TESTING WEB APIS

Frank Walsh

AGENDA

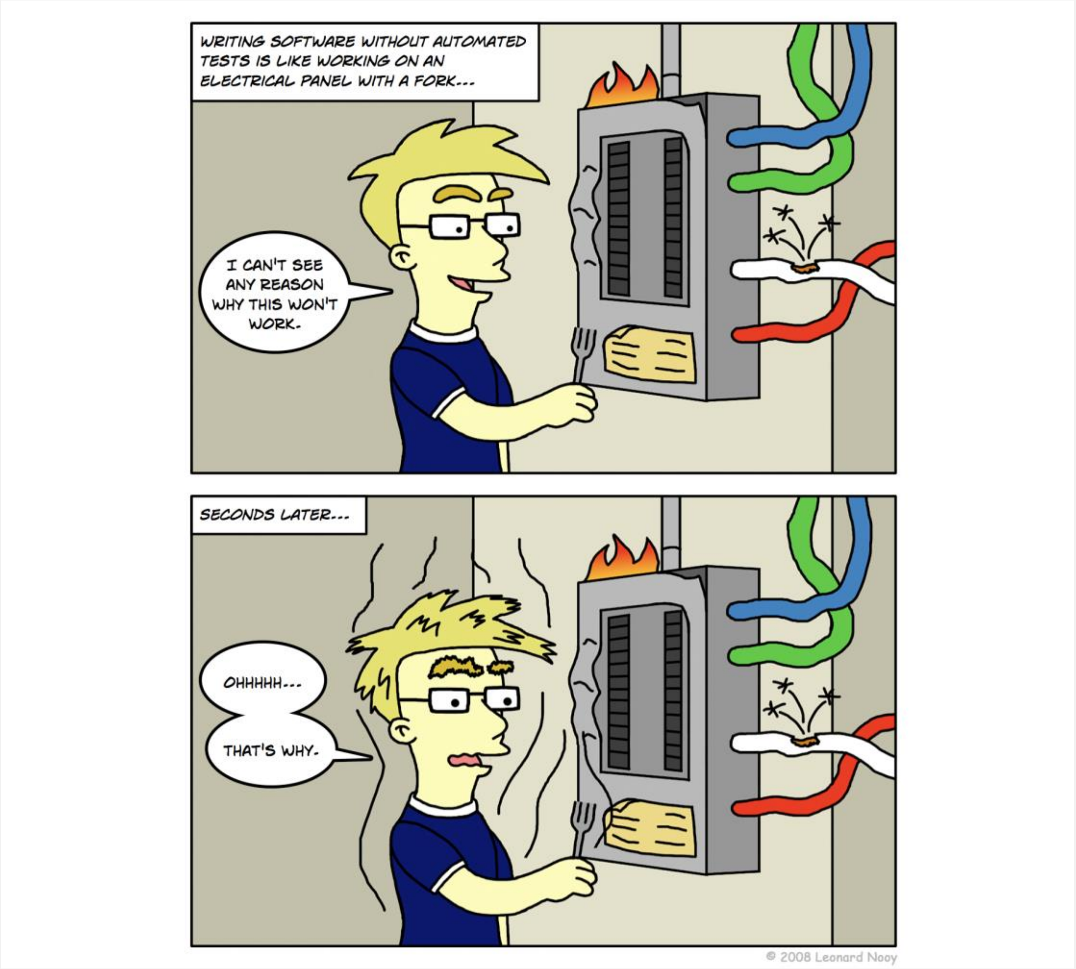
- Testing
- Test Driven Dev/Behaviour Driven Dev
- Automated Testing with Postman
  - Postman Collections
  - Postman Variables
  - Assertion framework: Chai
  - Newman

TEST CATEGORIES

- Static testing
  - Find typos/basic syntax errors
- Unit Testing
  - Test one single unit in isolation
- Integration Testing
  - Separate units work together
- End-to-End
  - Complete flow of project

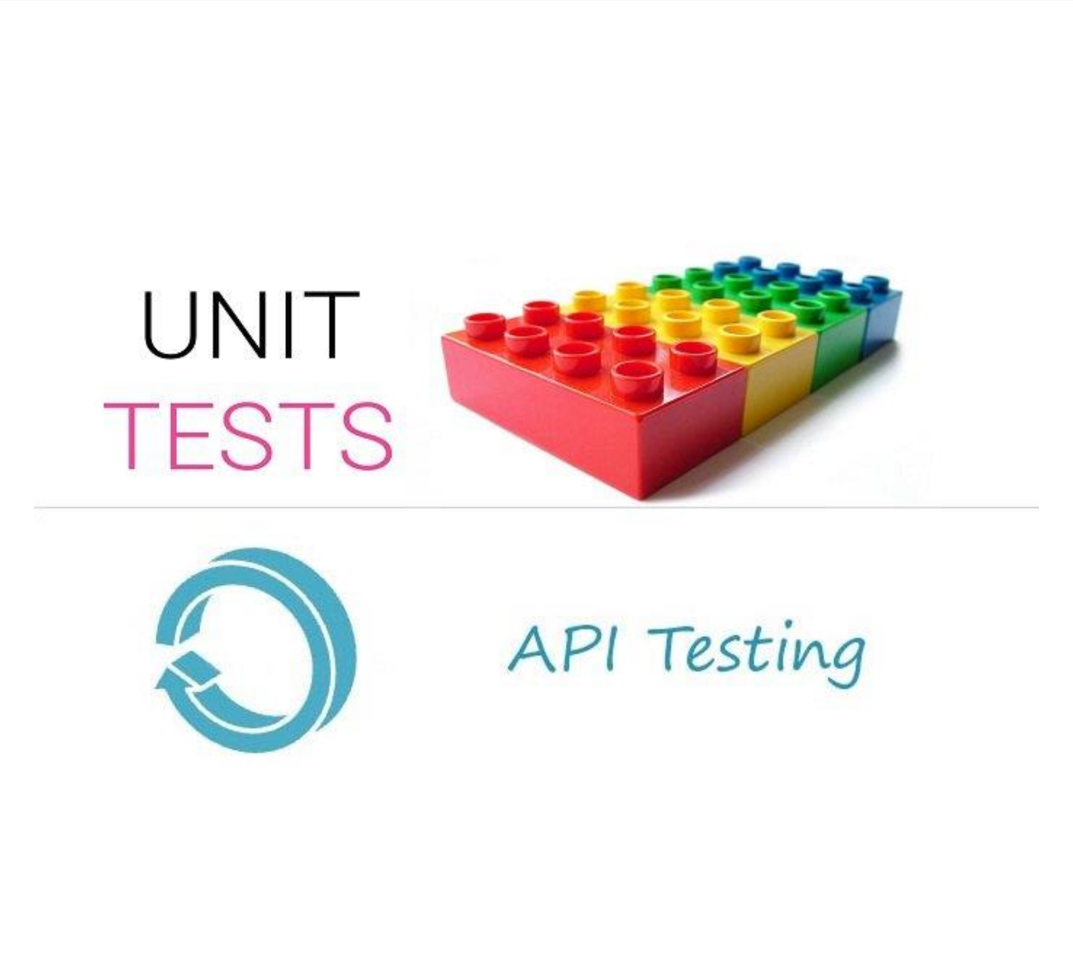
UNIT TESTING

- Code written by developer that exercises a small, specific area of functionality.
- “Program testing can be used to show the presence of bugs, but never to show their absence!” – Dijkstra
- Up to now – Manual tests with Postman
  - Not structured
  - Not repeatable
  - Not easy


WRITING SOFTWARE WITHOUT AUTOMATED TESTS IS LIKE WORKING ON AN ELECTRICAL PANEL WITH A FORK...
I CAN'T SEE ANY REASON WHY THIS WON'T WORK.
SECONDS LATER...
OHHHHH...
THAT'S WHY.
© 2008 Leonard Nooy

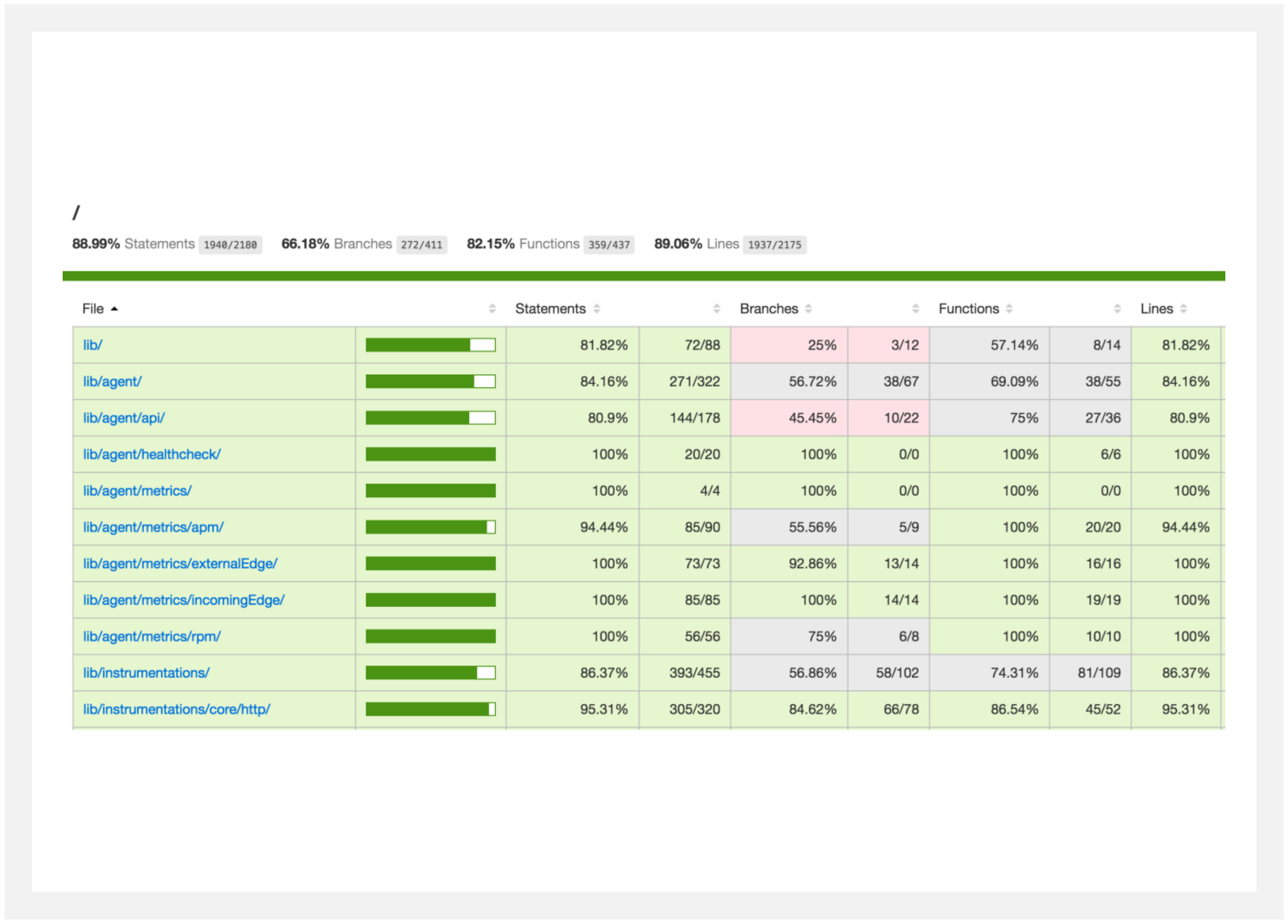
UNIT TESTS

- Unit Tests are specific pieces of code
- Tests are written by developers of the code, usually
  - Sometimes before the code is written
- Part of the code repository
  - They go where the code goes
- Use a testing framework
  - Junit, Jasmine, Chai, Mocha



UNIT TEST CONVENTION

- All objects and methods
- Look for 100% coverage
  - Although property getters/setters are sometimes omitted
- All tests should pass before commits?



/

88.99% Statements `1940/2180` **66.18%** Branches `272/411` **82.15%** Functions `359/437` **89.06%** Lines `1937/2175`

File ▲		Statements		Branches		Functions		Lines
lib/		81.82%	72/88	25%	3/12	57.14%	8/14	81.82%
lib/agent/		84.16%	271/322	56.72%	38/67	69.09%	38/55	84.16%
lib/agent/api/		80.9%	144/178	45.45%	10/22	75%	27/36	80.9%
lib/agent/healthcheck/		100%	20/20	100%	0/0	100%	6/6	100%
lib/agent/metrics/		100%	4/4	100%	0/0	100%	0/0	100%
lib/agent/metrics/apm/		94.44%	85/90	55.56%	5/9	100%	20/20	94.44%
lib/agent/metrics/externalEdge/		100%	73/73	92.86%	13/14	100%	16/16	100%
lib/agent/metrics/incomingEdge/		100%	85/85	100%	14/14	100%	19/19	100%
lib/agent/metrics/rpm/		100%	56/56	75%	6/8	100%	10/10	100%
lib/instrumentations/		86.37%	393/455	56.86%	58/102	74.31%	81/109	86.37%
lib/instrumentations/core/http/		95.31%	305/320	84.62%	66/78	86.54%	45/52	95.31%

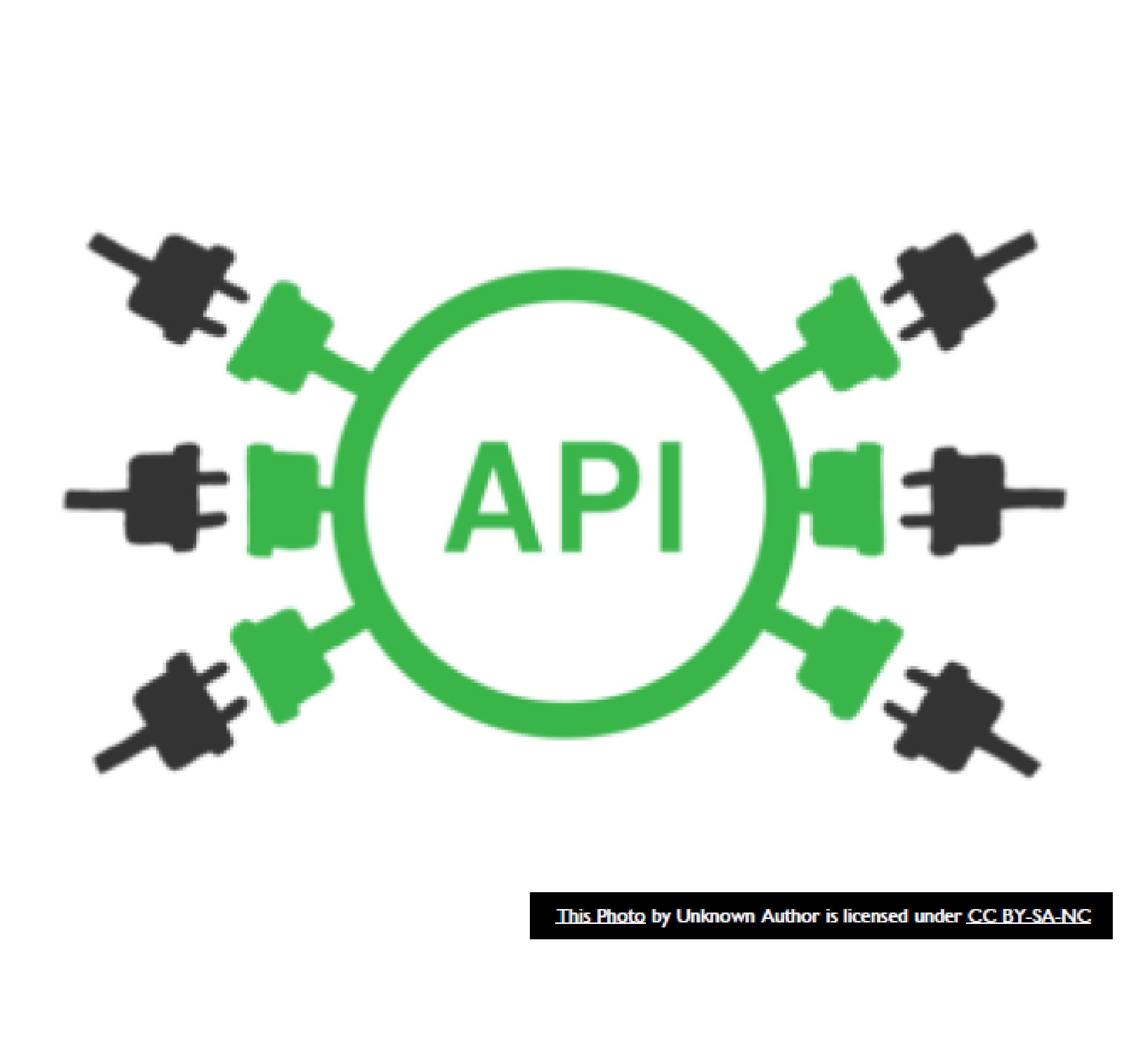
INTEGRATION TESTING

- Combines several components into a test
- Exposes faults in interaction between integrated components
- Usually done after unit testing
- Performed by devs and independent testers

2 UNIT TESTS, 0 INTEGRATION TESTS
via reddit.com/r/programmerhumor

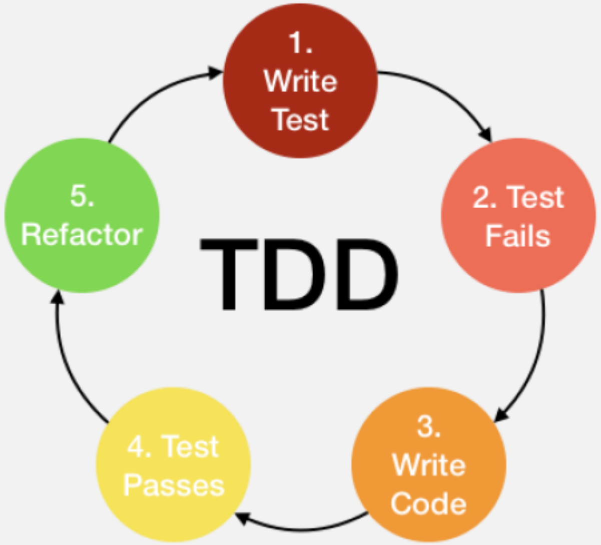
TESTING OUR API

- Is this integration or unit testing?
  - Integration testing, because you have to run a web server (locally)
  - Your Web API is an "Application boundary"
    - Requires HTTP to interact with it
  - And you've a DB/3rd party APIs going
  - So you're testing more than just your code…



ASIDE – TDD AND BDD

- **Test Driven Development**

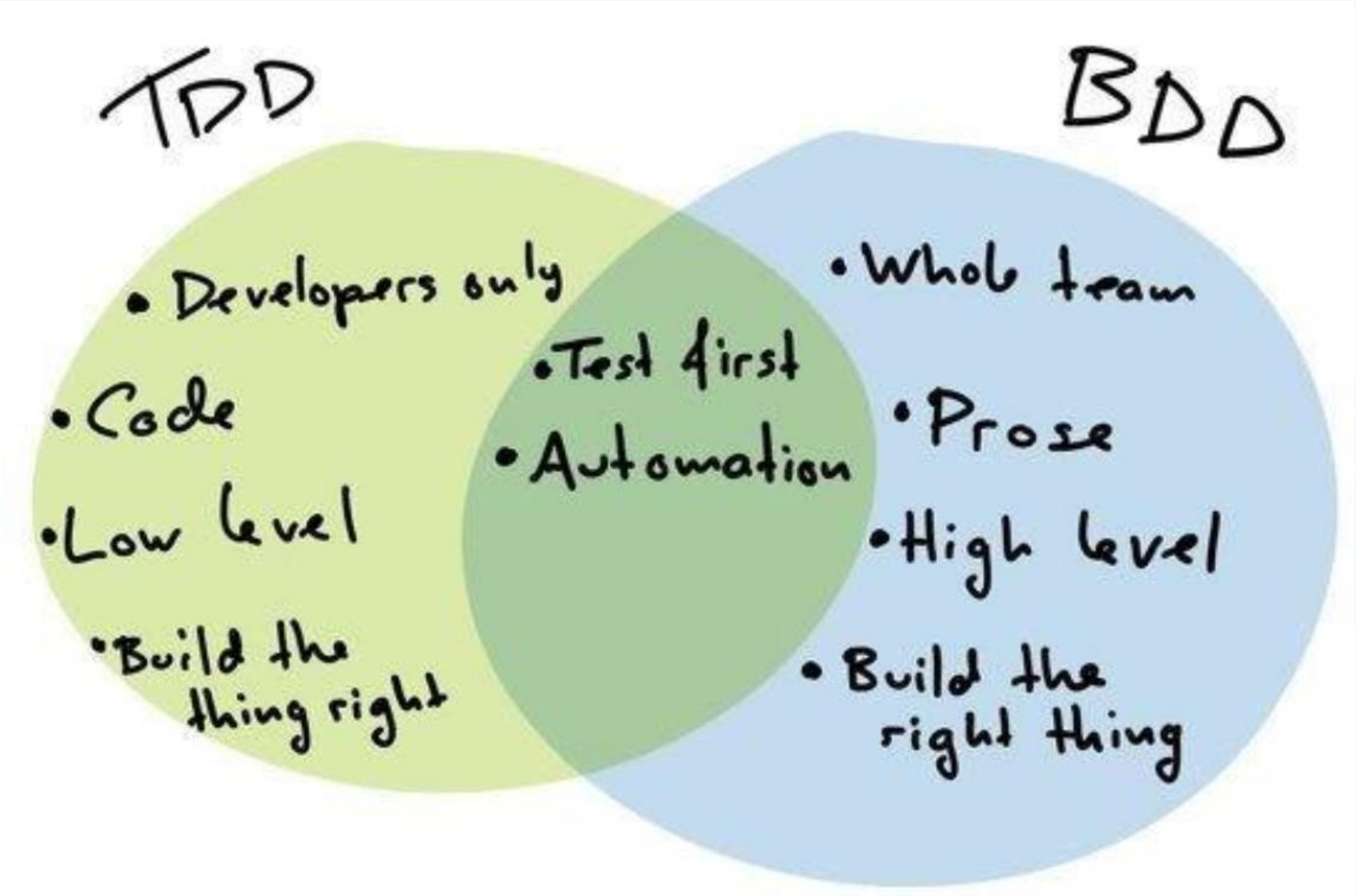


assertTheSame(user.name,’tj’)

- **Behaviour Driven Development**
  - Specify desired behaviour of the unit
  - Based on requirements set by the business
  - Behavioural specification from business and developer

```
expect(user).to.have.property(‘name’).equal(‘tj’)
```

user.should.have.property('name', 'tj');


TDD
BDD
• Developers only
• Code
• Low level
• Build the thing right
• Test first
• Automation
• Whole team
• Prose
• High level
• Build the right thing

TESTING TOOLS

- **Test Frameworks**
  - Makes it easier to write tests
  - Provide hooks, test suites, test runners
  - Examples Junit, VS Team Test, PHP Unit, Mocha
- **Assertion Frameworks**
  - Perform checks and decisions
  - Examples: assert, chai.js, should.js
- **Mocking Frameworks**
  - Create mock dependencies, stubs, proxys
  - Sinon, Jmock, Mockito, Mockgoose!

AUTOMATED TESTING WITH POSTMAN

POSTMAN TESTING

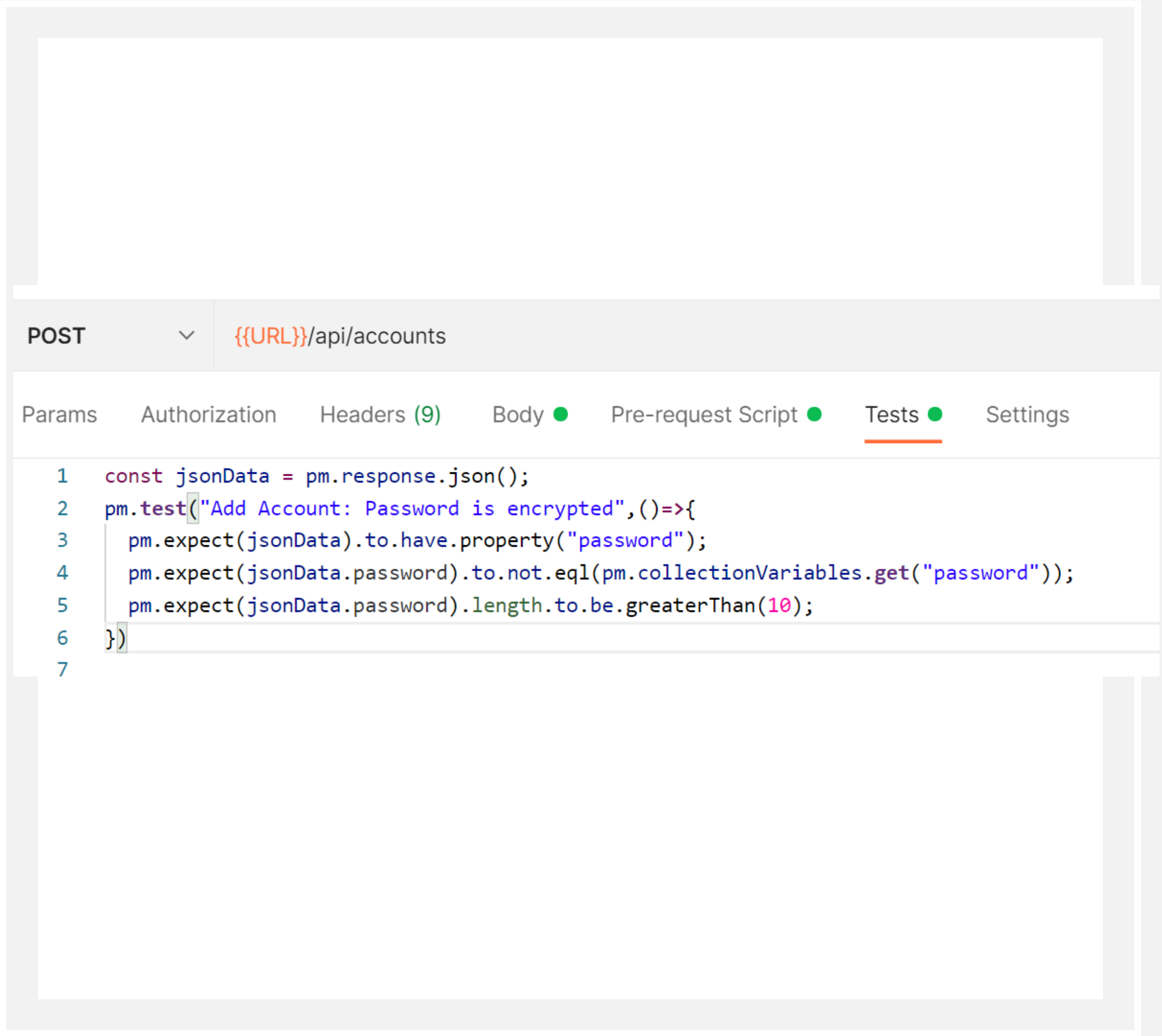
- Up to now, manual
- Fine for initial development cycle
- Better to have more structured method
  - Regression Testing: check everything still works when you make a change and before committing
  - Use HTTP requests to test Express App

CHAI

- BDD / TDD assertion library
  - Run in browser and server-side (e.g. node)
- Features
  - Expressive syntax
  - Can test Async code (Promises)
  - Pluggable
    - Compatible with test runners such as Karma

TESTING OVER HTTP WITH **POSTMAN**

- Postman includes the **Chai** assertion Library by default
- Provide a high-level abstraction for testing HTTP
- Can specify pre-request and test scripts as part of Postman Request
- Scripts are run when request is sent
  - Pre-request script can be used to set up scenario(fixture)
  - Tests script can be used to check request and response is as expected.



```
const jsonData = pm.response.json();
pm.test("Add Account: Password is encrypted",()=>{
  pm.expect(jsonData).to.have.property("password");
  pm.expect(jsonData.password).to.not.eql(pm.collectionVariables.get("password"));
  pm.expect(jsonData.password).length.to.be.greaterThan(10);
})
```

ASSERTIONS WITH CHAI **EXPECT**

- Chai has several interfaces.
  - Should, Expect, Assert
- Expect allows you to chain together

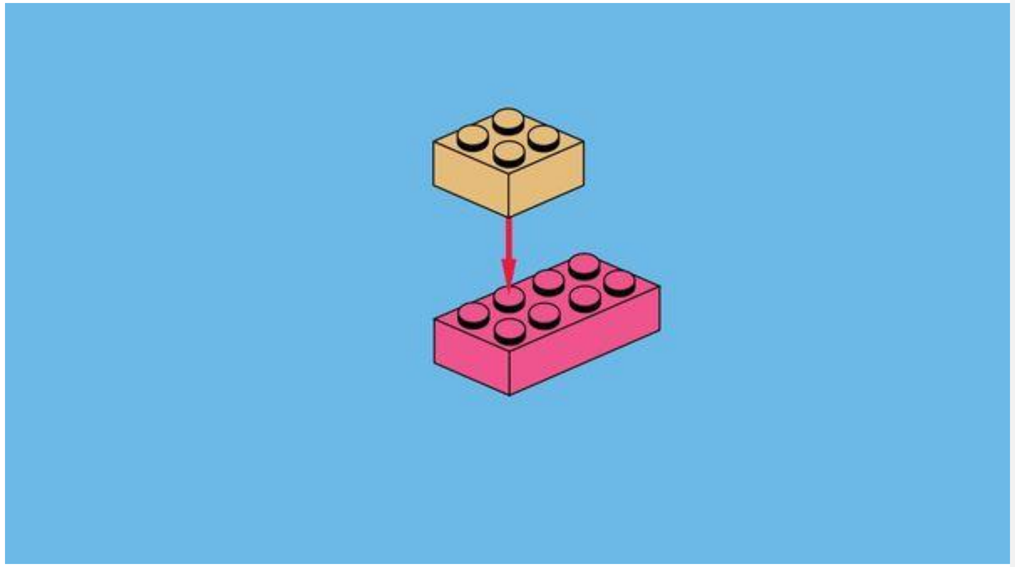
Readable assertions

  - Write tests that are closer to natural language.
  - Suitable for BDD
- Chai plugin for postman uses Expect interface

```
import chai from ‘chai’;
const expect = chai.expect;


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


const num1 = 5;
const num2 = 3;
const expectedResult = 8;


const result = add(num1, num2);


expect(result).to.equal(expectedResult);
  });
});
```

HOW CHAI WORKS WITH POSTMAN…

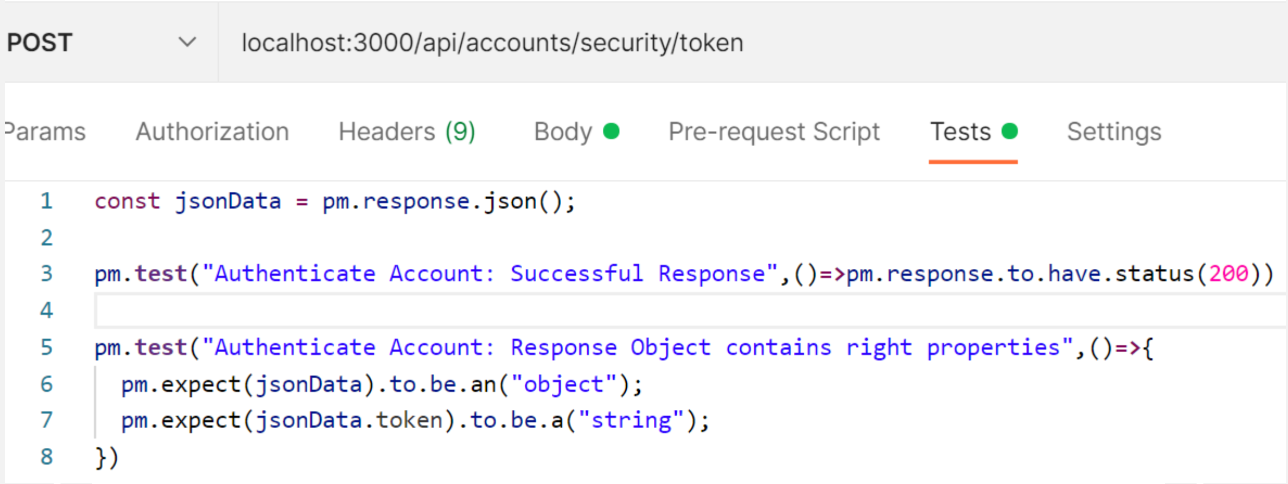
- Define Request in Postman as before
- Use the Tests tab to define your test in Javascript
- The **pm** object provides functionality for testing your request and response data.
  - provides access to request and response data, and variables.
- Provide description of test using **“pm.test”**
- Use **“expect()”** to define several test cases into it.



EXAMPLE – GET AUTHENTICATION TOKEN

Scenario: Test the authentication endpoint returns a Token

- Build request in Postman.
- Define test in Tests tab
- **pm.response.json()** returns response body json object
- **pm.test(..)** takes test name and runs test function
- The **test function** specifies the test that uses the pm object to define what’s expected (e.g. content type, status)
- Use **pm.expect(..)** to check response object



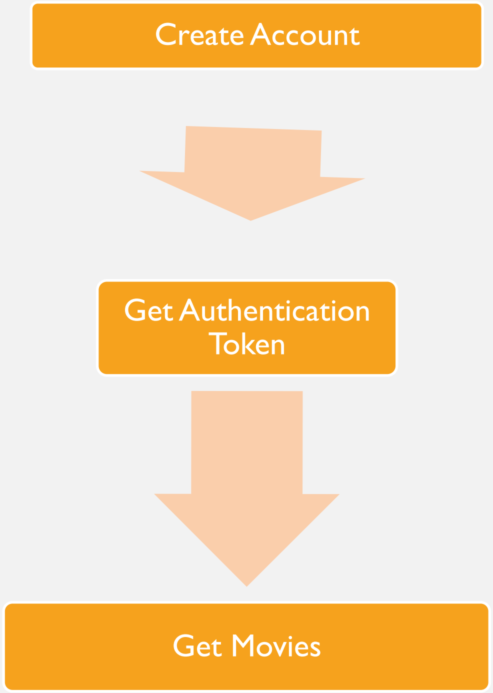
POST localhost:3000/api/accounts/security/token

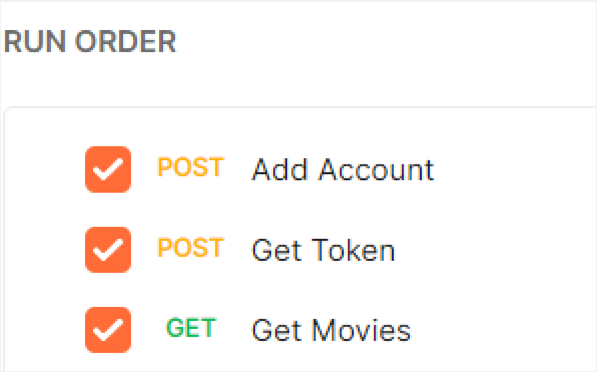
```
const jsonData = pm.response.json();

pm.test("Authenticate Account: Successful Response",()=>pm.response.to.have.status(200))

pm.test("Authenticate Account: Response Object contains right properties",()=>{
  pm.expect(jsonData).to.be.an("object");
  pm.expect(jsonData.token).to.be.a("string");
})
```

POSTMAN COLLECTIONS

- Collection of related requests to test an API
- Can structure a collection run order to test process flow in API

Account Registration and Movies Access





RUN ORDER

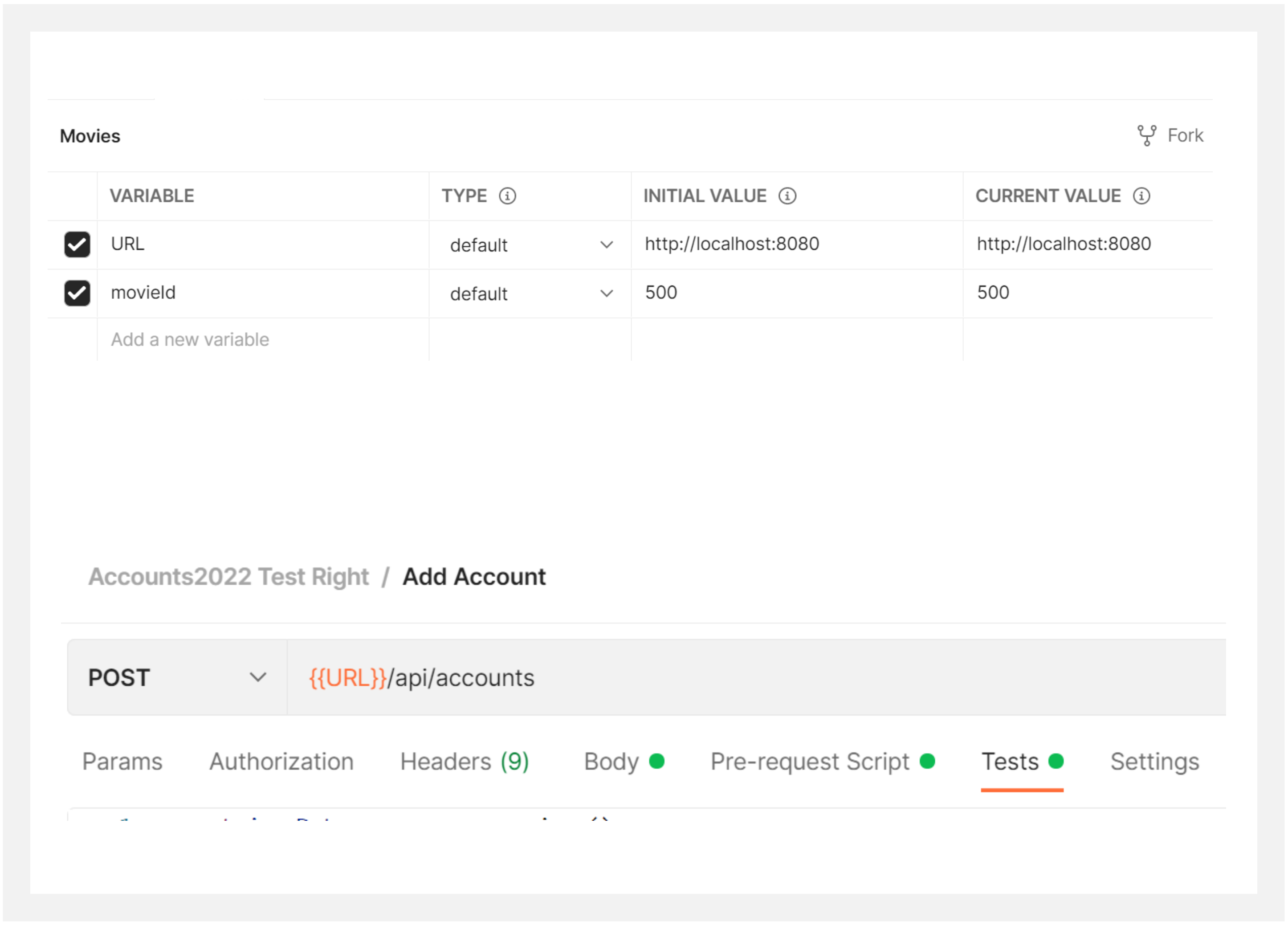
☑ POST Add Account

☑ POST Get Token

☑ GET Get Movies

POSTMAN VARIABLES

- *Variables* enable you to store and reuse values in Postman
  - Handy for repeatable testing
- Can store the URL in a variable URL and reference it in your requests using {{URL}}
- Can use "Dynamic Variables"
  - Postman uses the [faker library]() to generate sample data.



Movies

	VARIABLE	TYPE	INITIAL VALUE	CURRENT VALUE
☑	URL	default	http://localhost:8080	http://localhost:8080
☑	movieId	default	500	500
	Add a new variable			

Accounts2022 Test Right / Add Account

POST {{URL}}/api/accounts

VARIABLE SCOPES

- Global
  - access data between collections
- Collection
  - available throughout the requests in a collection
- Environment
  - scope your work to different environments, for example local development versus testing or production.

POSTMAN TESTING EXAMPLE

1

Create Collection

- Collection of related API requests

2

Create Environment

- Define commonly used variables

3

Create Tests

- Check response is as expected

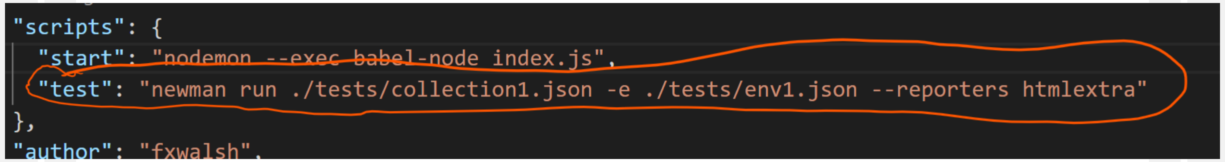
4

Run Tests!

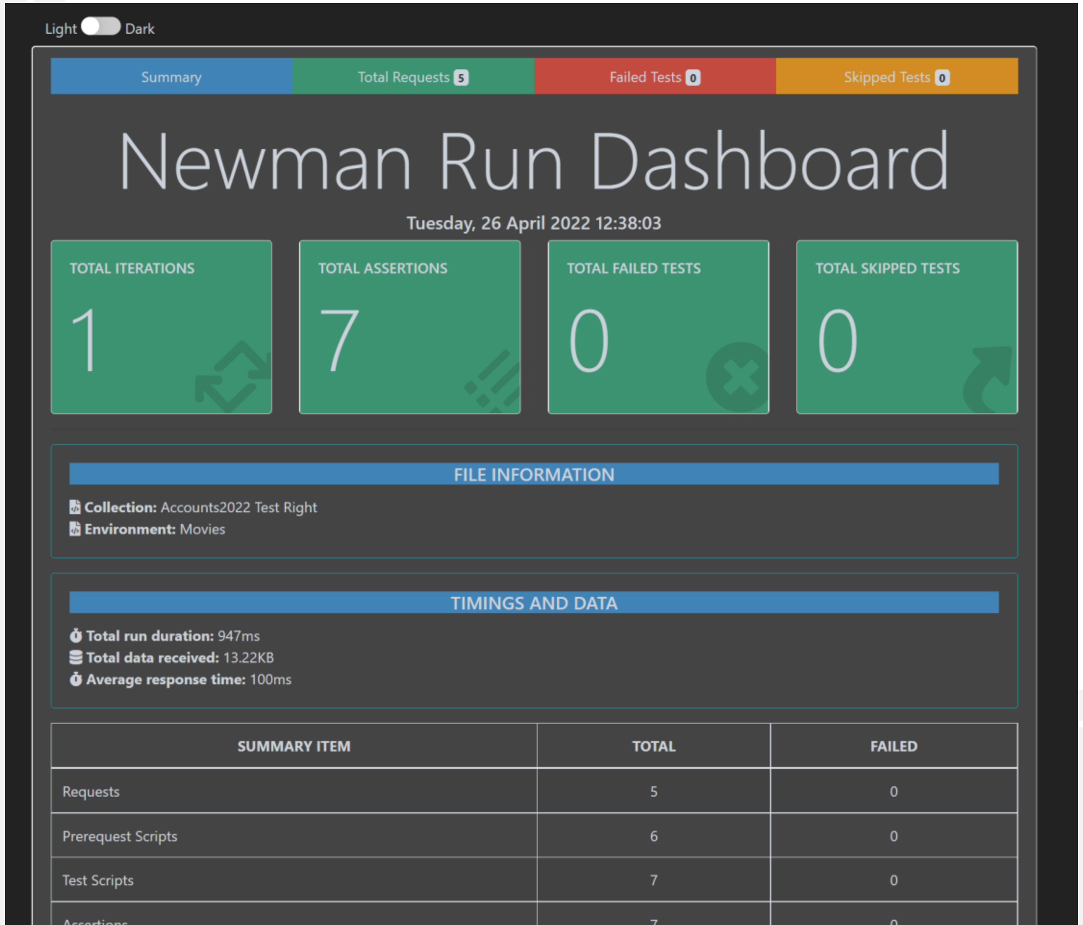
RUNNING THE TEST EXTERNALLY USING NEWMAN

Newman is a command-line collection runner for Postman. Can use it to execute your tests from command line and integrate into Continuous Integration/Continuous Delivery pipeline.

- Export Collection as JSON file
- Export Environment as JSON file
- Install Newman and Newman-html-extre and run on command line
- Add test script to your package.json file



```
"scripts": {
  "start": "nodemon --exec babel-node index.js",
  "test": "newman run ./tests/collection1.json -e ./tests/env1.json --reporters htmlextra"
},
"author": "fxwalsh",
```



Newman Run Dashboard

Tuesday, 26 April 2022 12:38:03

TOTAL ITERATIONS 1

TOTAL ASSERTIONS 7

TOTAL FAILED TESTS 0

TOTAL SKIPPED TESTS 0

FILE INFORMATION

Collection: Accounts2022 Test Right
Environment: Movies

TIMINGS AND DATA

Total run duration: 947ms
Total data received: 13.22KB
Average response time: 100ms

SUMMARY ITEM	TOTAL	FAILED
Requests	5	0
Prerequest Scripts	6	0
Test Scripts	7	0
Assertions	7	0

TESTING STRATEGIES

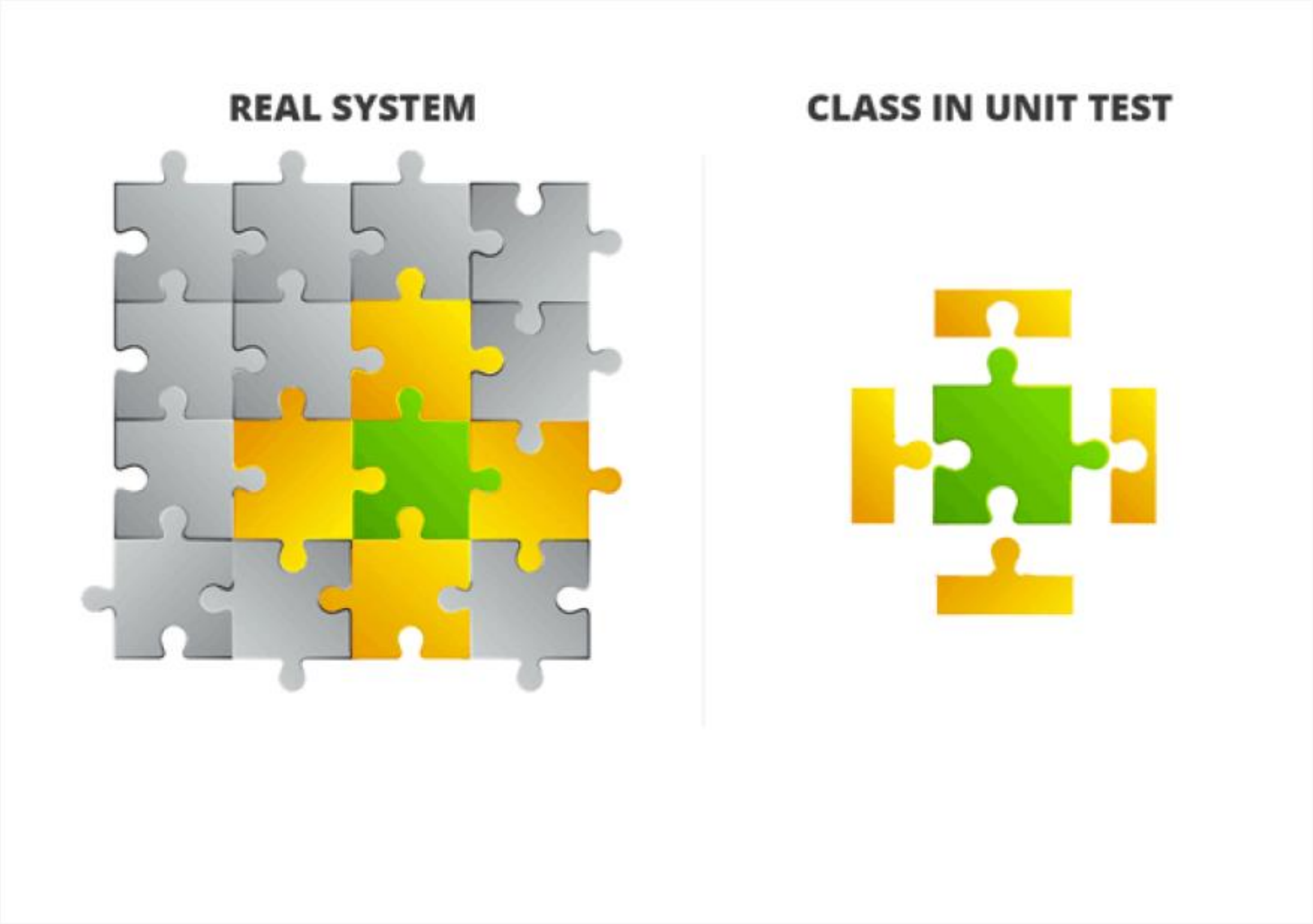
- Right-BICEP
  - Right – are results CORRECT
  - B – are boundary conditions correct
  - I – check inverse relationship
  - C – Cross check result using other means
  - E – Force error conditions
  - P – Performance characteristics

MOCKING/STUBBING

FYI….

MOCKING FRAMEWORK

- What if your code has methods that use/integrate a DB?
- What if your code uses an API that's not ready
- Can use mocking and stubs to override/replace/mutate aspects of the code to allow you to test various scenarios in an isolated fashon
- Examples: Proxyquire, Sinon



IMPROVEMENTS - MOCKING

- Unit testing should only concern the unit you're testing
  - Should be independent of servers/db dependencies
- Tests should just test the unit in question
- Unit under test may have dependencies on other (complex) units, e.g. database
- To isolate the behaviour of a unit, replace dependencies by "mocks" that simulate the behaviour
- DBs are impractical to incorporate into the unit test.
- In short, mocking is creating objects that simulate the behaviour of real objects.

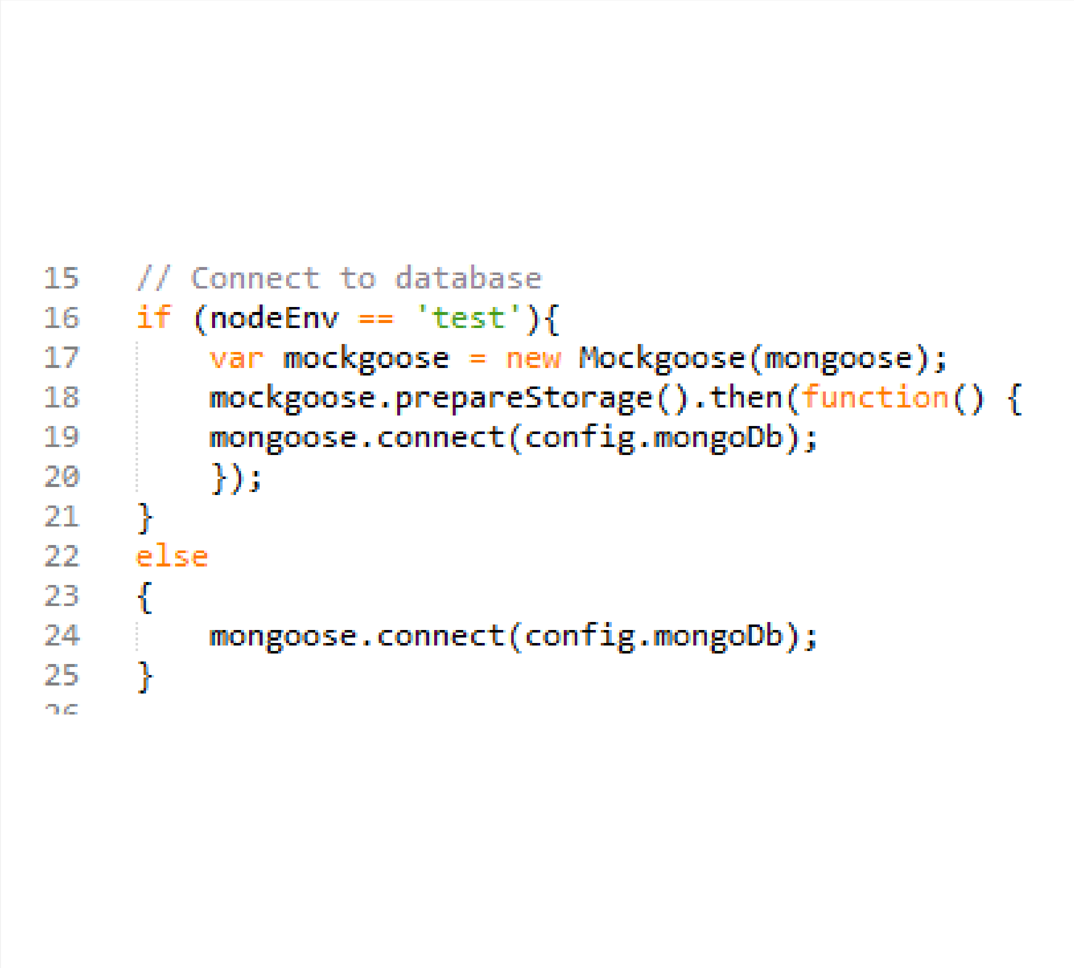
MOCKING MONGODB

- Several mocking frameworks out there
  - Mockery, PowerMockito
- We use Mongoose
  - How about "Mockgoose"?!
  - Turns out it exists!
- NPM install –save-dev Mockgoose

MOCKGOOSE

- Mockgoose spins up **mongod** when mongoose.connect call is made.
- Just uses memory store with no persistence.
- Can take a while on first test, after which it's fast
  - Tests may time out
  - You can increase mocha wait time

```
describe (…){
        this.timeout(10000);
```



```
// Connect to database
if (nodeEnv == 'test'){
    var mockgoose = new Mockgoose(mongoose);
    mockgoose.prepareStorage().then(function() {
    mongoose.connect(config.mongoDb);
    });
}
else
{
    mongoose.connect(config.mongoDb);
}
```