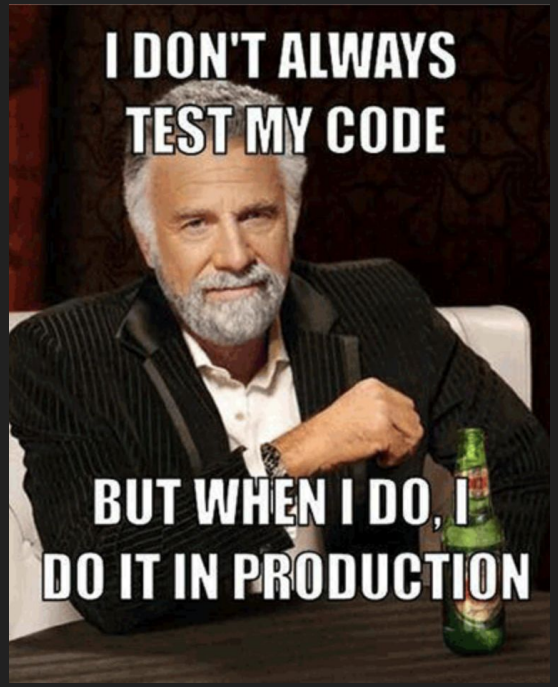
Testing in React

Goal - understand the basic concepts of software testing and show you the tools needed to write good tests in React

What we will cover

- General overview
- Different types of testing
- Writing actual tests
- Testing Environment
- Coding Demo



General overview

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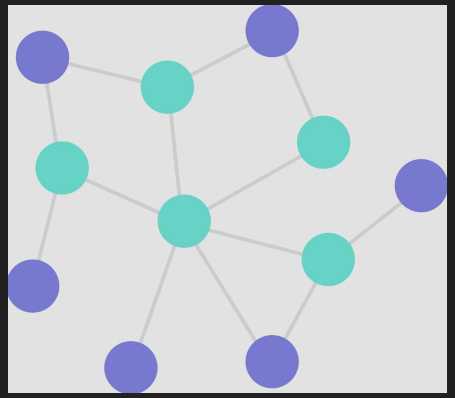
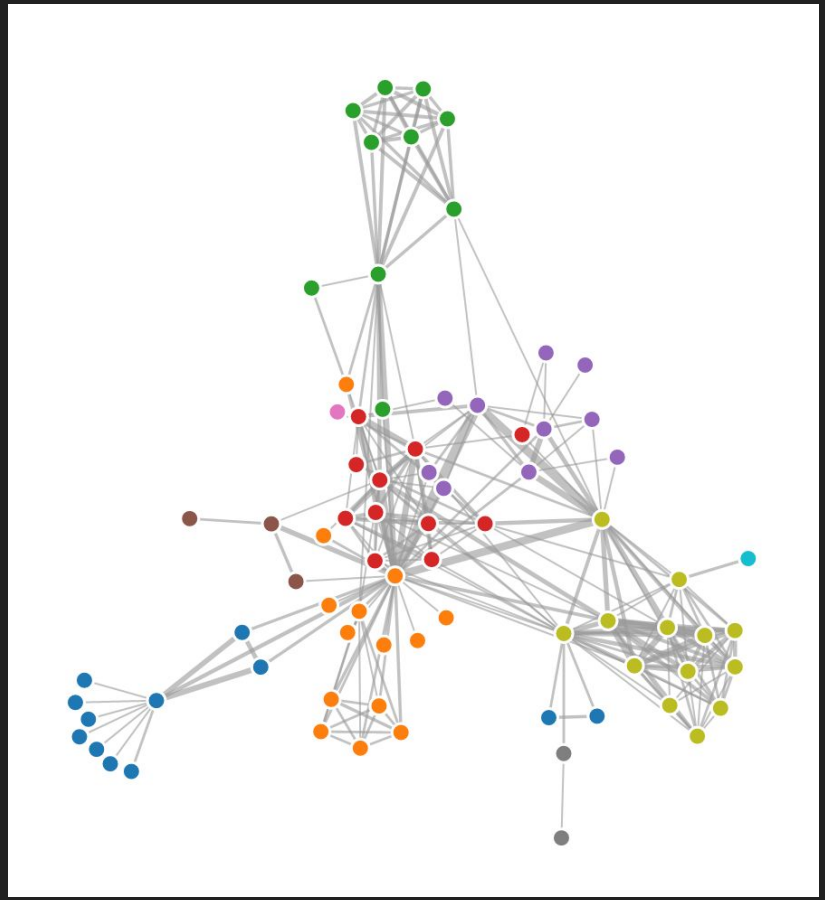
What is software testing?

- Process of evaluating and verifying that software is doing what we expect
- Can be performed by a human (e.g. QA Engineer) or machine (e.g. coded by developer/SDET)
- Many different kinds of testing
- Many different tools available to us

Our Code



Time



Writing tests - tradeoffs

Pros

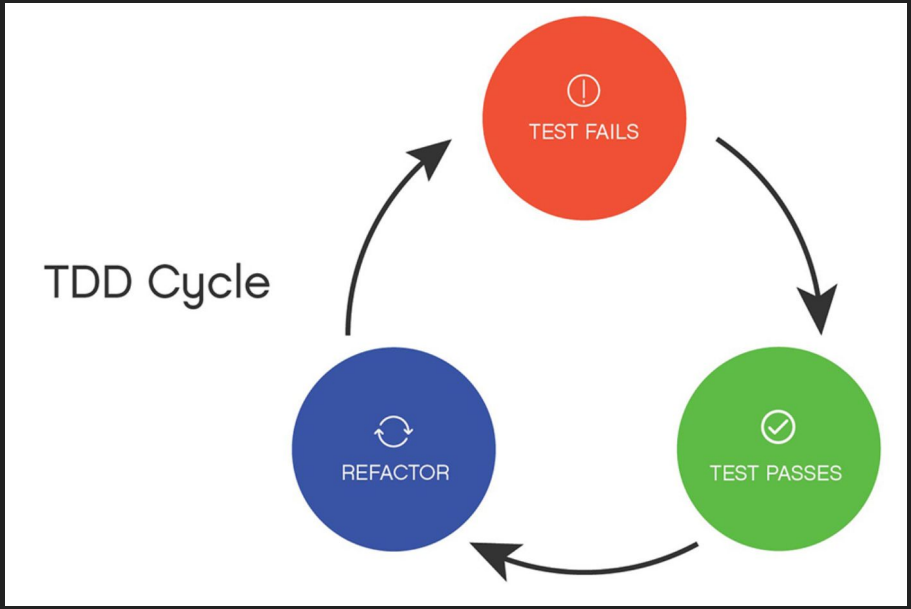
- Doing major refactors is easier
- Catches bugs earlier
- More confident in code quality

Cons

- Additional things to maintain
- Slows down development
- CI pipeline takes longer
- As application gets more complex writing tests can become more difficult
- Expensive

Test-Driven Development

- Software development process where test cases are written before the code
- Works when business logic and rules are well defined



Brenan Keller
@brenankeller

A QA engineer walks into a bar. Orders a beer. Orders 0 beers. Orders 99999999999 beers. Orders a lizard. Orders -1 beers. Orders a ueicbksjdhd.

First real customer walks in and asks where the bathroom is. The bar bursts into flames, killing everyone.

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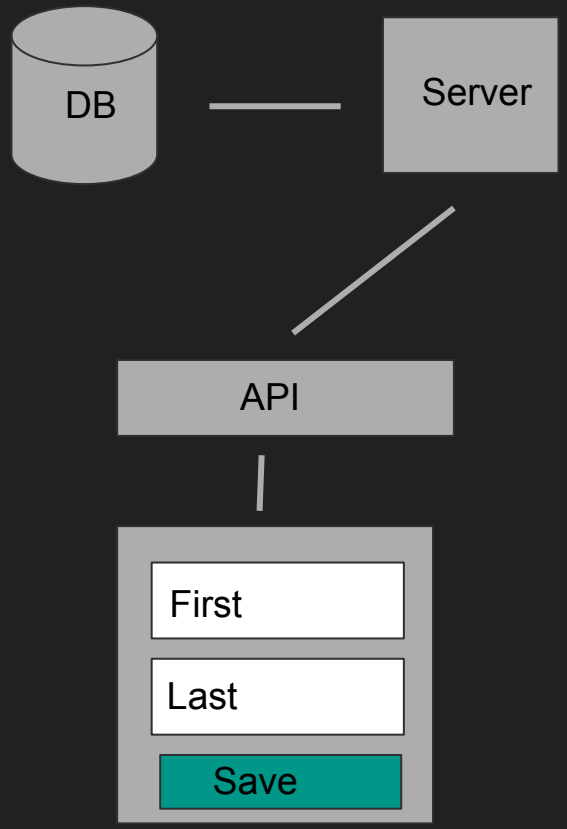
Why different types/levels?

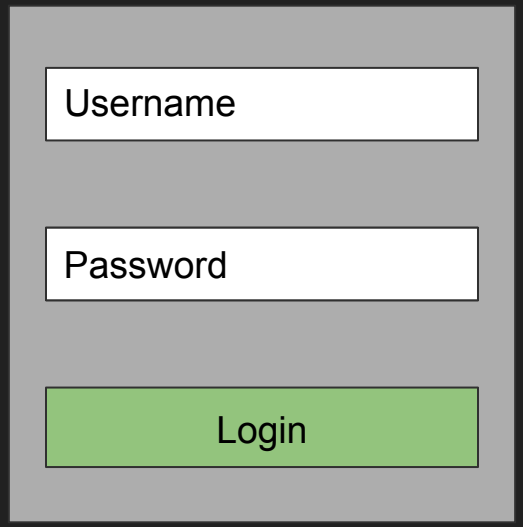
- It makes it easier to pinpoint the point of failure
- Easier to test more things
- Example - writing one test for a user profile



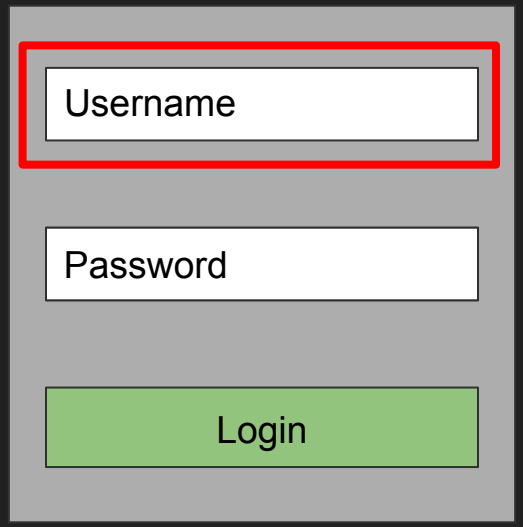
Main types of tests we care about

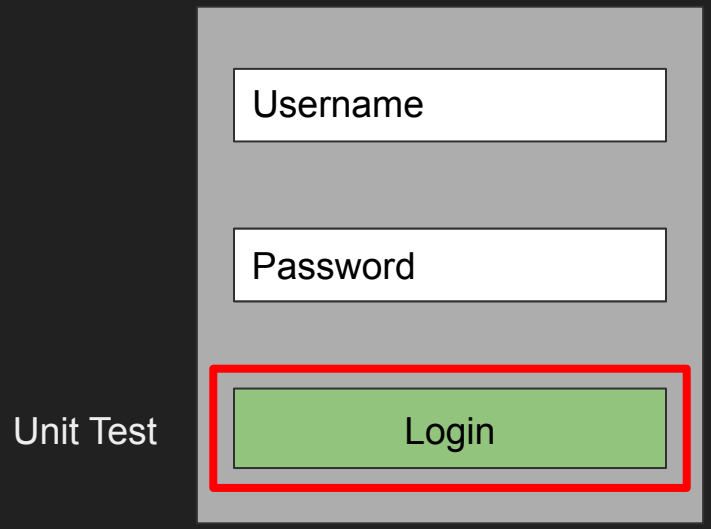
- Unit - validating that each software “unit” performs as expected where a unit is the smallest testable component
  - individual functions and classes
- Integration - ensures components operate as a group
  - Involving network activity
- Acceptance - ensures whole system works as intended

Example

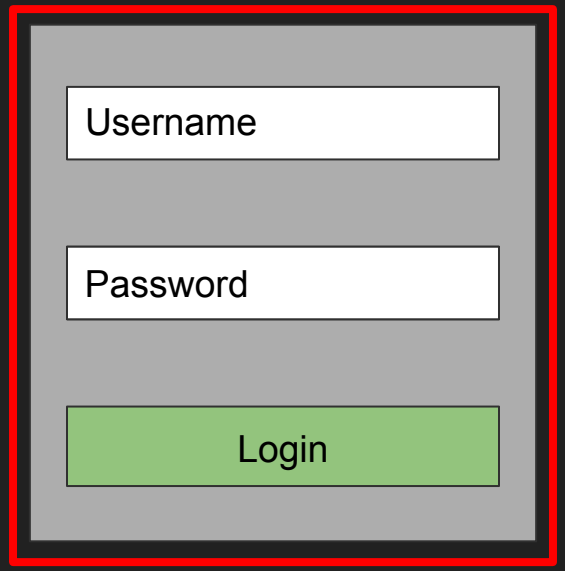


Unit Test

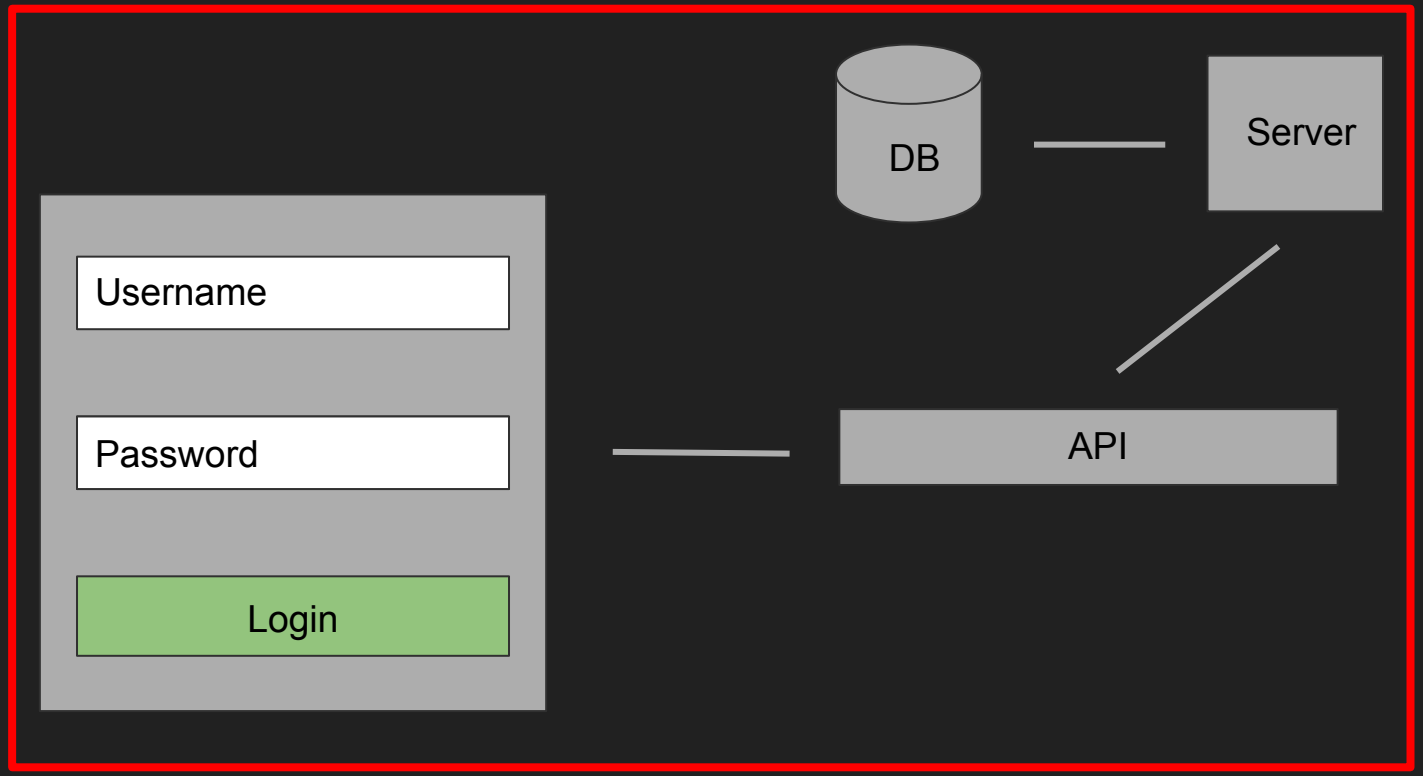



Username
Password
Unit Test
Login

Integration test

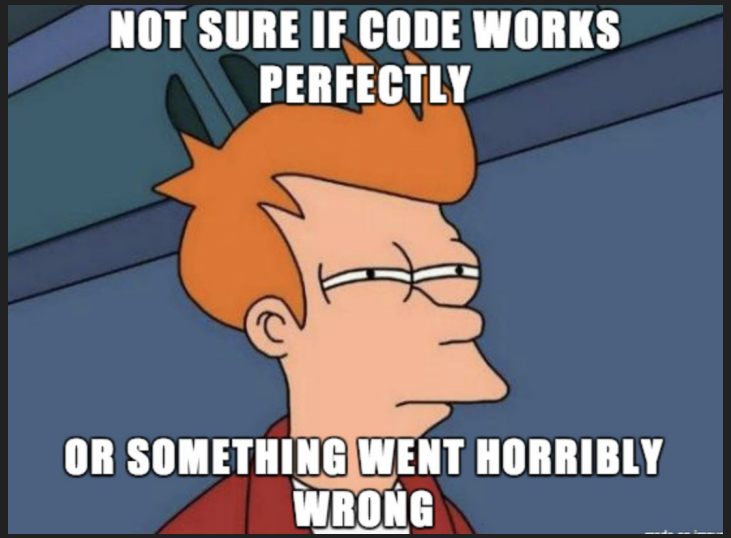


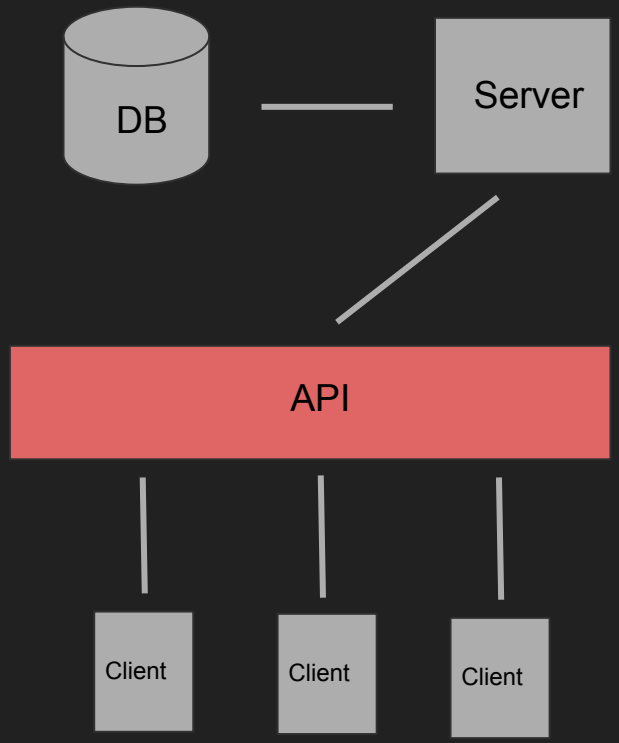
Acceptance test



Other types of testing

- Performance testing - how software performs under different workloads
  - In FE code case, how it works in other browsers
- Regression testing - check whether new features break or degrade functionality
- Stress testing - testing how much strain the system can take before it fails
- Penetration testing - is my system secure




DB
Server
API
Client
Client
Client

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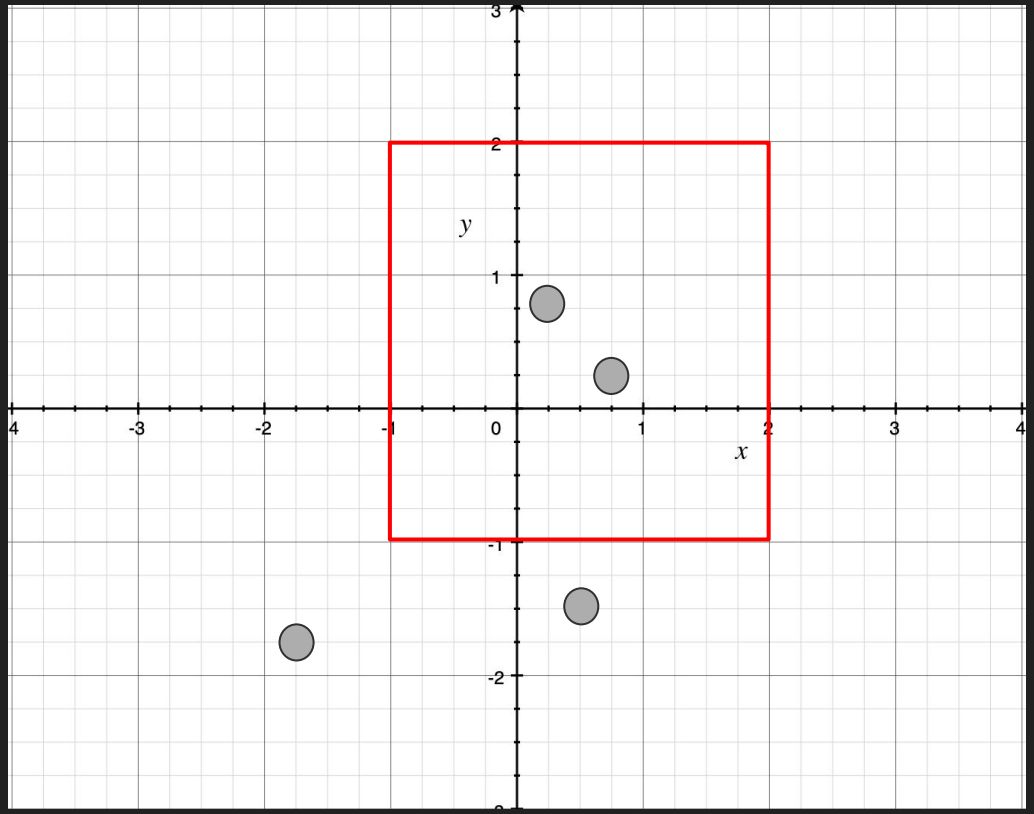
Structure - “Arrange-Act-Assert ”

- **Arrange -** all necessary preconditions and inputs
- Act - on the object or method under test
- Assert - that the expected results have occurred


3
2
y
1
-4
-3
-2
-1
0
1
2
3
4
x
-1
-2

Structure - “Arrange-Act-Assert ”

- **Arrange -** all necessary preconditions and inputs
- Act - on the object or method under test
- Assert - that the expected results have occurred

```
import { findPointsInBox } from "src/calc/findPointsInBox.js";

test(() => {
  const points = [
    { x: 3, y: 1 },
    { x: 1, y: 1 },
    { x: 1, y: 3 }
  ];
  const box = {
    min: { x: 0, y: 0 },
    max: { x: 2, y: 2 }
  };

  const pointsInBox = findPointsInBox(box, points);

  asset(pointsInBox.length, 1);
  asset(pointsInBox[0], { x: 1, y: 1 });
});
```

Testing Recipes - common patterns for React components

- Rendering - how the component looks
- Data fetching - mock API requests with dummy data
- Mock modules - mock entire node modules (e.g. Google Maps)
- Events
- Timers

Snapshots

- Testing that compares the stored “good output” with the current output of a component
- “Good output” can be text (e.g. rendered DOM tree) or even screenshots
- Only concerned with detecting unexpected UI changes

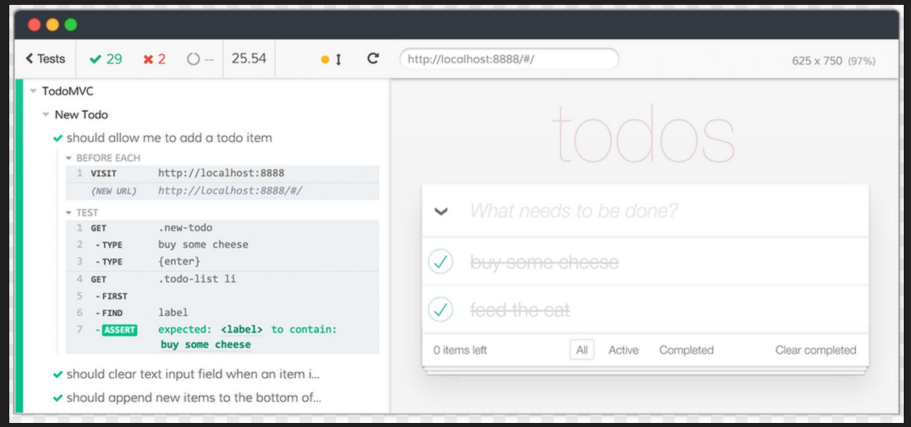
Testing Tools - Test runners

- Test runners - run tests in a reliable and predictable way
- Libraries are written in the same language as the projects codebase
- Generally written by developer or a SDET
- Examples of test runners for React
  - Jest (included in create-react-app)
  - Mocha

```
(base) ➜  typescript-jest-example git:(master) ✗ npm run tests

> typescript-jest-example@1.0.0 tests /Users/dmar/Repos/typescript-jest-example
> jest --config jest-config.json

 PASS  tests/utils.spec.ts
  Utils test case
    ✓ Add 1 + 2, should return 3 (6 ms)
    ✓ Add -1 and 2 should return an Error (5 ms)

----------|---------|----------|---------|---------|-------------------
File      | % Stmts | % Branch | % Funcs | % Lines | Uncovered Line #s
----------|---------|----------|---------|---------|-------------------
All files |     100 |      100 |     100 |     100 |
 utils.ts |     100 |      100 |     100 |     100 |
----------|---------|----------|---------|---------|-------------------
Test Suites: 1 passed, 1 total
Tests:       2 passed, 2 total
Snapshots:   0 total
Time:        1.597 s, estimated 2 s
Ran all test suites.
```

Testing Tools - Integration/Acceptance

- Setting up a realistic browser environment (Firefox, Safari, etc …) where you simulate an actual user
- Testing on a real API or Mock API
- Headless mode
- Testing frameworks like **Cypress**, Puppeteer, and CodeceptJS



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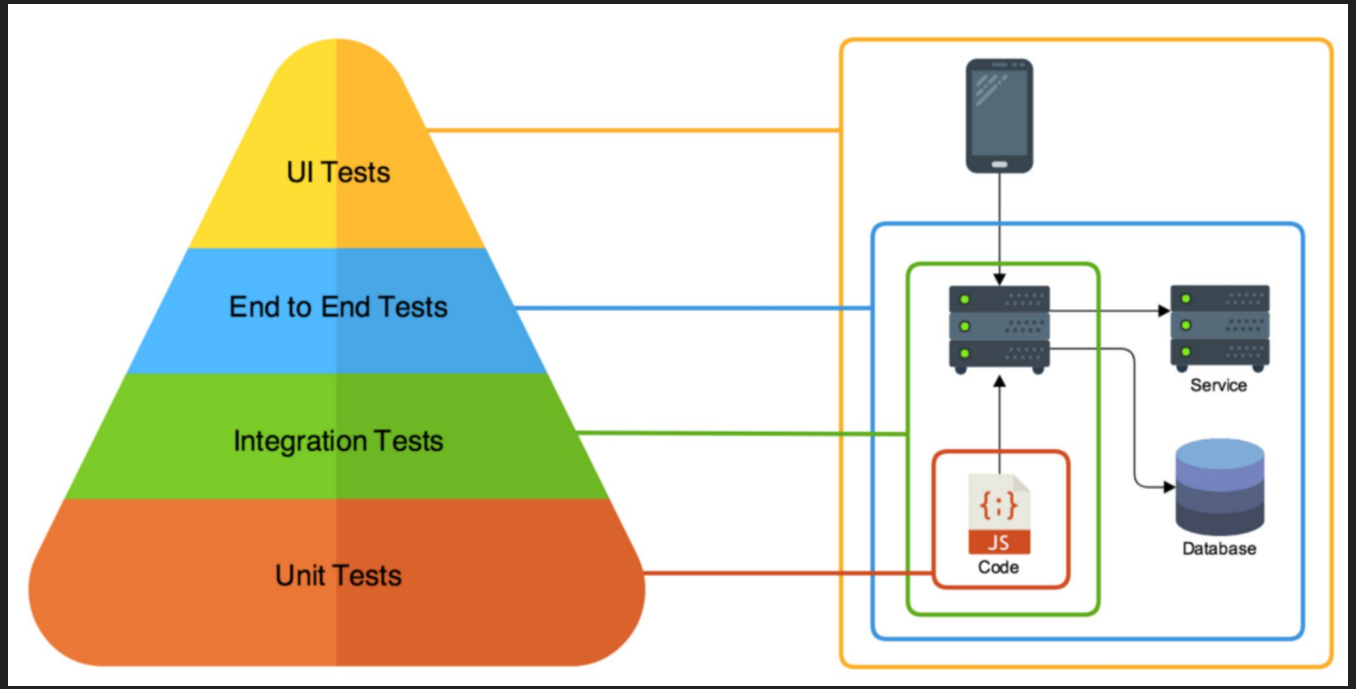
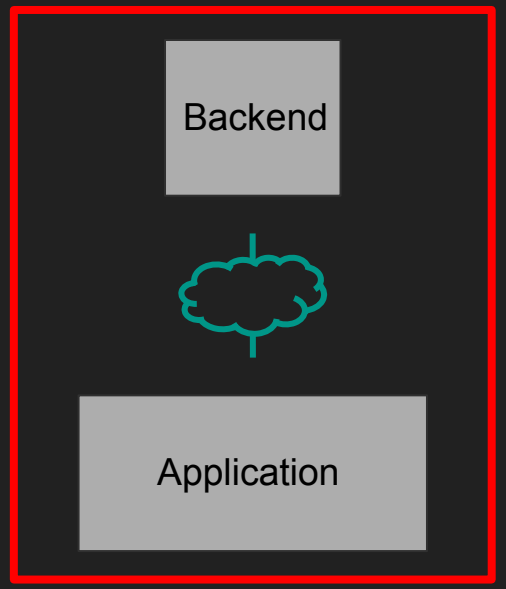
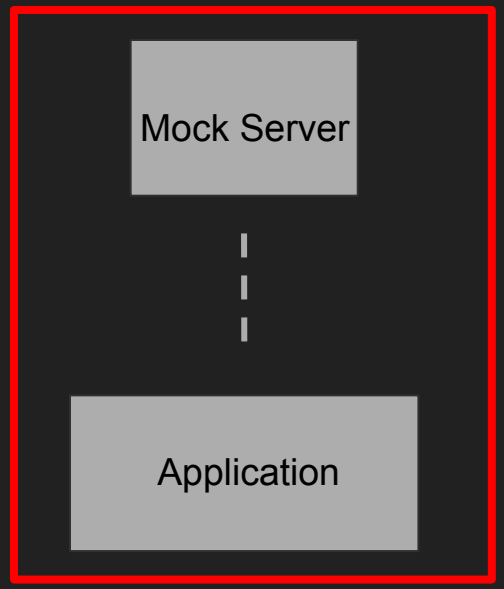

UI Tests
End to End Tests
Integration Tests
Unit Tests
Service
Database
JS
Code

Real API



Mock API



Mock API

Pros

- Minimal setup required
- Lots of existing FE tools for generating fake data
- Testing environment becomes FE only
- Speed of running tests is much faster
- FE isn’t blocked by development work on BE

Cons

- API can become out of sync with mock server (requires maintenance)
- Not always obvious when mock server and actual API are out of date
- Client will only be as good as your mock server

Real API

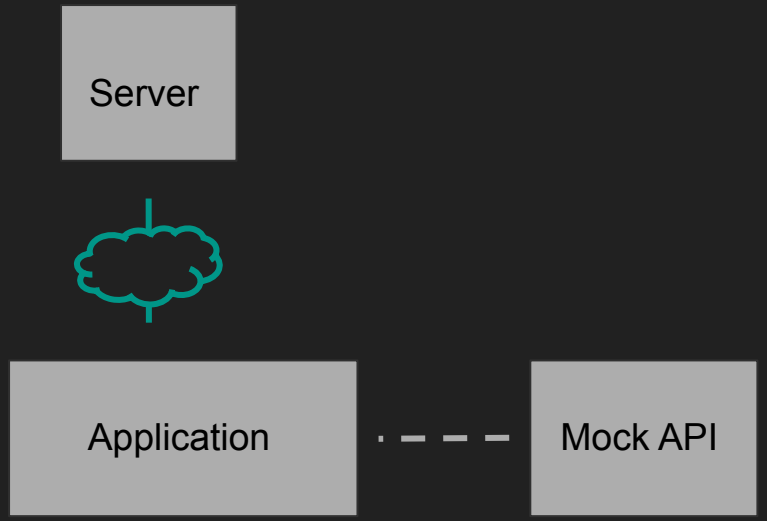
Pros

- Tests are more accurate
- Only one API to maintain

Cons

- Slower
- Testing environment becomes more difficult to set up
- Client development is now blocked by backend development
- Tests are less stable

Hybrid Approach



In practice testing on FE is added once codebase matures

- Writing and maintaining tests take a lot of time and energy
- We can deliver features quicker without them
- On day zero when a feature is written, they serve no value to our end user
- Testing FE code becomes complicated due to rendering UI
- Setting up CI environment is tricky

Sidenote on Continuous Integration (CI)

- Continuous integration (CI): software development practice where developers regularly merge their code changes into a central repository, after which automated builds and tests are run.
- Github actions, Teamcity, etc

Some checks were not successful

10 successful and 2 failing checks

Hide all checks

✓	**Athenian Pull Request Labeler / labeler (pull_request_target)** Successful in 4s		Details
✓	**Checks / ESLint (pull_request)** Successful in 3m		Details
✓	**PR Jira Title Checker / Jira Issue Checker (pull_request)** Successful in 4s		Details
✓	**Checks / Type Check (pull_request)** Successful in 3m		Details
✓	**Frontend Dev deployment / Get Frontend Stack Name / Get Frontend Stack Name (pull_reques...**		Details
✓	**Checks / Circular Dependencies, and Unused Code Check (pull_request)** Successful in 2m		Details
✗	**Checks / Jest Unit Tests (pull_request)** Failing after 2m		Details
✓	**Frontend Dev deployment / Build And Push Frontend Docker Image To ECR / Build And Push Fr...**		Details
✗	**Frontend Dev deployment / Cypress Tests / Cypress Tests (pull_request)** Failing after 47m		Details
✓	**Frontend Dev deployment / Deploy Frontend Ephemeral Environment To Kubernetes / Deploy F...**		Details
✓	**Backend Build (Testing / E2E)** — TeamCity build finished	Required	Details
✓	**E2E (Testing / E2E)** — TeamCity build finished	Required	Details

This branch has no conflicts with the base branch

Merging can be performed automatically.

Questions???

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Show me the code

- Jest (integration/unit)
  - Neat features: async test suites
- Cypress (end-to-end/UI)
  - Neat features: retry logic
- Helpful links
  - https://reactjs.org/docs/testing-recipes.html
  - https://docs.cypress.io/api/table-of-contents
  - https://jestjs.io/docs/api