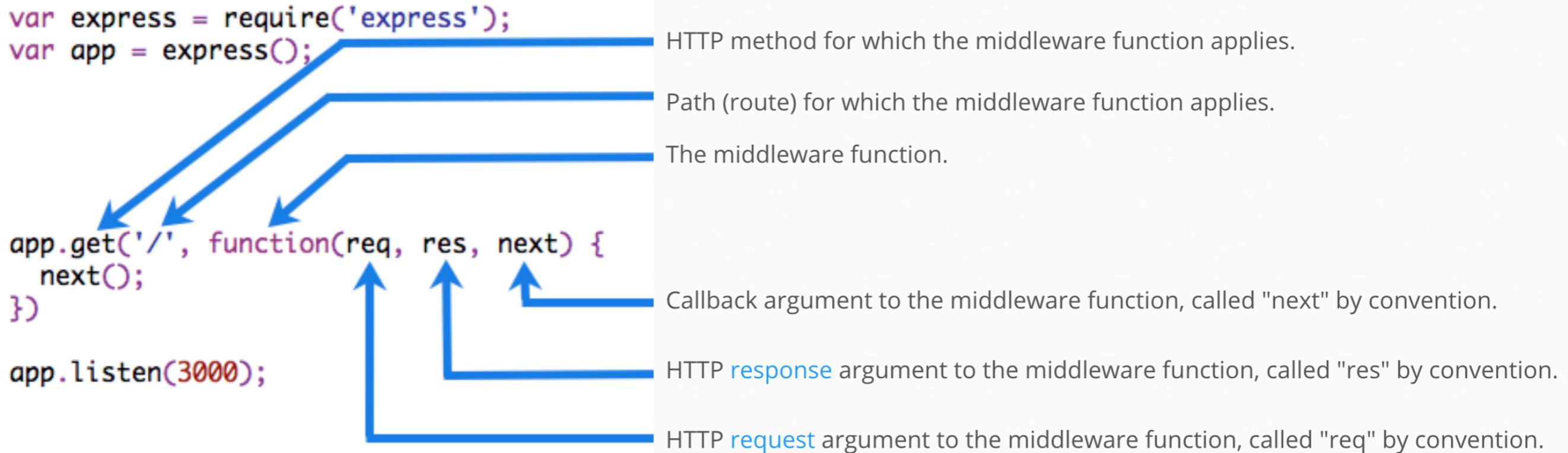
# Testing with Jest



# Express middleware



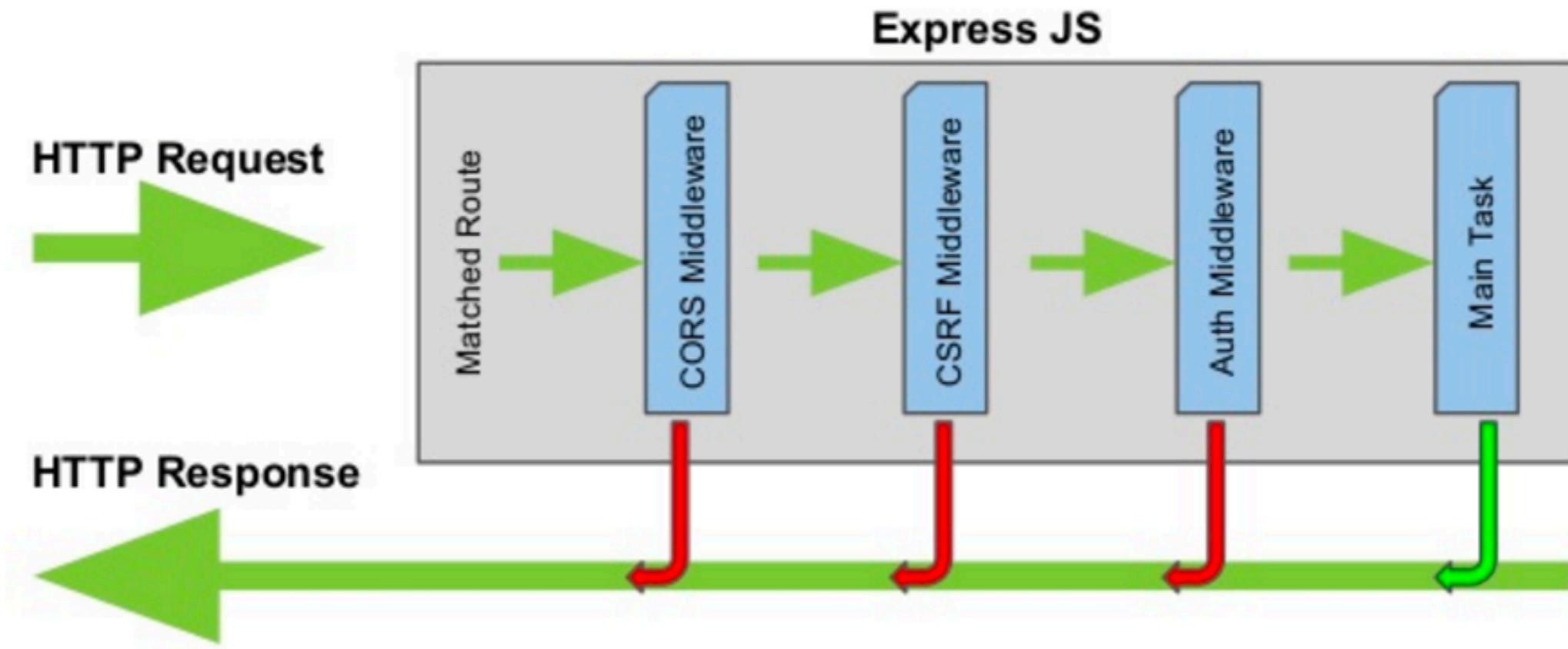
# Express middleware



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



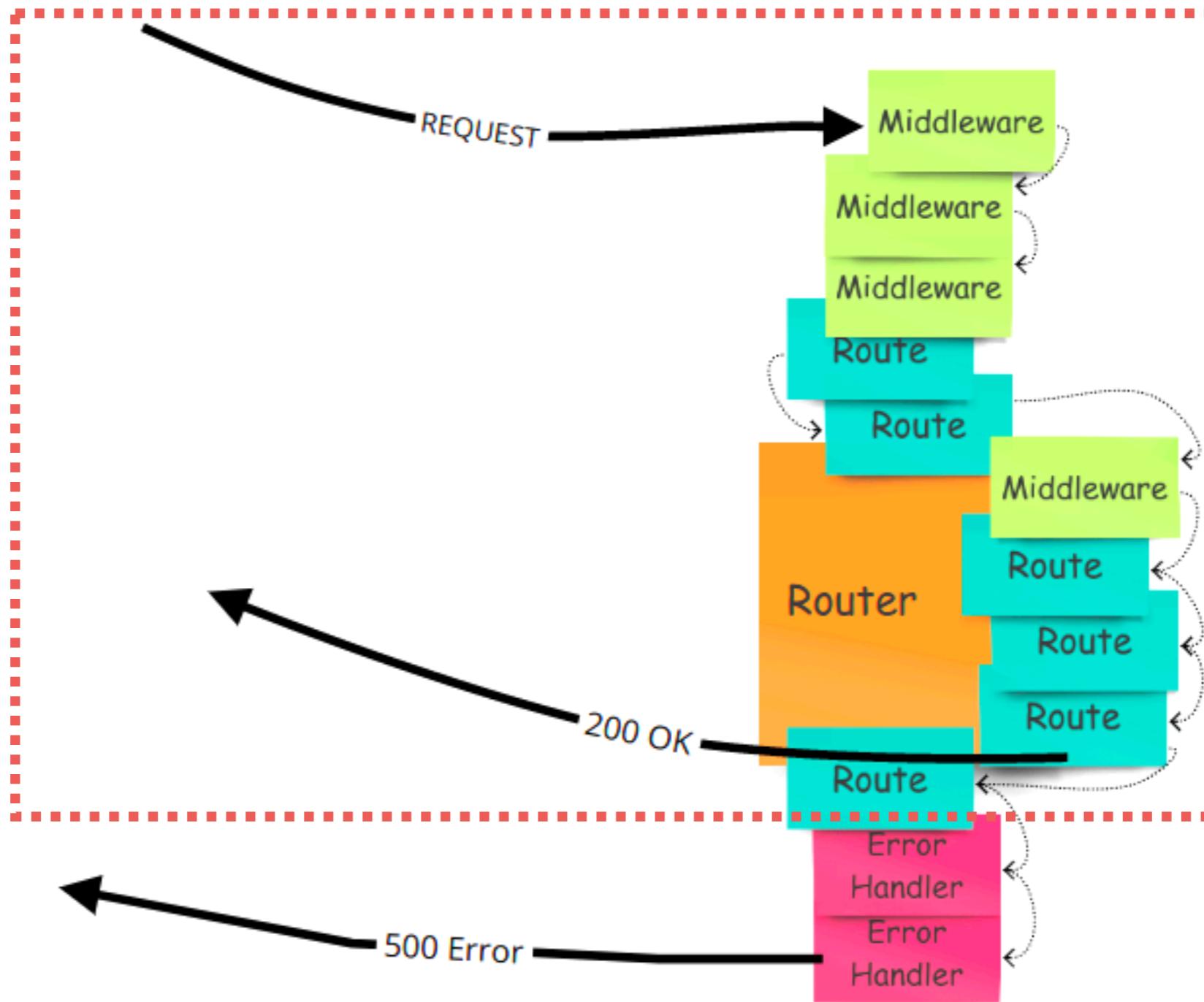
# Express middleware



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



# Express middleware



# **Authentication**

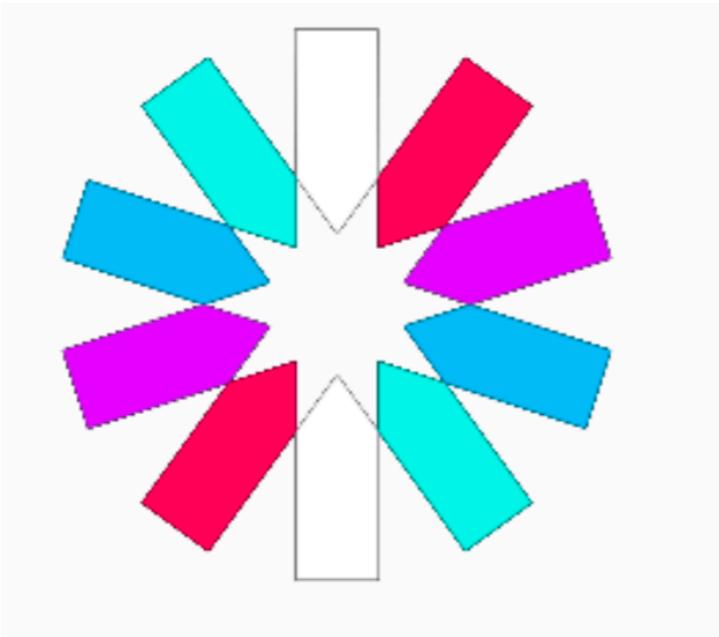
# **Authorization**



# API authentication and security

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





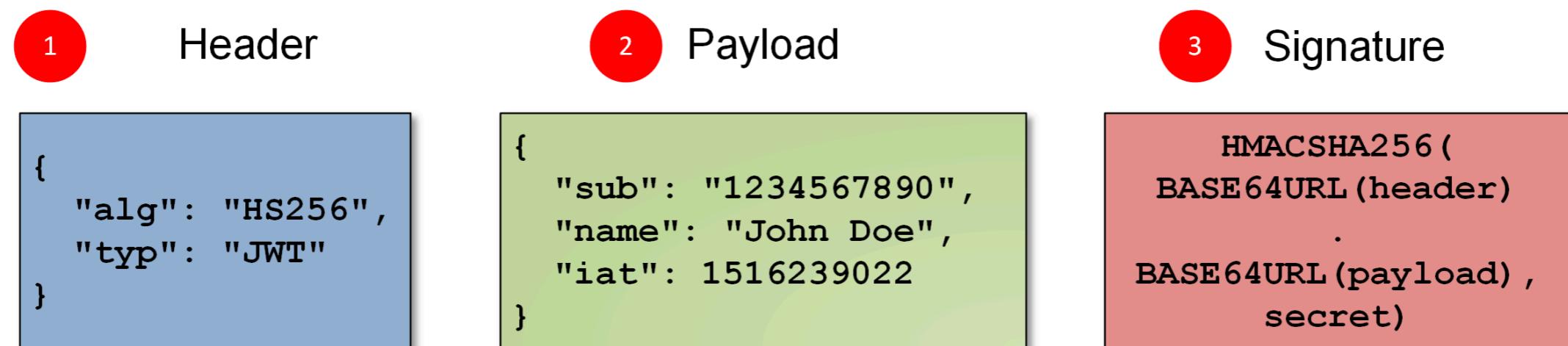
# JWT

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

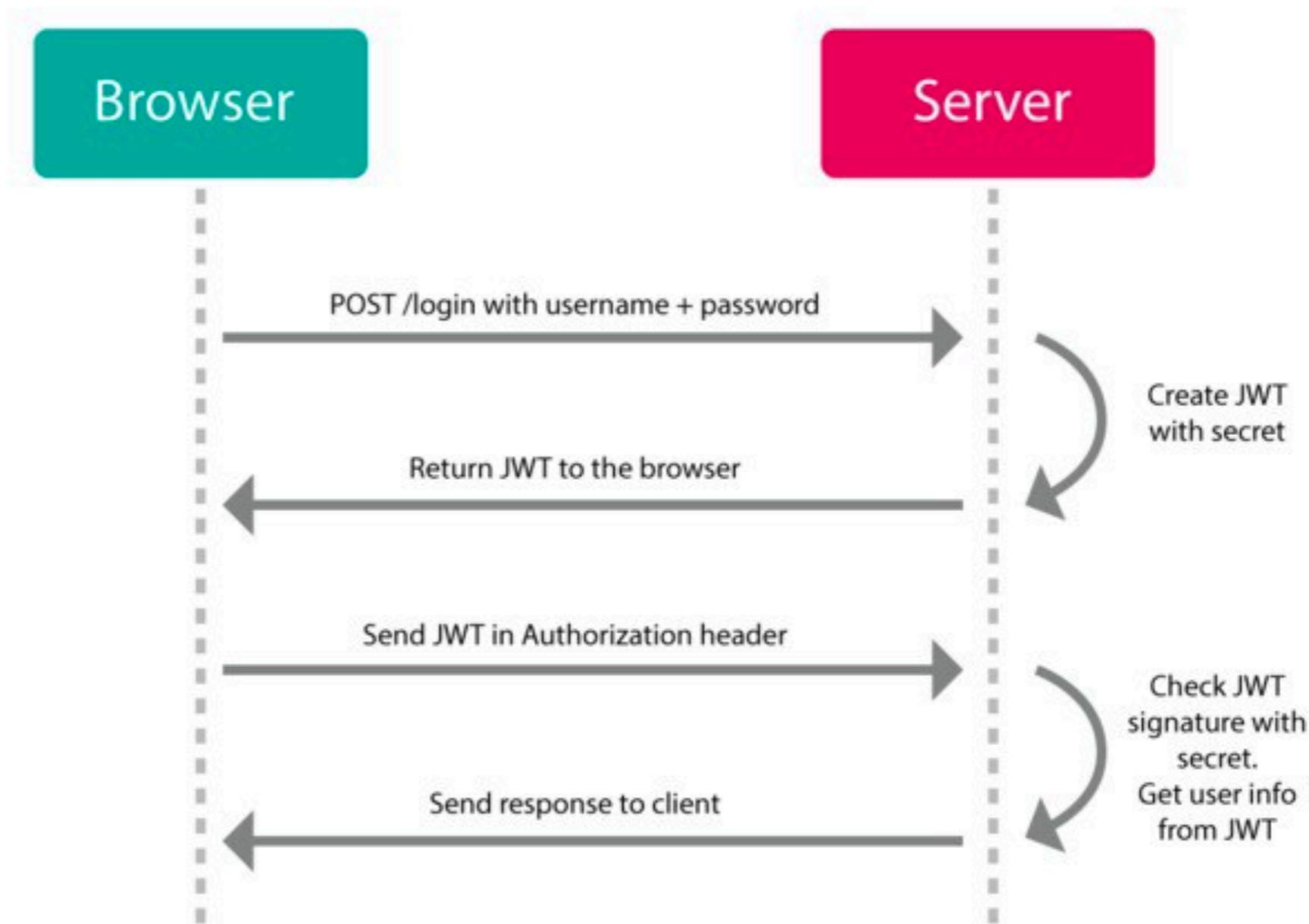


# JWT structure

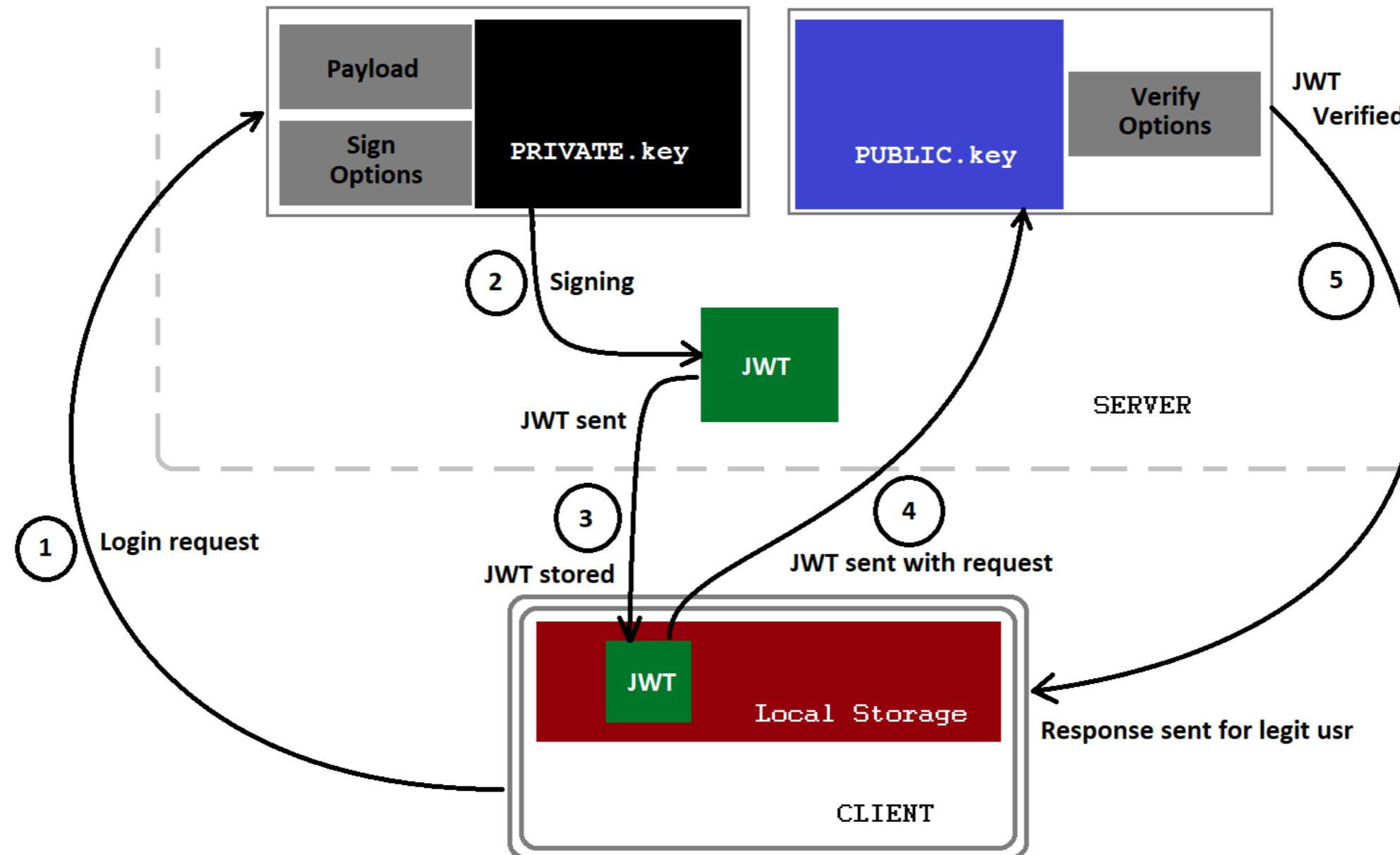
1 eyJhbGciOiJIUzI1NilsInR5cCI6IkpXVCJ9.eyJzdWliOilxMjM0NT  
Y3ODkwliwibmFtZSI6IkpvaG4gRG9IliwiaWF0IjoxNTE2MjM5M  
DlyfQ.XbPfbIHMI6arZ3Y922BhjWgQzWXcXNrz0ogtVhfEd2o 2 3



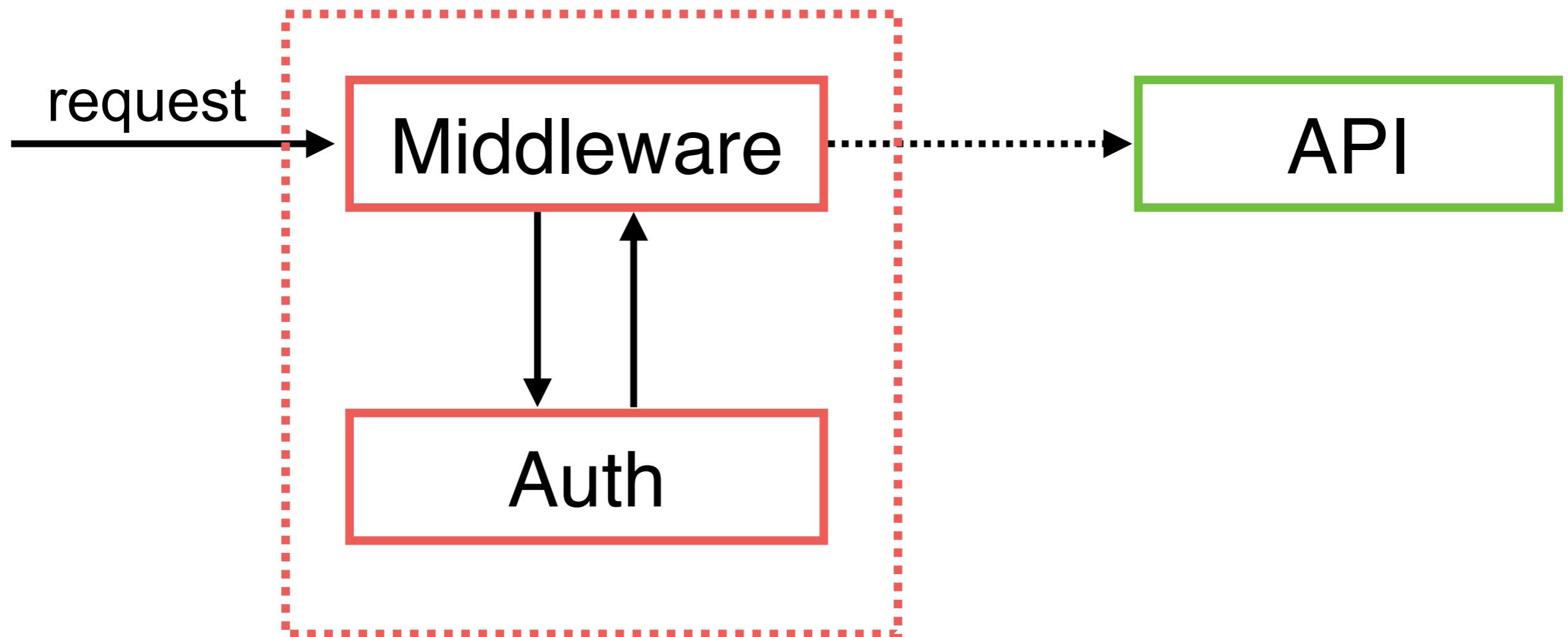
# JWT Process



# JWT Process (Better)



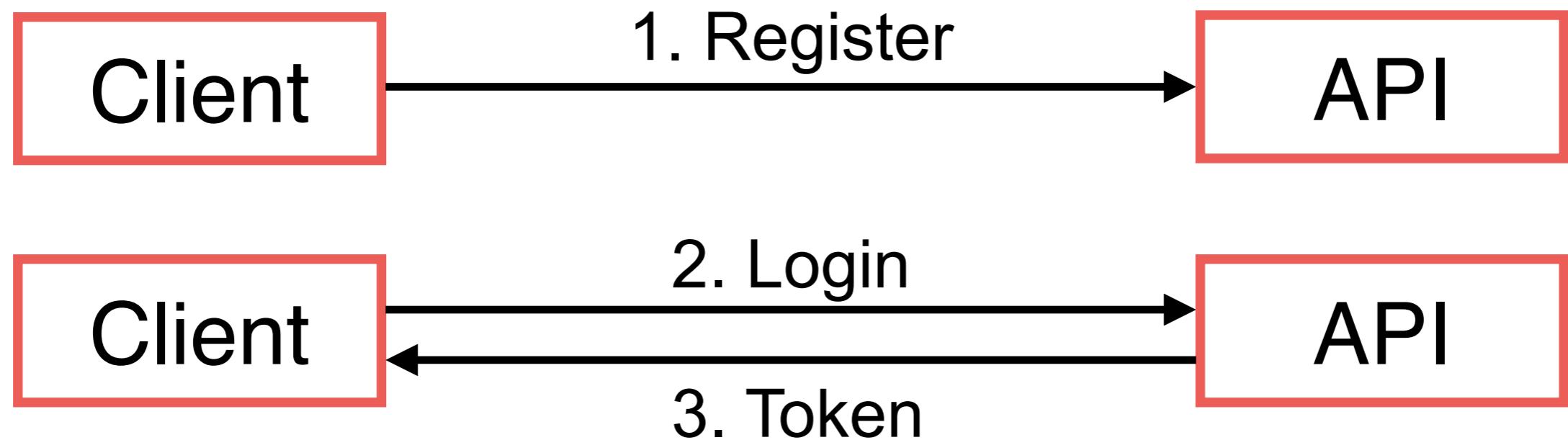
# Using Middleware



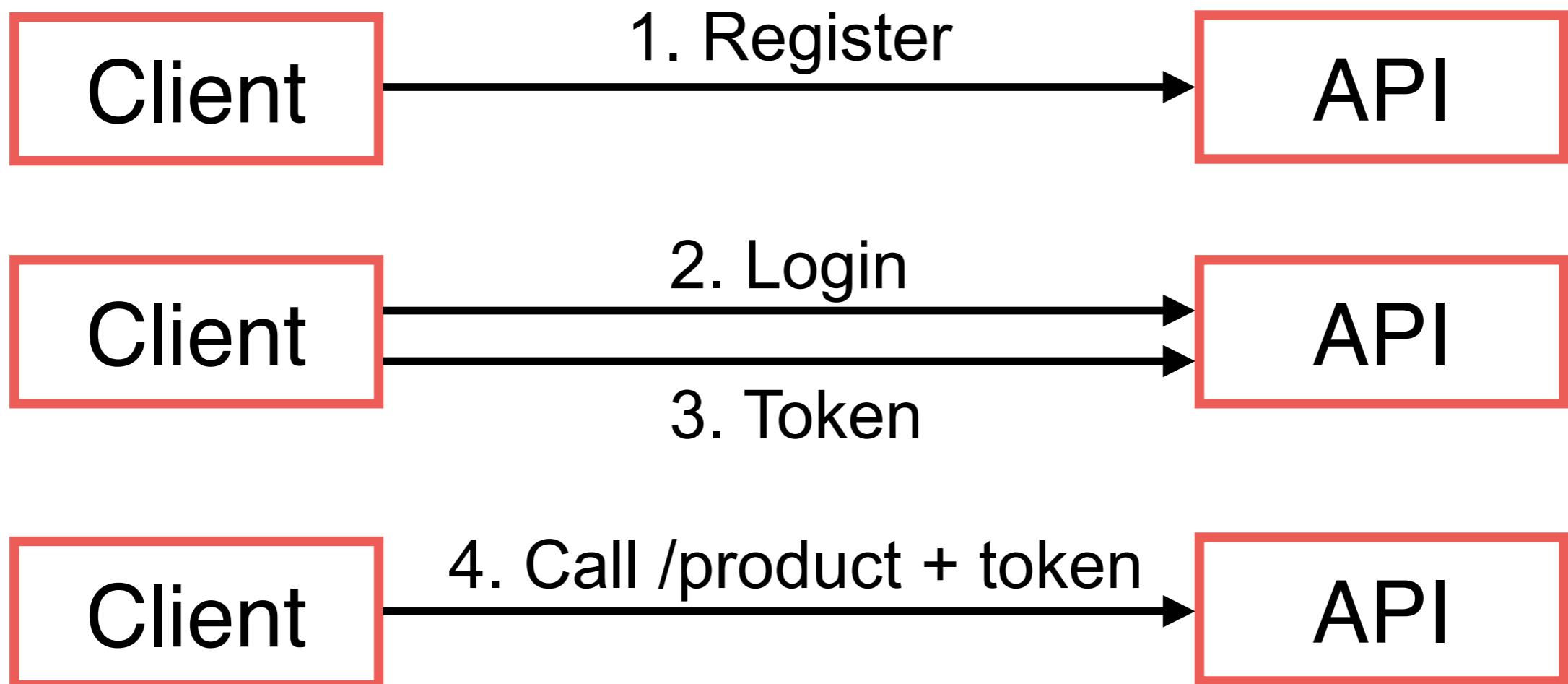
# Working with JWT



# Working with JWT

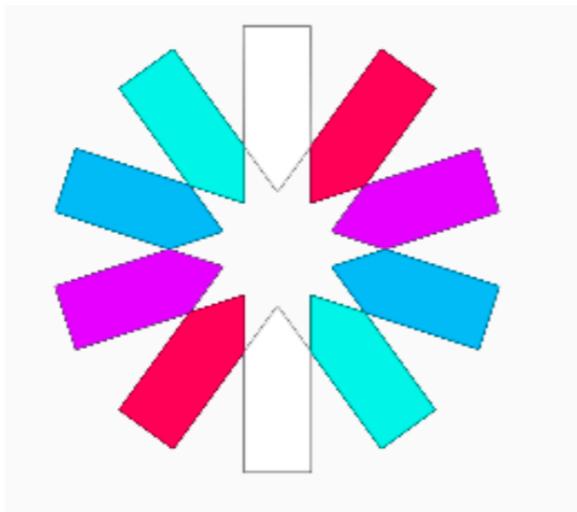


# Working with JWT



# 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

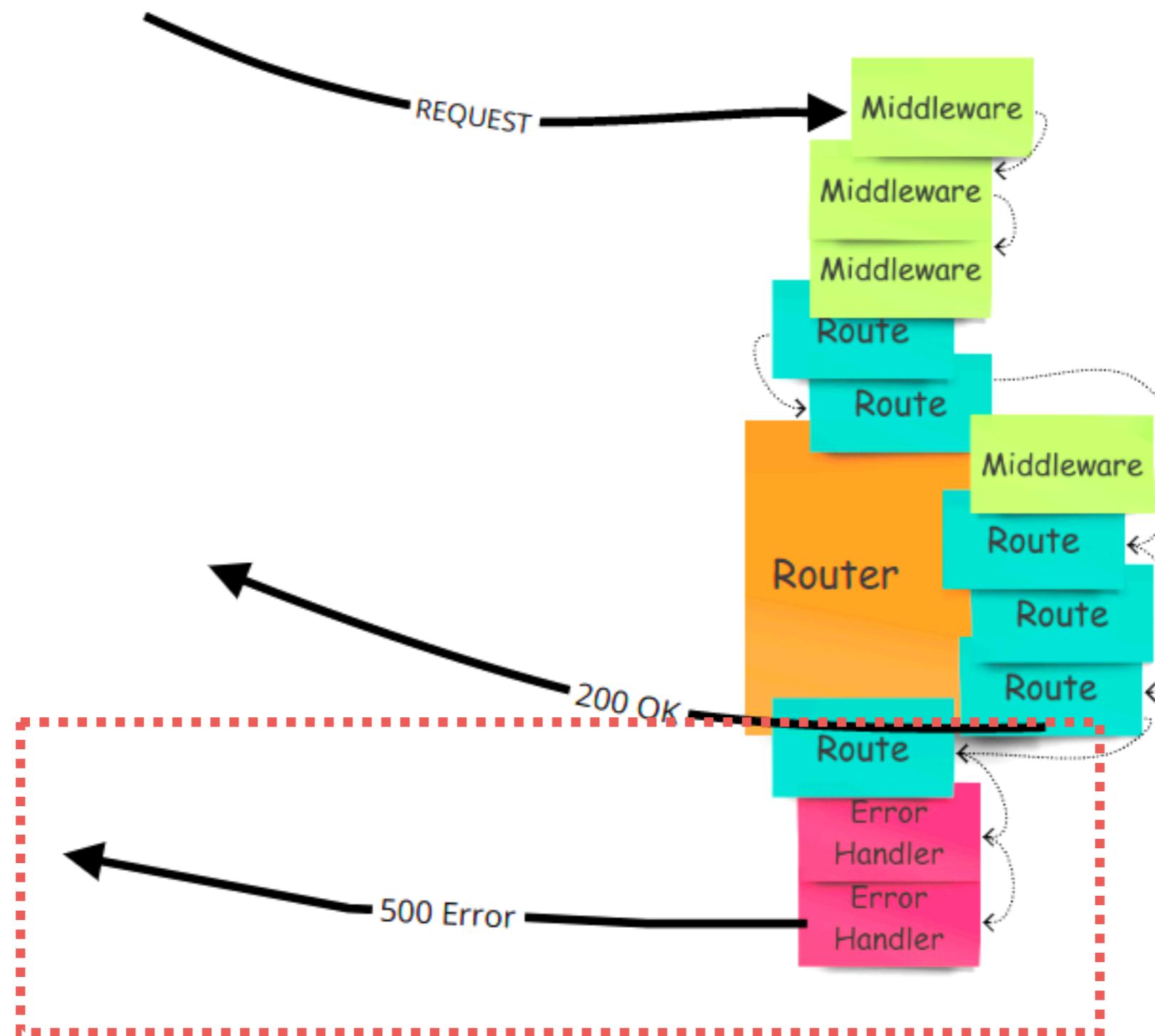
A screenshot of the Postman application interface. At the top, it shows a 'POST' method and a URL 'http://localhost:3000/secure'. On the right, there's a blue 'Send' button. Below the URL, there are tabs for 'Params', 'Authorization', 'Headers (9)', 'Body', 'Pre-request Script', 'Tests', and 'Settings'. 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.

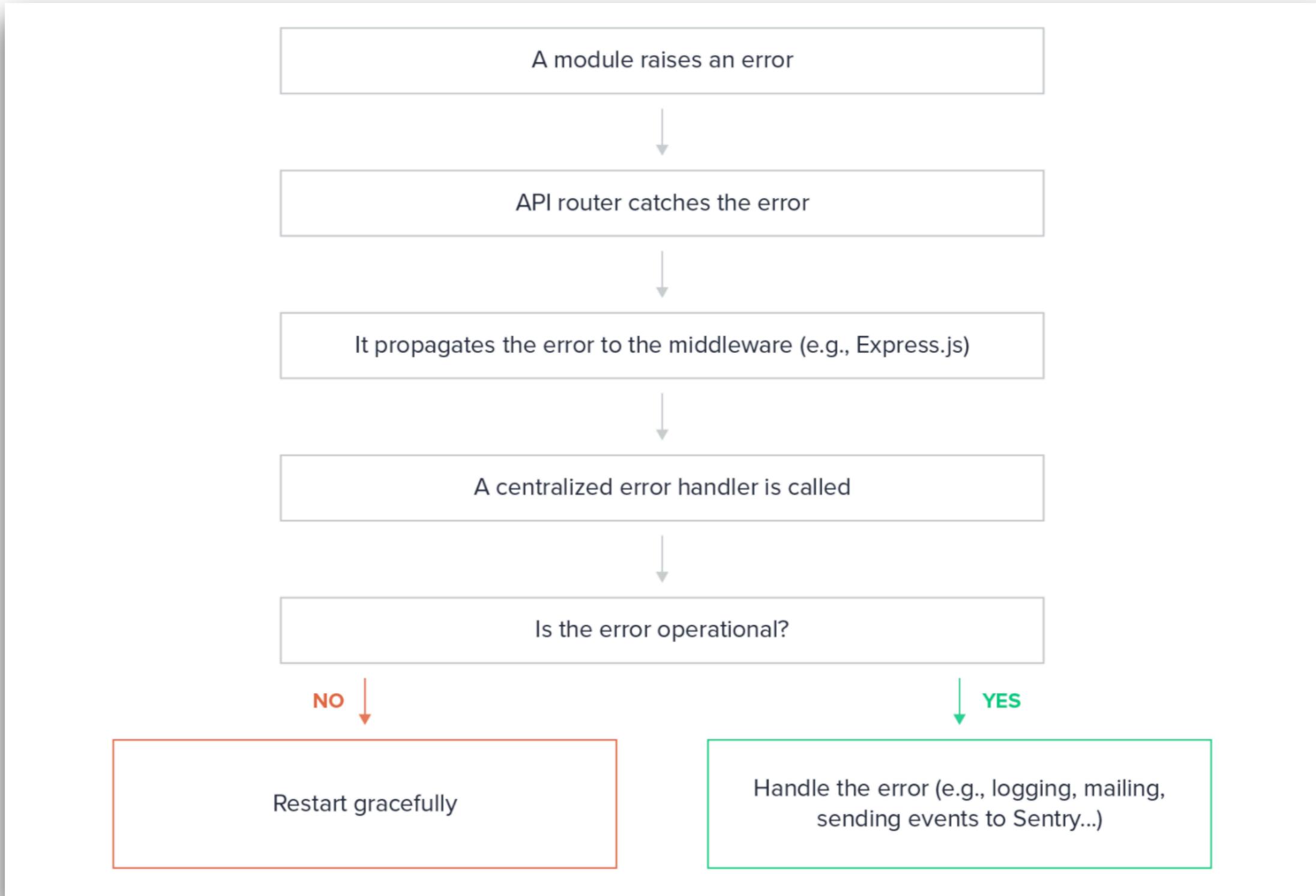


# Error Handling with Express



# Express middleware

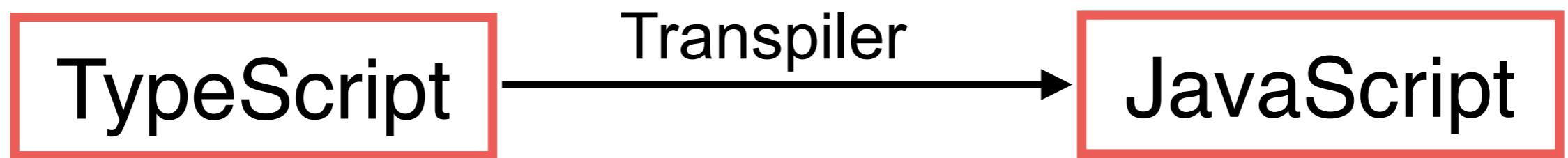


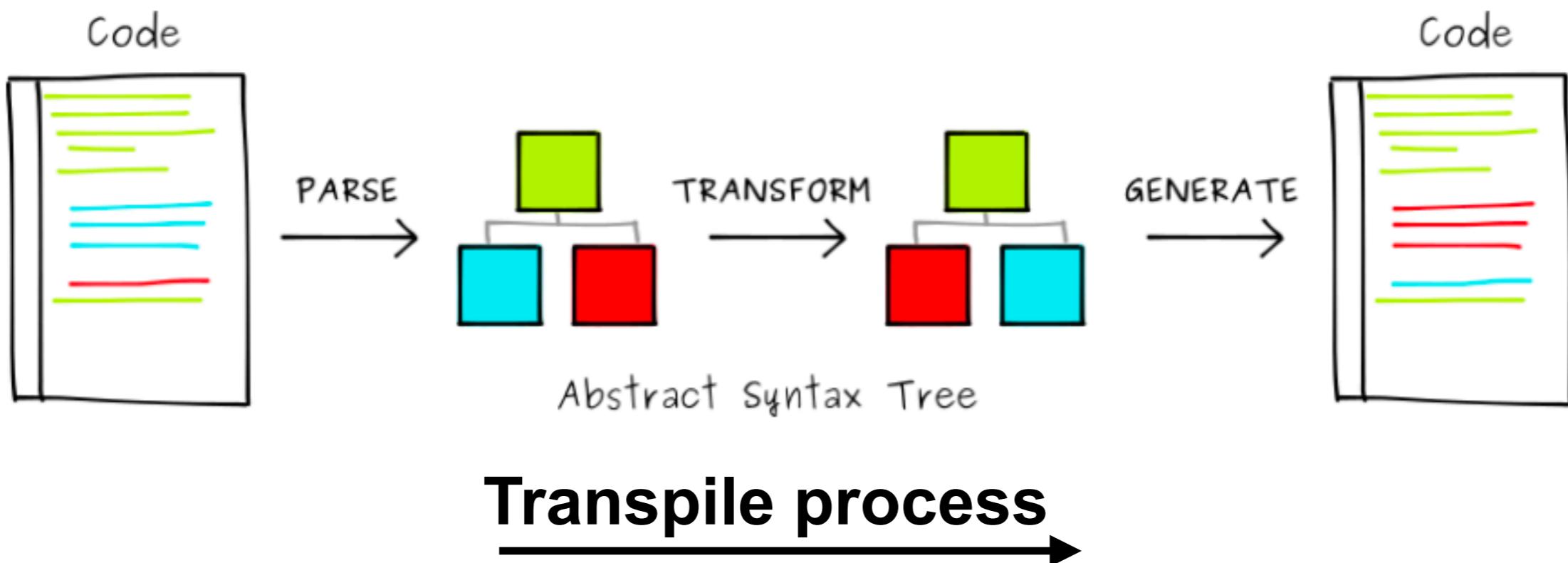


# TypeScript









# 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/>

