Testing

- Automated
- Manual

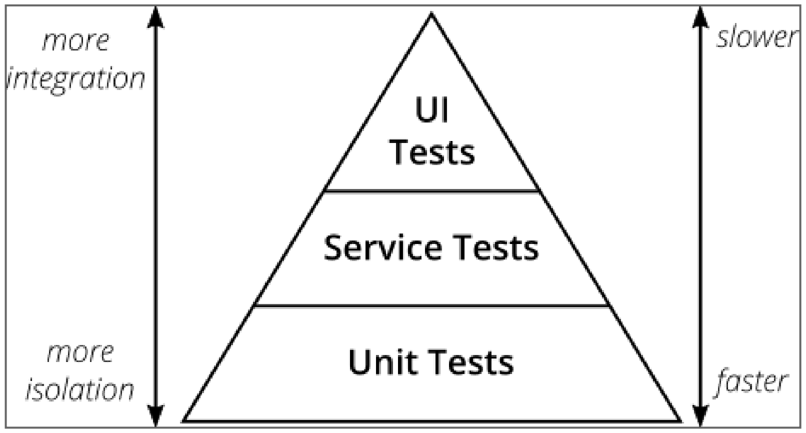
Ultimately about **confidence**

Almost *every* quality job will expect automated testing

Testing Pyramid

Various Names

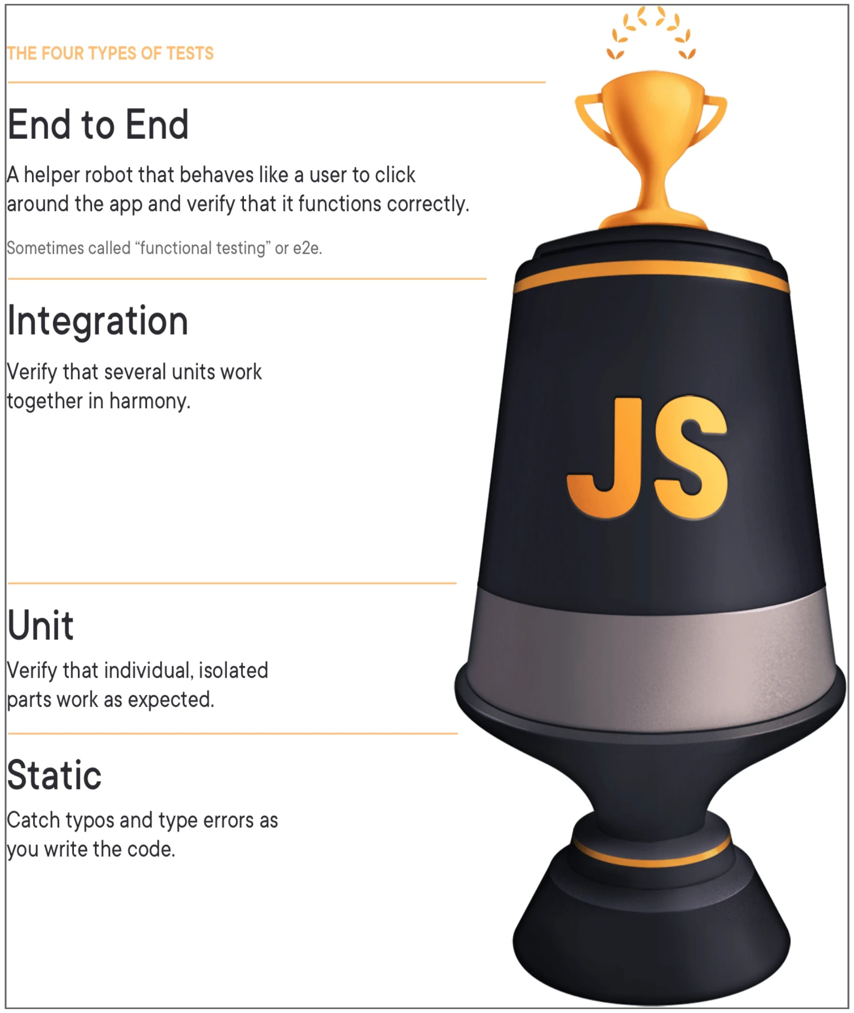
- E2E/UI
- Service/Integration
- Unit Tests



Testing Pyramid from **https://martinfowler.com/articles/practical-test-pyramid.html**

The Testing Trophy

- More Integration
- "does app work"
- browser-focused


THE FOUR TYPES OF TESTS
End to End
A helper robot that behaves like a user to click around the app and verify that it functions correctly.
Sometimes called "functional testing" or e2e.
Integration
Verify that several units work together in harmony.
Unit
Verify that individual, isolated parts work as expected.
Static
Catch typos and type errors as you write the code.
JS

Testing Trophy from **https://kentcdodds.com/blog/the-testing-trophy-and-testing-classifications**

Unit Tests

Most important tests:

- Easier to automate
- A "unit" is an indivisible piece of code
  - function, module, component
- Tested in **isolation**
  - means: by itself, without other parts
- Fast to run
  - usually seconds (or less!)
- Durable
  - Code changes makes test fail only if input/output changes

What does a unit test test?

The test:

- Confirms the input/output for the unit
- Defines behavior for bad input
    - If you don't test it, it is undefined
- Can serve as documentation for devs
- **Confirms behavior after change**
    - Allows you to change with confidence

Integration Tests

- Fewer Integration Tests than Unit tests
- Slower to run (10s of seconds to minutes)
- Confirms assumptions of unit testing
    - Connects units into bigger pieces
        - or with other systems
            - DB
            - browsers
            - service calls
- More "brittle" than unit tests
    - tests can fail after changes for several reasons
        - requires you update the tests

End-to-End Tests (E2E)

- Fewest tests
- Complete start-to-finish tests
- Slowest to run (minutes to 10s of minutes)
- Most "Brittle"
    - Can break for many reasons
- Hard to debug
- Only guarantee that everything works for end user

Test Driven Development (TDD)

Practice of writing tests, then code

- Red-Green-Refactor cycle
- Easier when covering a mostly-known interface
- Harder when doing exploratory code
- Builds good habits
    - Create code that is easily testable
- Takes time to adjust to
    - You will code slower for ~6 months
    - Very rough estimate!
    - Then you are as fast or faster!
- Generates a lot of confidence

Writing Tests After

- Fairly common practice
    - Write code until it mostly works
    - Then write tests
        - Check for all cases
        - Detect problems in the future
- Can have problems if your code is "hard to test"
    - Ex: uses hidden/private/internal methods
    - Ex: needs state only set by series of steps

Unit Tests with JS

Multiple test systems exist:

- Jest (JS or Components)
- Karma (Technically *not* unit tests)
- Mocha/Chai, Jasmine
- Tape

Process for all:

- Load code
- Organize Tests
- Each test calls code with input
    - defines expected output

Example unit test

```
import compare from './compare';

describe('compare', () => {
  it('requires 2 inputs of the same length', () => {
    expect(compare()).toThrow('invalid input');
    // more checks here
  });

  it('returns the number of matching letters', () => {
    expect(compare('eat', 'eat')).toBe(3);
    expect(compare('eat', 'hop')).toBe(0);
  });

  it('works regardless of case', () => {
    expect(compare('eat', 'EAT')).toBe(3);
    expect(compare('EAT', 'eat')).toBe(3);
    expect(compare('EaT', 'eAT')).toBe(3);
  });
  //...
});
```

So much more with testing!

- Web E2E tests automate the browser
    - Type and click for user
    - Several options
        - Selenium/webdriver
        - puppeteer
        - Cypress
- Automate for different browsers
    - Ex: Saucelabs
- Continuous Integration (CI)
    - Automates running tests on commit
        - Can automate release of next version!