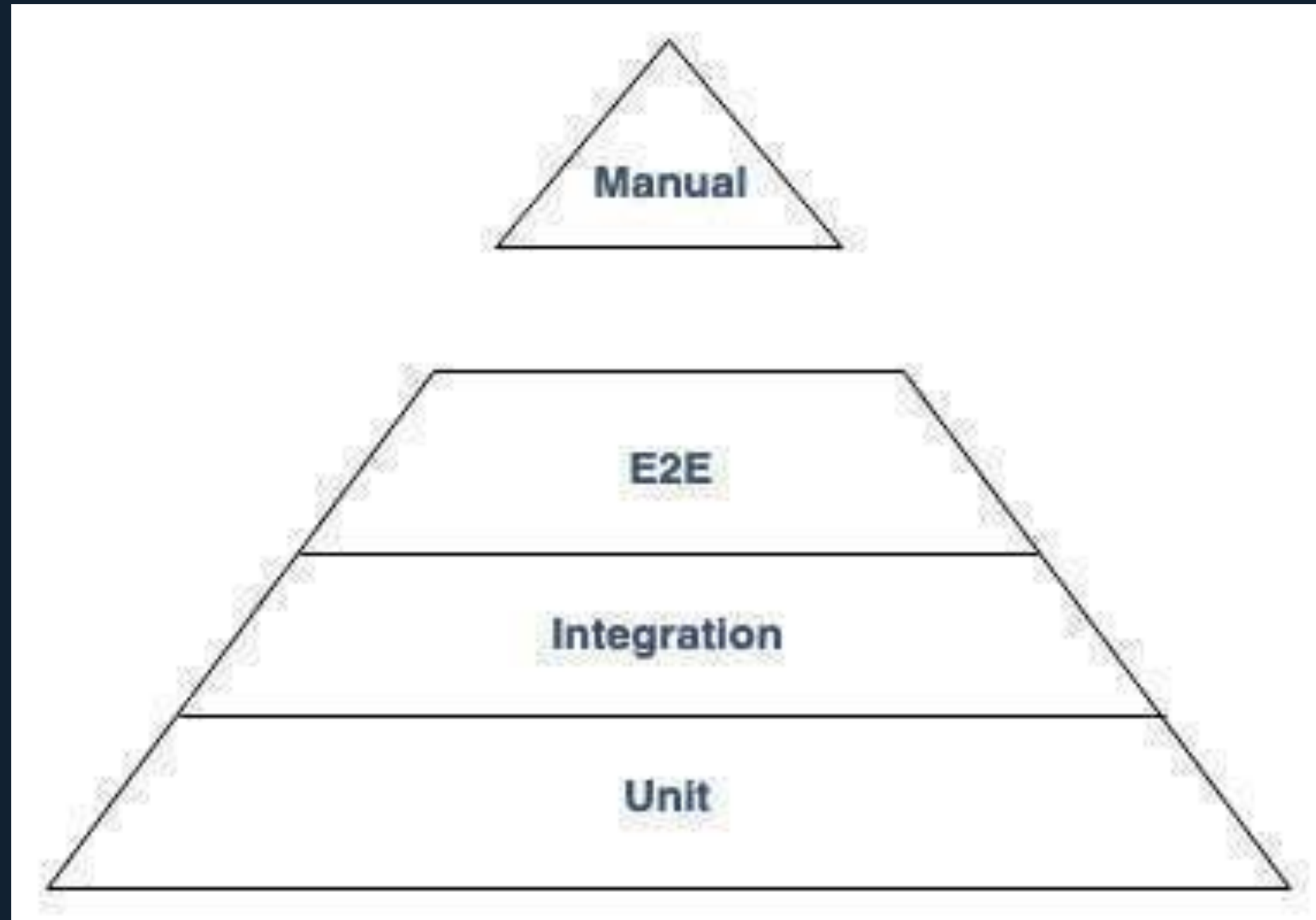


CLIENT SIDE WEB ENGINEERING CLIENT SIDE TESTING

WHY AUTOMATED TESTING

- » manual testing is expensive
 - » long feedback loop between developer/testers
- » helps to find and prevent defects
- » allow to change a systems behavior predictably
- » find/prevent defects
- » gain confidence about quality of the software

TESTING PYRAMID



TESTING PYRAMID

» Unit tests

- » lots of small and isolated tests which are fast to execute

» Integration tests

- » some integration tests which test external systems like databases

» E2E

- » few tests which test the whole system

UNIT TESTING AND TDD

- » Test driven development (also known as TDD)
- » Type of software development
- » Introduced by Kent Beck
 - » Author of Extreme Programming

WHY TDD

- » early/fast feedback during development
- » Driving the design of our application
 - » Testing is a side-effect
- » Possibility to refactor
 - » Confidence that app is still working
- » Break down large problems into small problems
 - » Think about edge cases

TDD TO ME

“Helps me to break down bigger tasks into small steps
I can keep in my head”

TDD

“TDD doesn't drive good design. TDD gives you immediate feedback about what is likely to be bad design. (Kent Beck)
I want to go home on Friday and don't think I broke something. (Kent Beck)”

WHAT IS TDD NOT

- » Silver bullet for clean code
 - » it eventually leads to better code
- » Replacement for other testing strategies
 - » TDD doesn't catch all bugs
 - » Helps adding regression tests

**“THE BEST TDD CAN DO,
IS ASSURE THAT THE
CODE DOES WHAT THE
DEVELOPER THINKS IT
SHOULD DO. (JAMES
GRENNING)”**

TDD INTRO IN 7:26 MINUTES

https://www.youtube.com/watch?v=WSes_PexXcA

ESSENTIAL VS. ACCIDENTAL COMPLICATION

- » Essential complication
 - » The problem is hard
 - » eg. Tax return Software
 - » nothing we can do about
- » Accidental complication
 - » We are not so good in our job
 - » eg. future proofing code

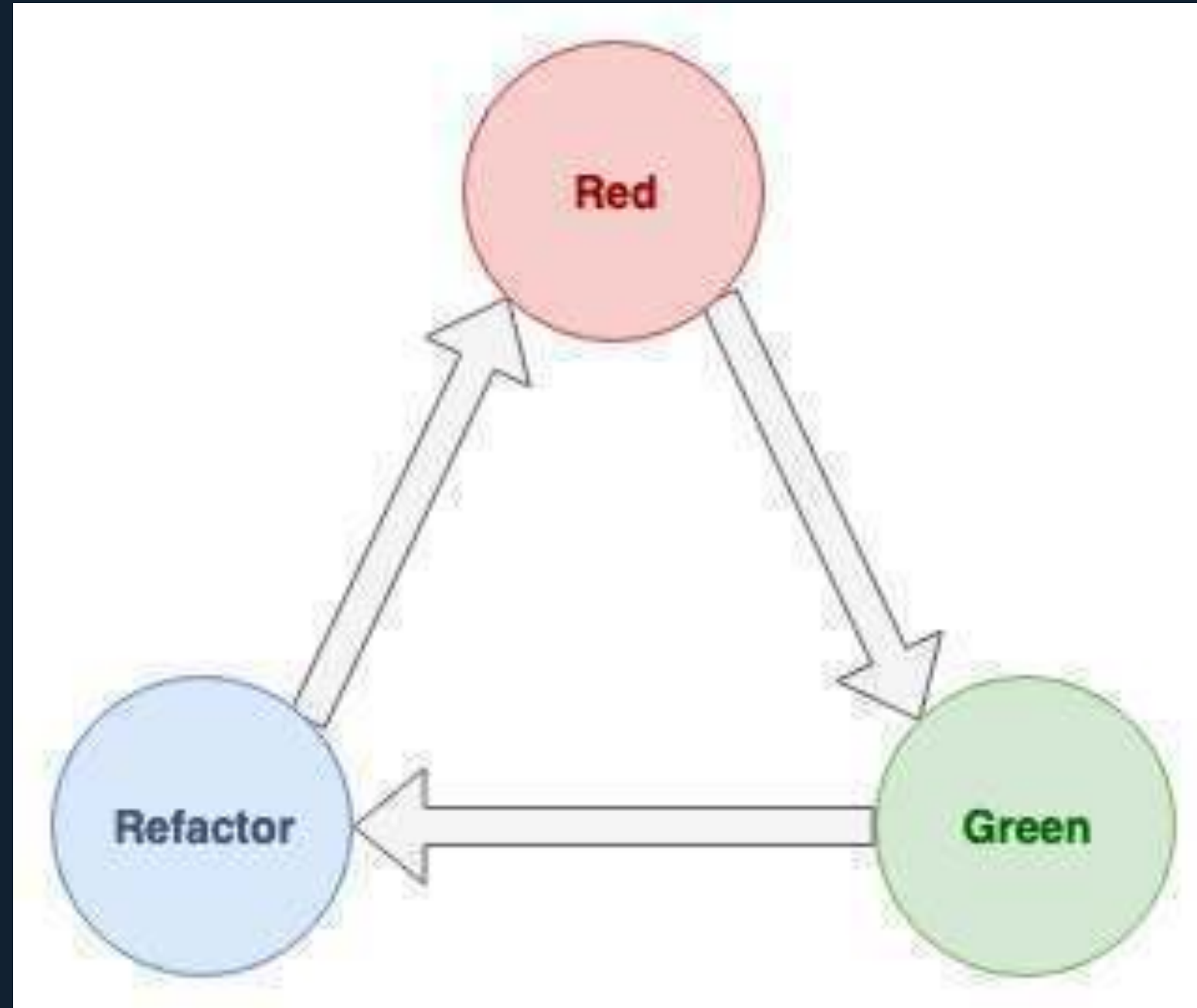
ACCIDENTAL COMPLICATION

- » future proofing code
- » cutting corners
 - » to get stuff out of the door
 - » we're not going to change this anyways
- » drives up the cost/development time of a feature
 - » mostly the feature isn't complex
 - » the way the app is built drives the cost of a

AVOID ACCIDENTAL COMPLICATION

- » Baby steps and TDD
- » Refactor a little after every feature/green test
 - » clean the kitchen
 - » prevents big bang refactoring
 - » which are hard to sell to business
- » Without refactoring features will take longer

TDD CYCLE



TDD CYCLE

- » Red: Write a test and watch it fail
- » Green: Write just as much code to make the test pass
- » Refactor: Clean up

RED

- » Think about the test description
- » Descriptions should reflect the behaviour of the program

```
it('when product A given, price is 3$', () => {  
  expect(calculatePrice('productA')).toEqual('3$')  
})
```

GREEN

» Write just enough code to make the test pass

» if there is only 1 product just return 3\$

```
function calculatePrice () {  
    return '3$'  
};
```

```
it('when product A given, price is 3$', () => {  
    expect(calculatePrice('productA')).toEqual('3$')  
})
```

REFACTOR

» Change the code without changing any of the behaviour

» "Clean the kitchen"

```
const calculatePrice = () => '3$'
```

```
it('when product A given, price is 3$', () => {  
  expect(calculatePrice('productA')).toEqual('3$')  
})
```

RED (REPEAT)

» start with the next test-case

```
const calculatePrice = () => '3$'
```

```
it('when product A given, price is 3$', () => {  
  expect(calculatePrice('productA')).toEqual('3$')  
})
```

```
it('when product b given, price is 10$', () => {  
  expect(calculatePrice('productB')).toEqual('10$')  
})
```

GREEN

» start with the next test-case

```
const calculatePrice = (product) => {  
  if (product === 'productA') { return '3$' }  
  if (product === 'productB') { return '10$' }  
}
```

```
it('when product A given, price is 3$', () => {  
  expect(calculatePrice('productA')).toEqual('3$')  
})
```

```
it('when product B given, price is 10$', () => {  
  expect(calculatePrice('productB')).toEqual('10$')  
})
```

```
const calculatePrice = (product) => {  
  if (product === 'productA') { return '3$' }  
  if (product === 'productB') { return '10$' }  
}  
  
it('when product A given, price is 3$', () => {  
  expect(calculatePrice('productA')).toEqual('3$')  
})  
  
it('when product B given, price is 10$', () => {  
  expect(calculatePrice('productB')).toEqual('10$')  
})  
  
it('when unknown product is given, throws UnknownProductError', () => {  
  expect(() => calculatePrice('productB')).toThrow(UnknownProductError)  
})
```

```
class UnknownProductError extends Error {}

const calculatePrice = (product) => {
  if (product === 'productA') { return '3$' }
  if (product === 'productB') { return '10$' }
  throw new UnknownProductError();
}

it('when product A given, price is 3$', () => {
  expect(calculatePrice('productA')).toEqual('3$')
})

it('when product B given, price is 10$', () => {
  expect(calculatePrice('productB')).toEqual('10$')
})

it('when unknown product is given, throws UnknownProductError', () => {
  expect(() => calculatePrice('productB')).toThrow(UnknownProductError)
})
```

ANATOMY OF A TEST

- » Arrange => test setup
- » Act => call the unit to test
- » Assert => verify the result

ANATOMY OF A TEST

```
it('employeeReport: returns a list of employees ordered by their name', () => {  
  // Arrange  
  const employees = [  
    { name: 'Sepp' },  
    { name: 'Max' },  
    { name: 'Anton' }  
  ]  
  
  // Act  
  const result = employeeReport(employees)  
  
  // Assert  
  assertThat(result, orderedBy((a, b) => a.name < b.name))  
})
```

WHAT MAKES A GOOD UNIT TEST

- » Deterministic
 - » randomness hard to test
 - » current date or time is hard to test
- » Tests should not have any effect on the system
 - » changing global state (eg. database)
- » no external systems are called
- » little test setup

CODE KATA

- » Small exercise
 - » to improve programming skills
 - » by challenging your abilities
 - » and encouraging you to find multiple approaches

STEPS

- » Step 1: Think
- » Step 2: Write a test
- » Step 3: How much does this test suck?
- » Step 4: Run the test and watch it fail
- » Step 5: Write just enough code to make it pass
- » Step 6: Cleanup

FIZZ BUZZ (20 MINUTES)

- » go to <http://tddbin.com/>
- » or `git clone git@github.com:webpapaya/fhs-tdd-starter.git`
- » <https://codingdojo.org/kata/FizzBuzz/>

ISOLATING UNITS UNDER TEST

RECAP: WHAT MAKES A GOOD UNIT TEST

- » Deterministic
 - » randomness hard to test
 - » current date or time is hard to test
- » Tests should not have any effect on the system
 - » changing global state (eg. database)
- » no external systems are called

DUMMY OBJECTS

- » Objects which aren't used
 - » so that the compiler doesn't complain
 - » used to fill parameter lists
 - » not relevant for JS but if you're using TS you might need these

```
class Person {  
  constructor(public firstName: string, public age: number) {}  
  isOfLegalAge(): boolean { return this.age >= 18 }  
}  
  
it('when age is 18, Person is of legal age', () => {  
  const person = new Person("Max", 18)  
  //      ^^^^  
  // this parameter would be a dummy object as it's  
  // not relevant for the test  
  
  // ...  
})
```


FAKE OBJECTS

- » Objects have a working implementation
 - » but take some shortcuts
 - » eg. inMemoryDatabases instead of persistent DB
- » example fake-local-storage

STUB OBJECTS

- » Predefined return values for testing
- » Instead of calling the real API we return a value for testing
- » Examples:
 - » retrieving geolocation in tests
 - » testing edge cases (eg.: database throws `OutOfMemory` exception)

```
const retrieveGPSPosition = () =>  
  Promise.resolve({ lat: 12.12, lng: 14.15 })
```

SPY OBJECTS

» Are stubs that also record the way they were called

» Used to verify side effects (eg. E-Mail sending)

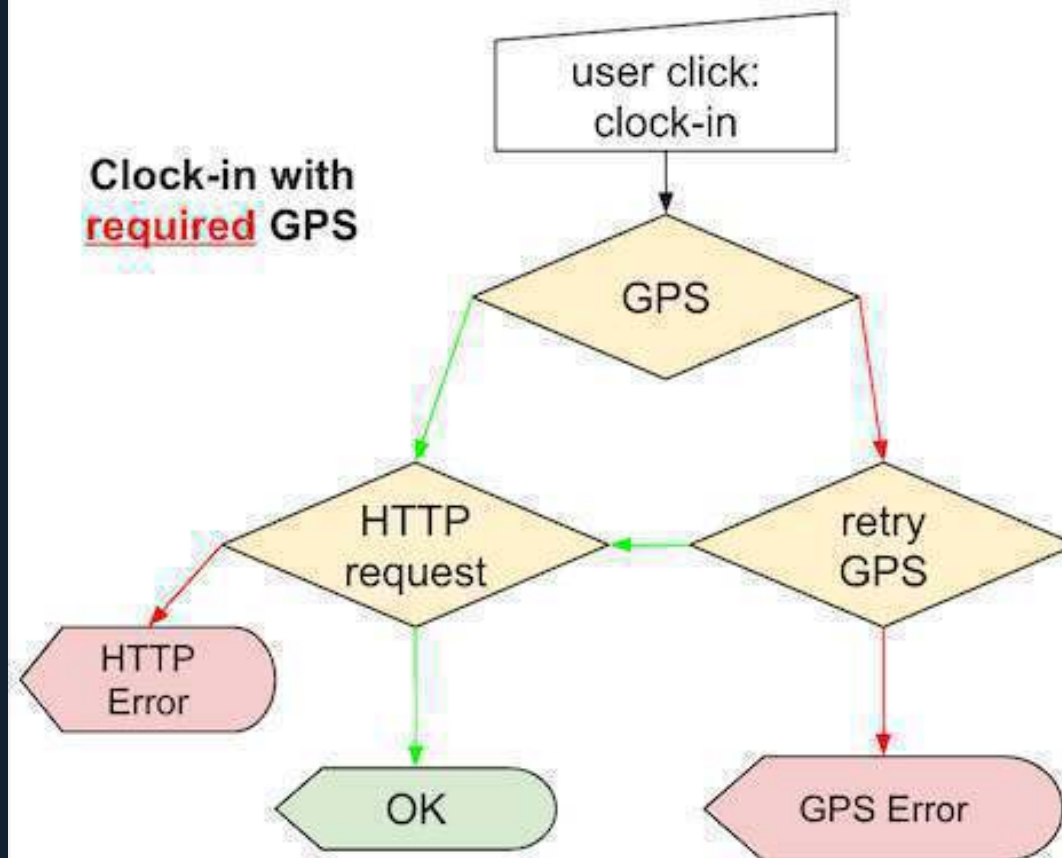
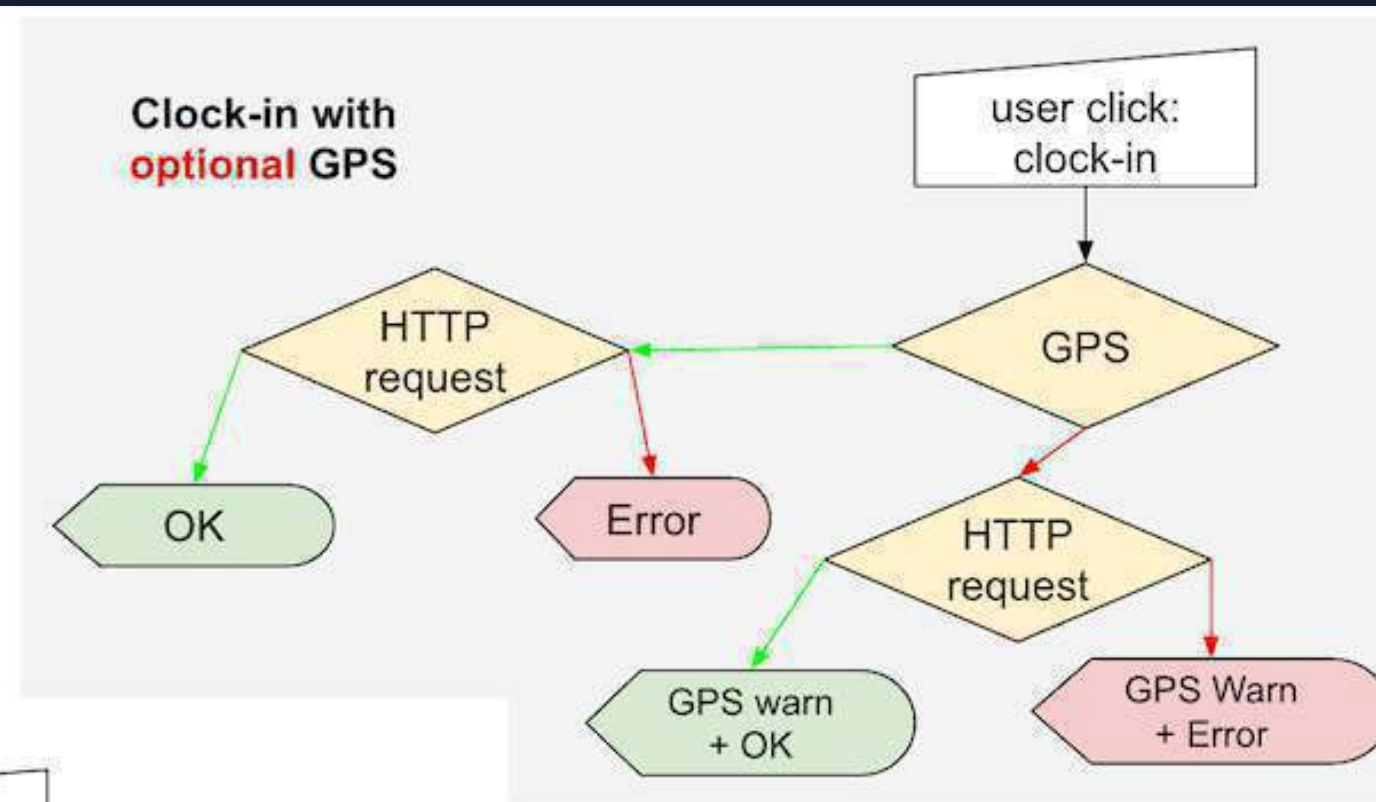
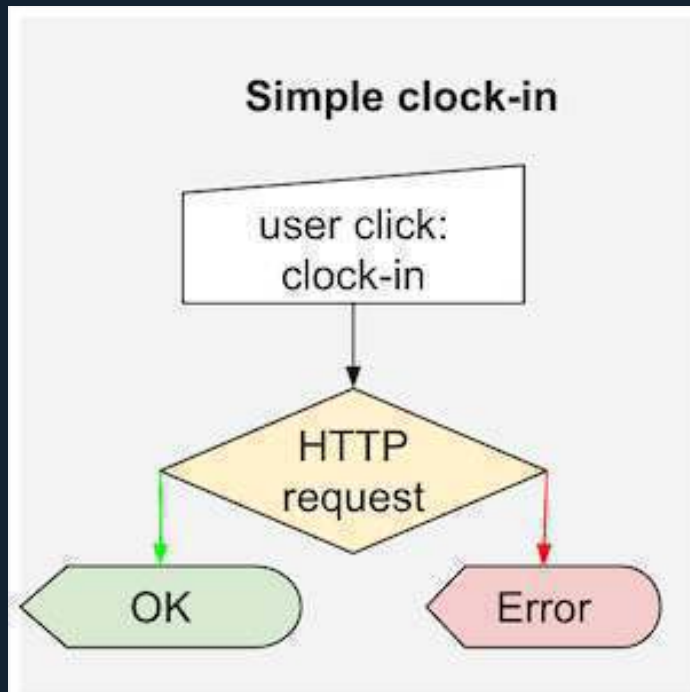
```
it('sends an email on sign up', () => {  
  const username = 'username'  
  const password = 'password'  
  
  const sendEmail = jest.fn() // create a spy  
  const signUp = signUp(username, password, { sendEmail })  
  
  expect(sendEmail).toHaveBeenCalledWith(username, password);  
  //                ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^  
  // verify that the spy has been called  
})
```

CLOCK IN KATA (REST OF THE LECTURE)

- » go to `http://tddbin.com/`
- » `http://kata-log.rocks/clock-in-kata`

REMEMBER STEPS

- » Step 1: Think
- » Step 2: Write a test
- » Step 3: How much does this test suck?
- » Step 4: Run the test and watch it fail
- » Step 5: Write just enough code to make it pass
- » Step 6: Cleanup



Bonus

- 3 x retry GPS
- network error
- timeout
- unify all of them

Legend

Success →

Error →

asynchronous action

HOMEWORK

» Homework:

» can be done in pairs

» implement <https://codingdojo.org/kata/Bowling/>

» Work in a strict TDD loop

» commit before every new test

» write descriptive commit messages

» try to implement as little as possible in one

RESOURCES

» Integrated Tests are a Scam

» Is TDD Dead

» Mocks, Stubs, Spys

» Extreme Programming

» TDD