Automated Testing of Web Mapping Applications

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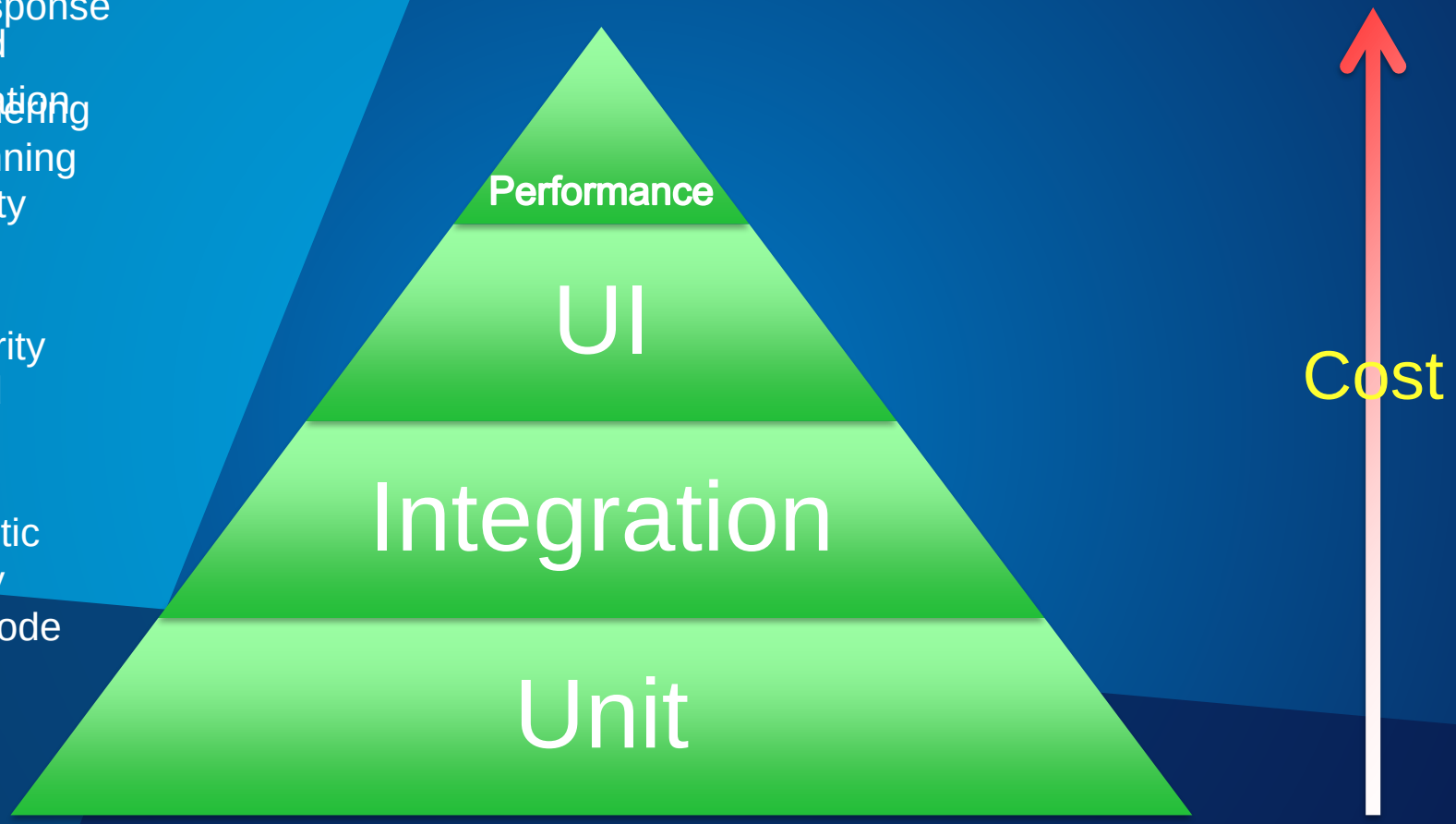
Anatomy of a web application

- UI/client app
- API/Service Layer
- Backend/Business Logic

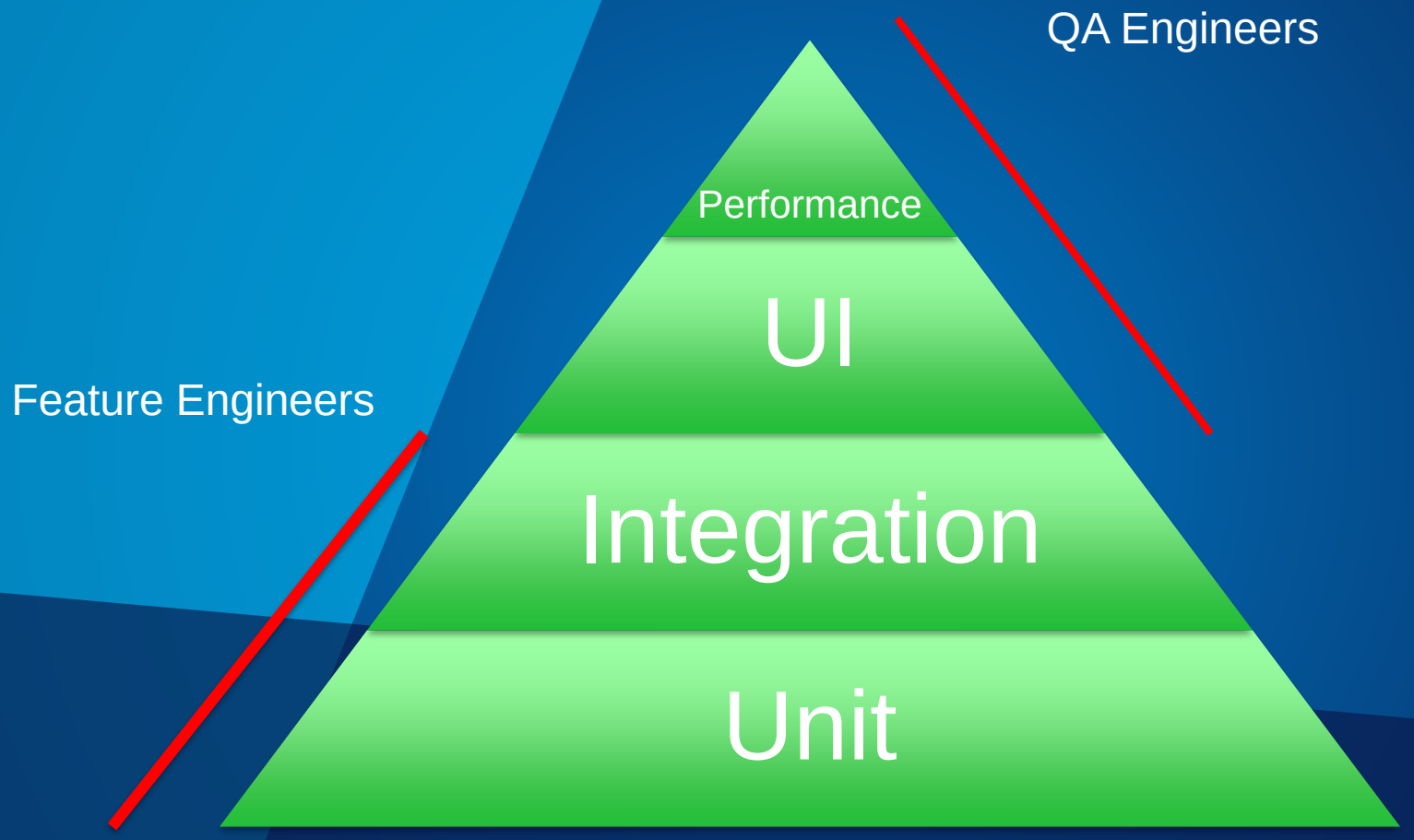
Why test?

The Test Pyramid

- Server response time
- End-to-end
- Full integration
- Page rendering
- Longer running
- Connectivity
- Protocol
- CRUD
- Data Integrity
- Fast/Rapid feedback
- Isolated
- Deterministic
- Run locally
- Live with code



Who writes what and how much?

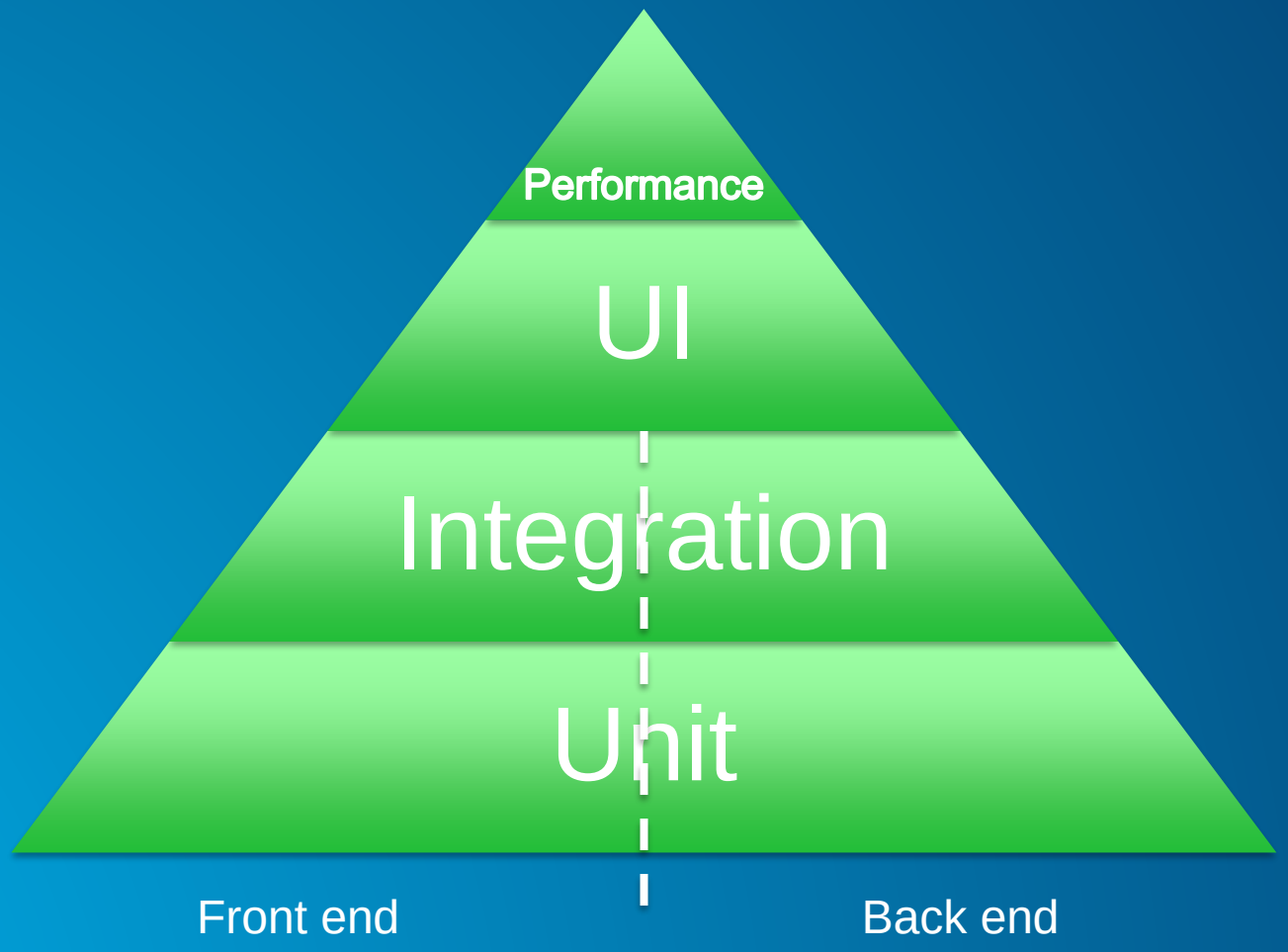


Where to start?

Front-end Unit and Component Tests

Tom Wayson @tomwayson

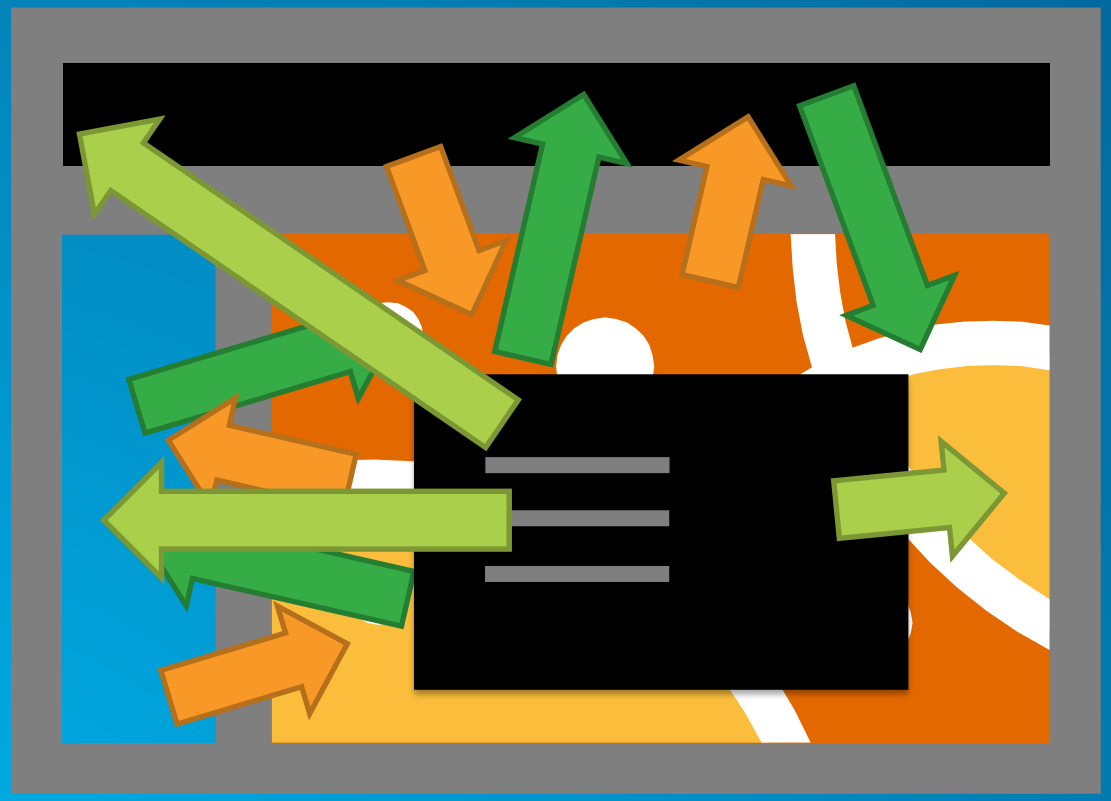
Front-end vs Back-end Tests



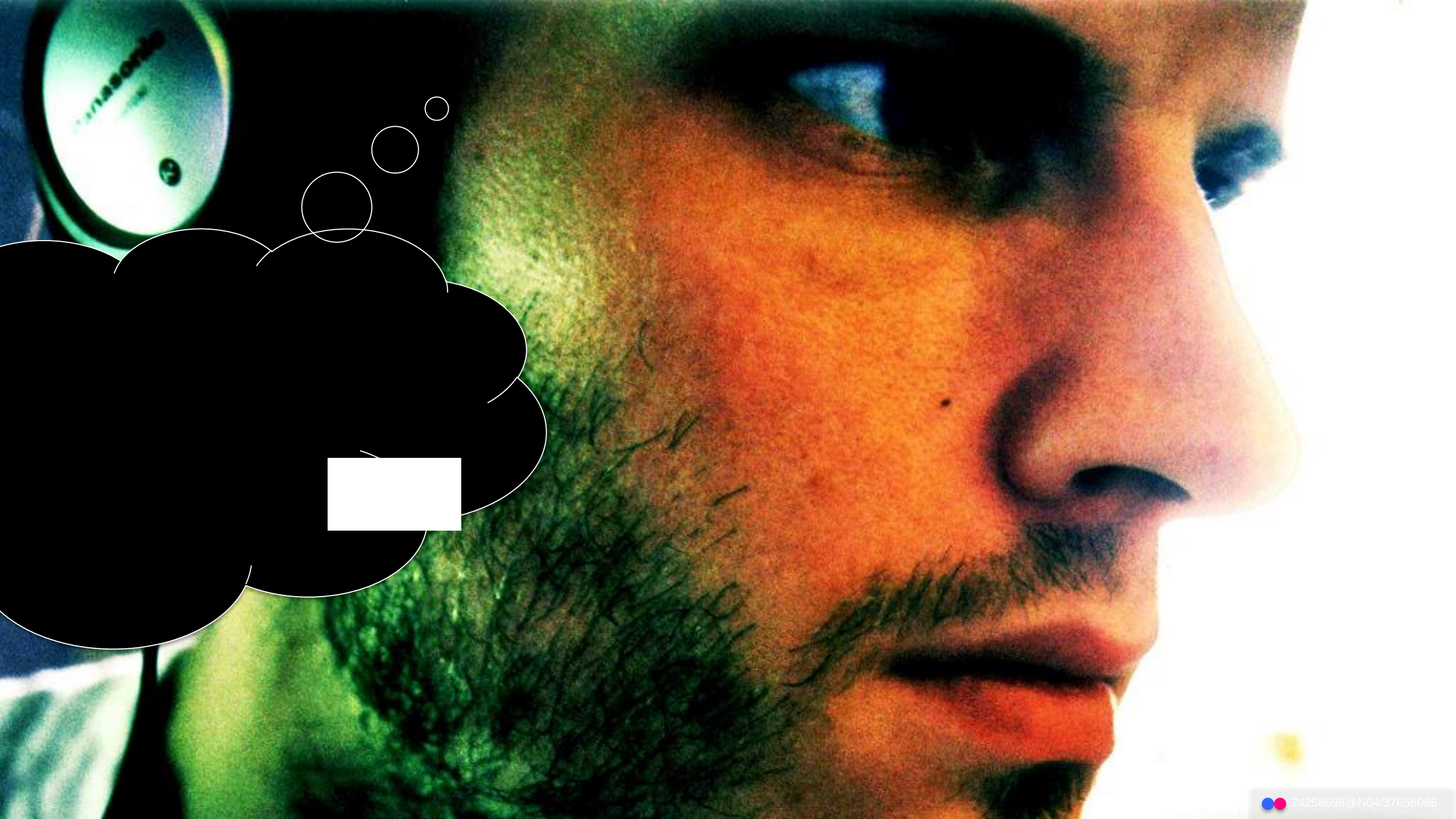

Unit tests
Test a ”unit” of code in isolation

Primary value of unit tests:

1. drive code structure
2. ~~code is correct~~
3. catch regression



average web mapping application



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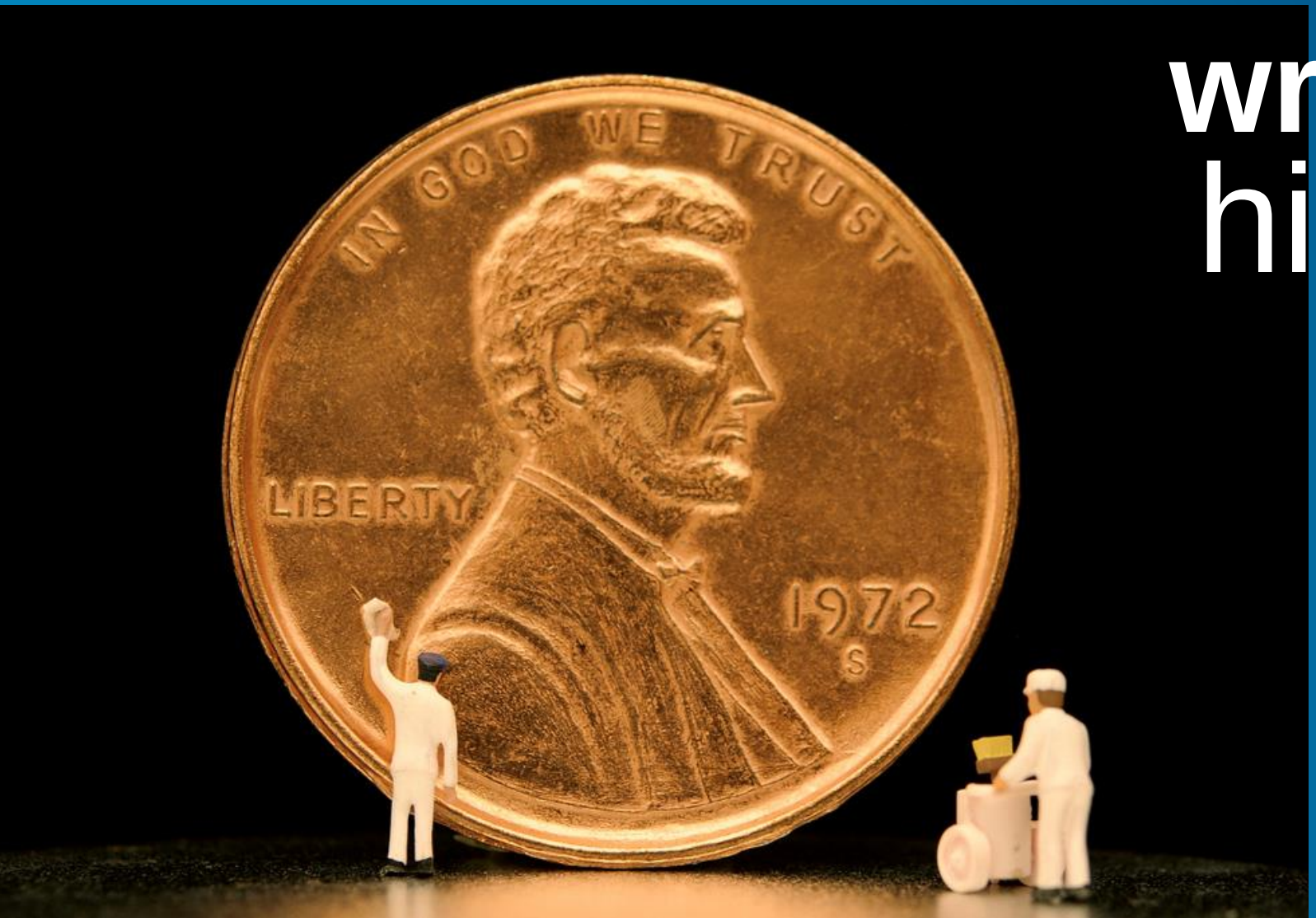
4 rules for super unit tests



write high value tests

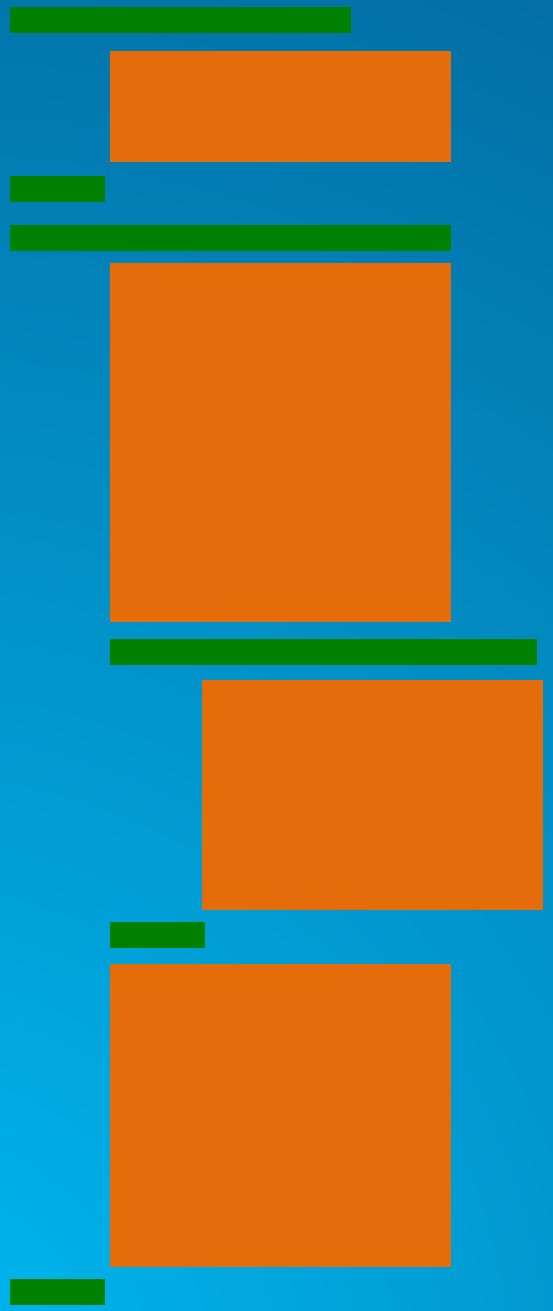

test only your code

test one thing at a time


refactor
ruthlessly

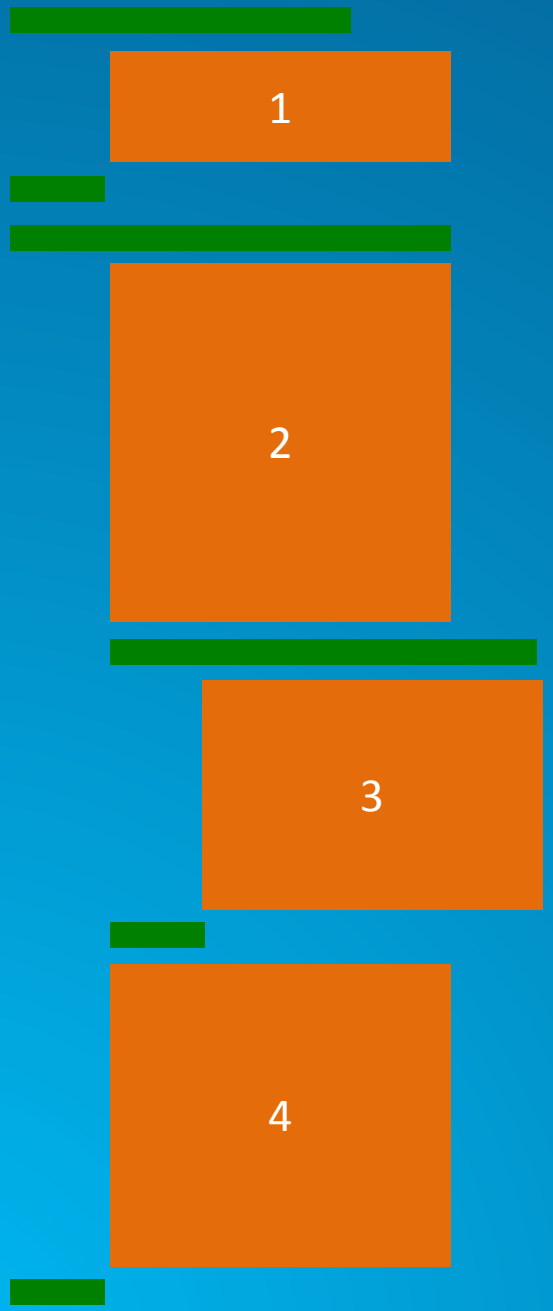
test one thing!

“logic”



“logic”

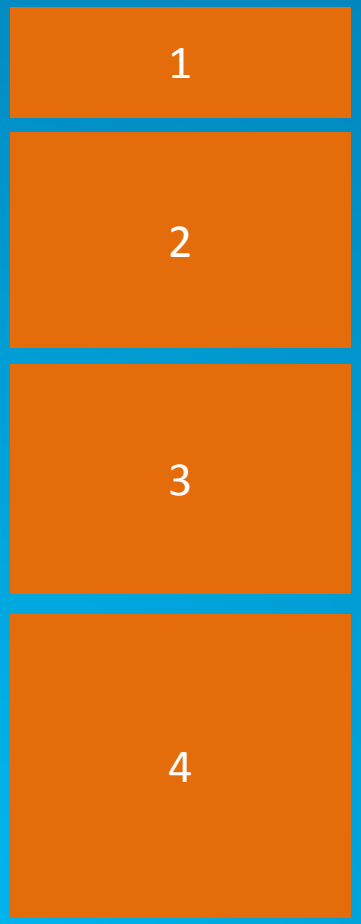
“action”



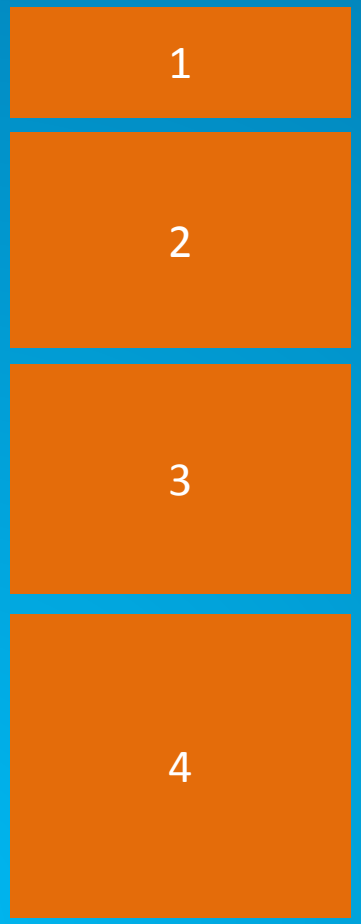
“logic”

“action”

“logic with calls”



“action functions”



“action functions”

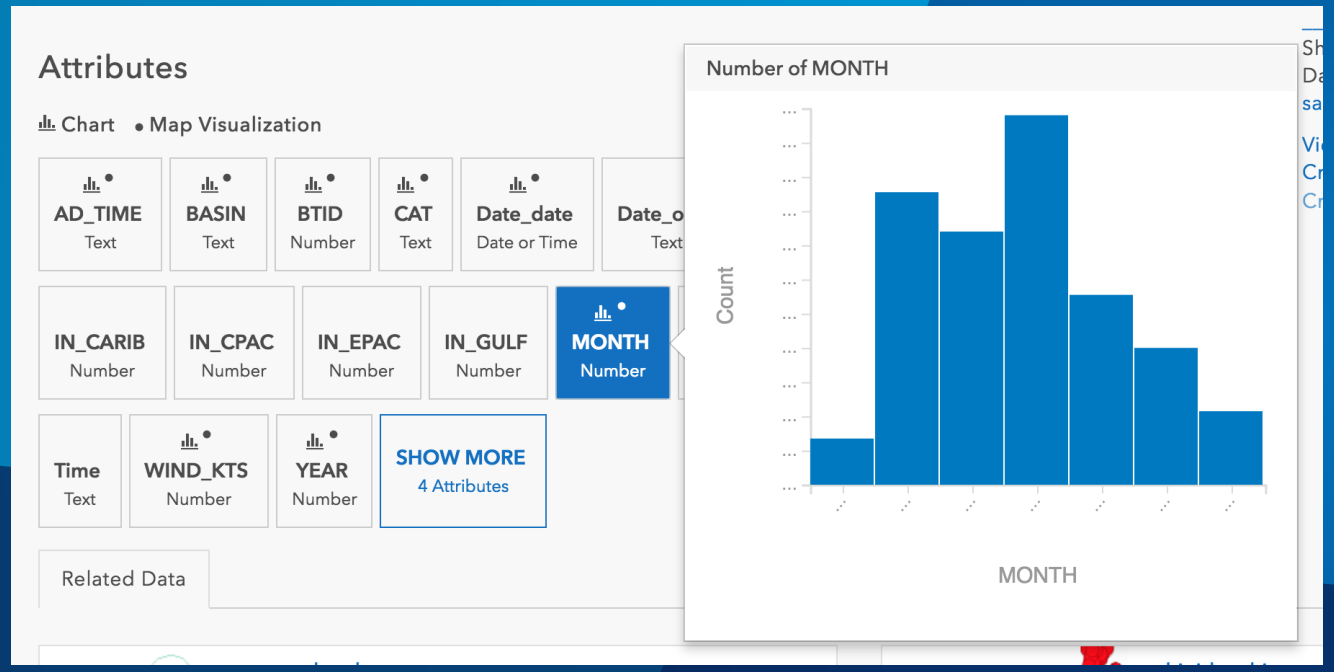
often (too) easy to test

tests are high-value when formulating an algorithm

write high value tests!

Don’t Test This Function

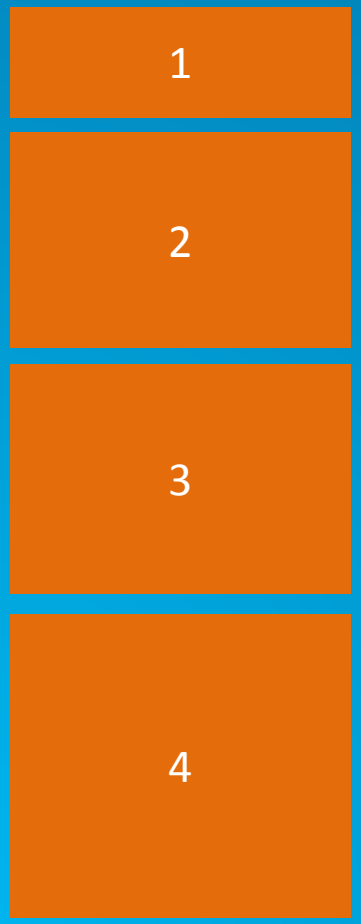
```
function add(a, b) {
  return a + b;
}
```



Demo: Test Driving an Algorithm

"Simple" Charts in Open Data

@tomwayson/arcgis-chart-utils



“high-value” tests

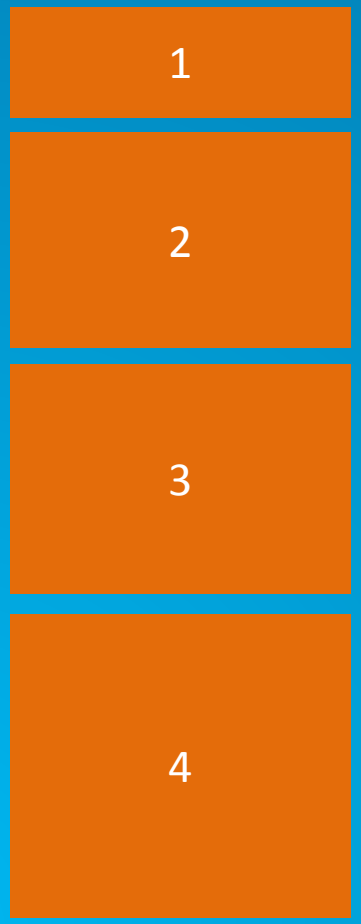
focus on the “logic”

given a,b,c…

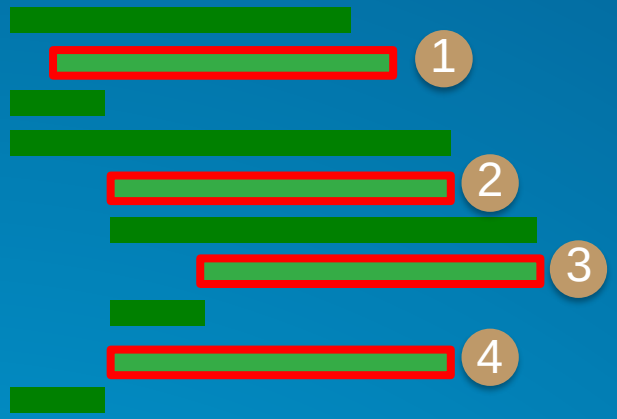
was fn 1 called with a,c?

did fn 3 call fn 4 with c?

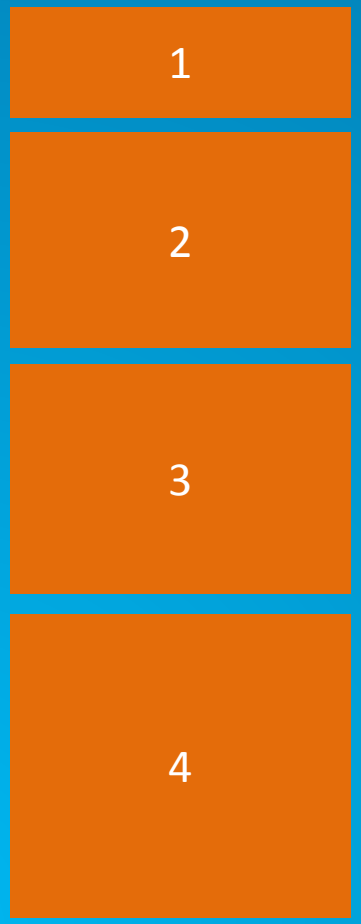
testing logic



spies & fakes!



testing logic



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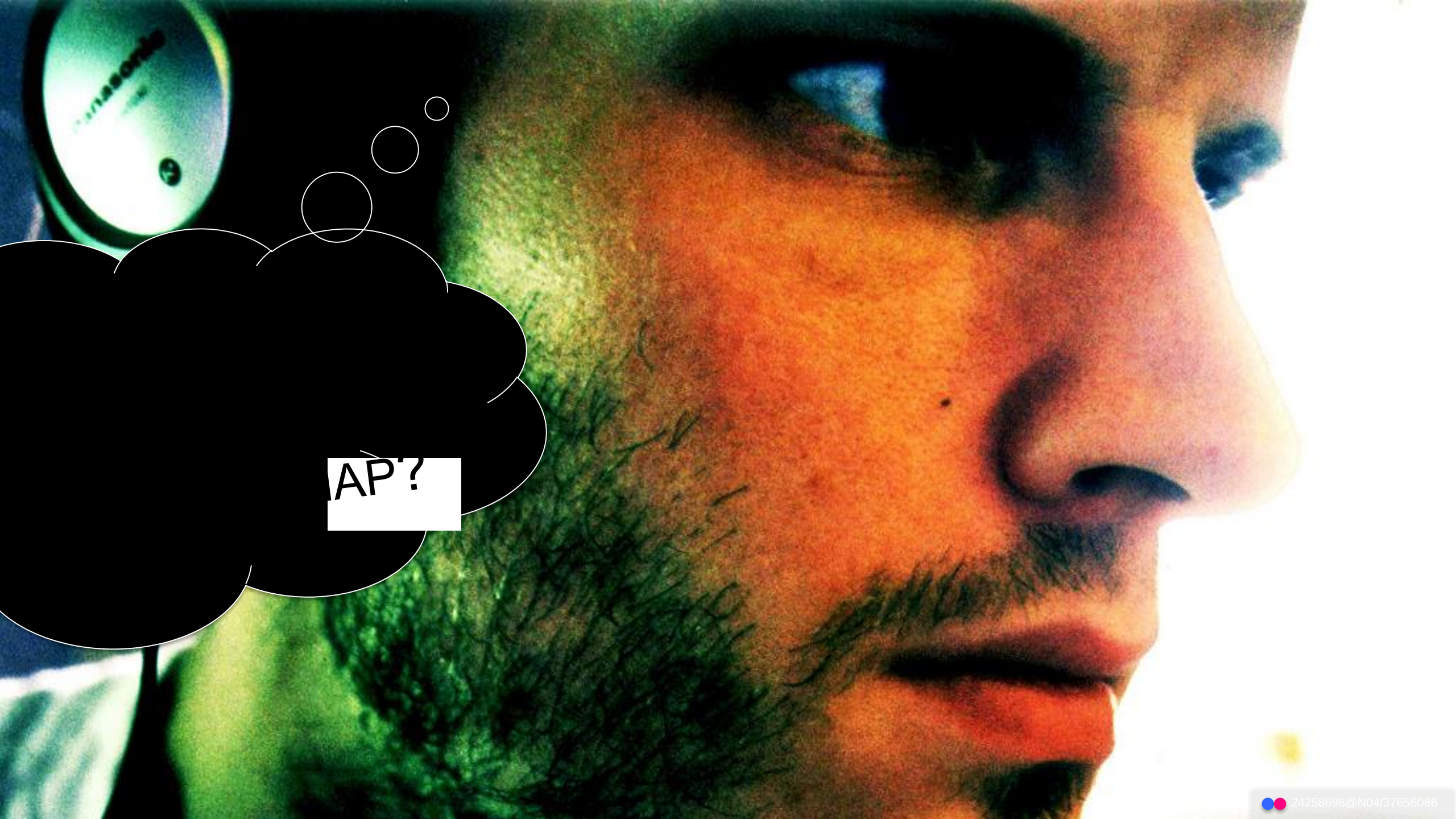

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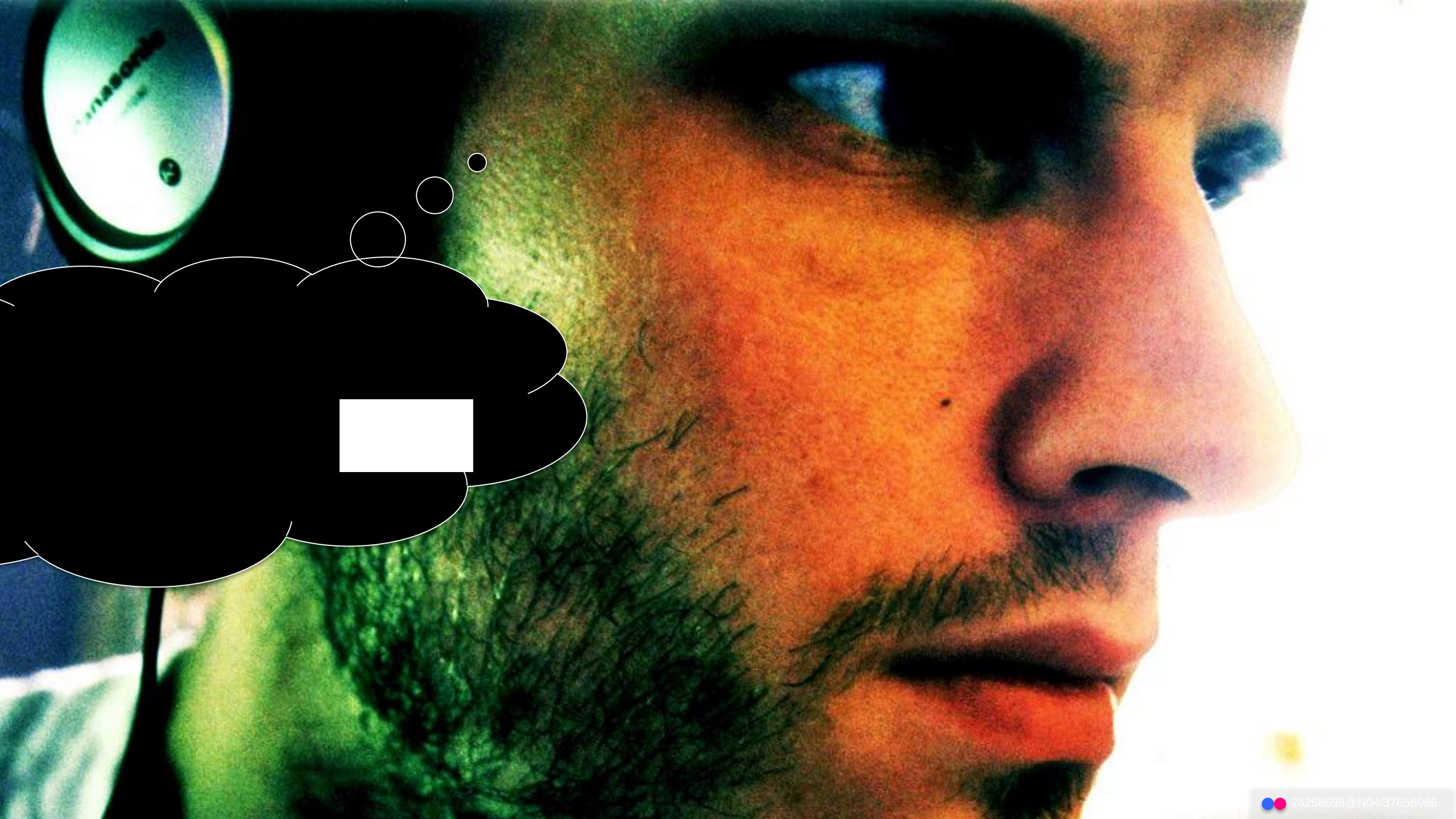
Don’t Test the Map



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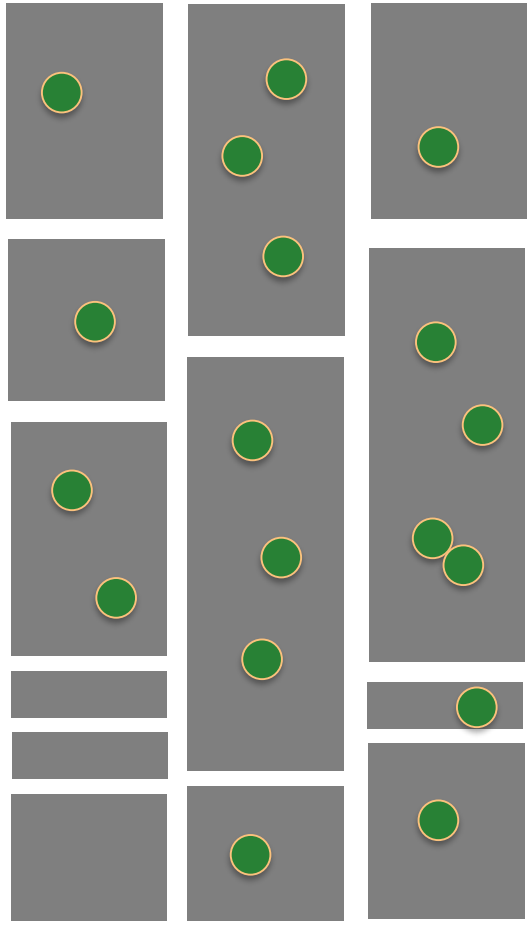
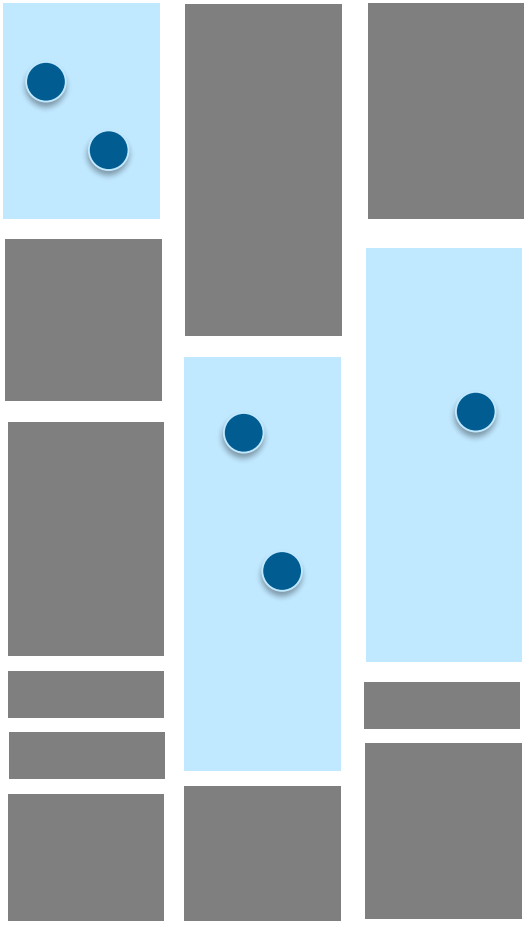


- map access

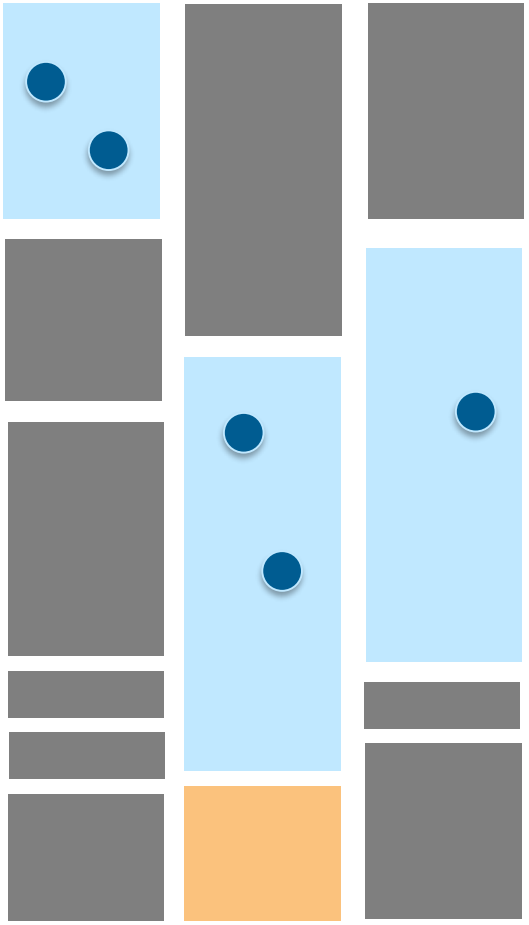
Separation of Concerns

(hint: use a framework)



UI components

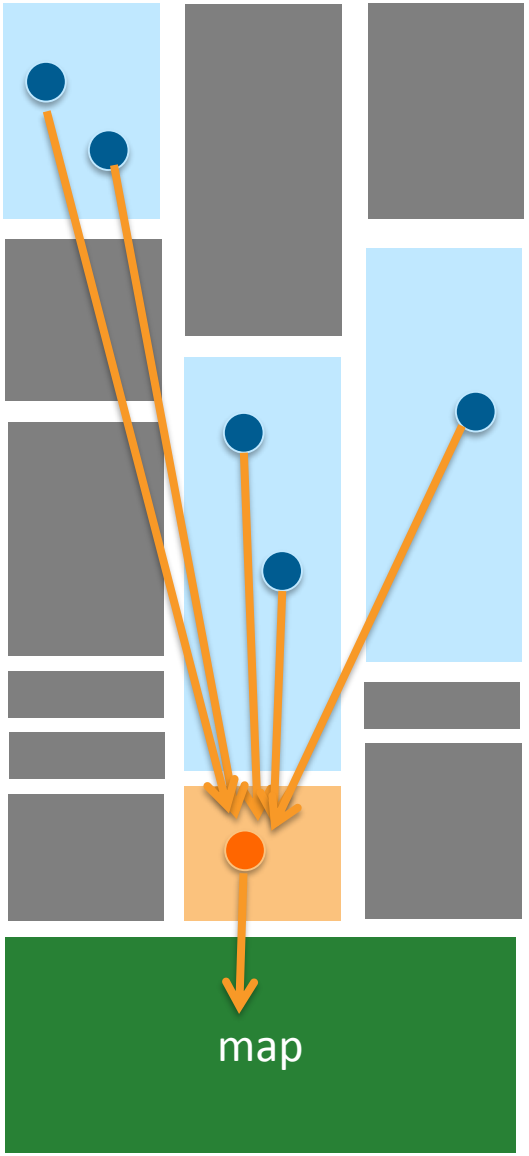
controllers



map service

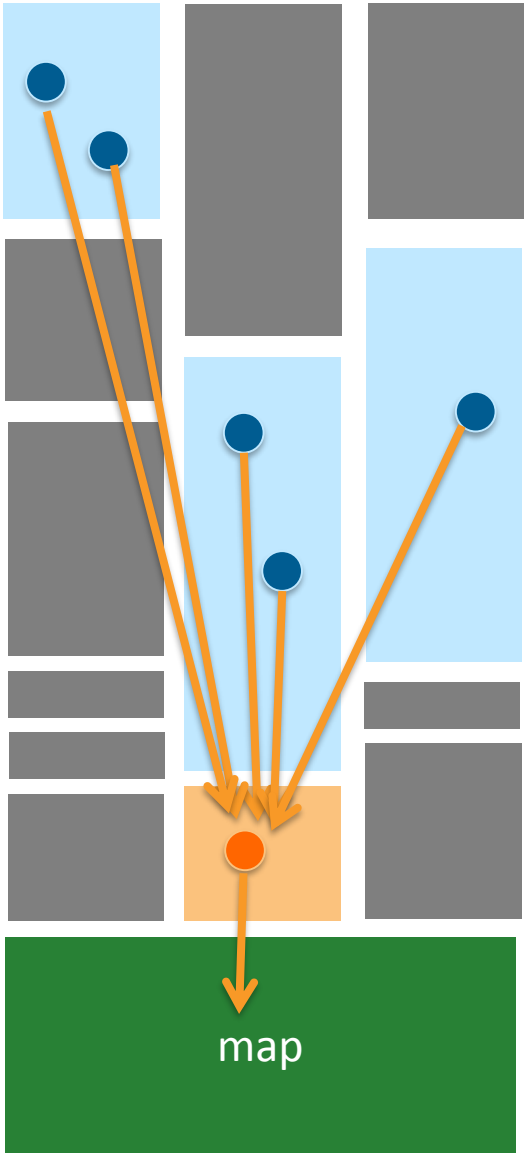
(or “map controller”)

a facade



map service

```
mapService.on("load", …)
mapService.newMap(…)
mapService.showLayer(…)
mapService.destroyMap(…)
```



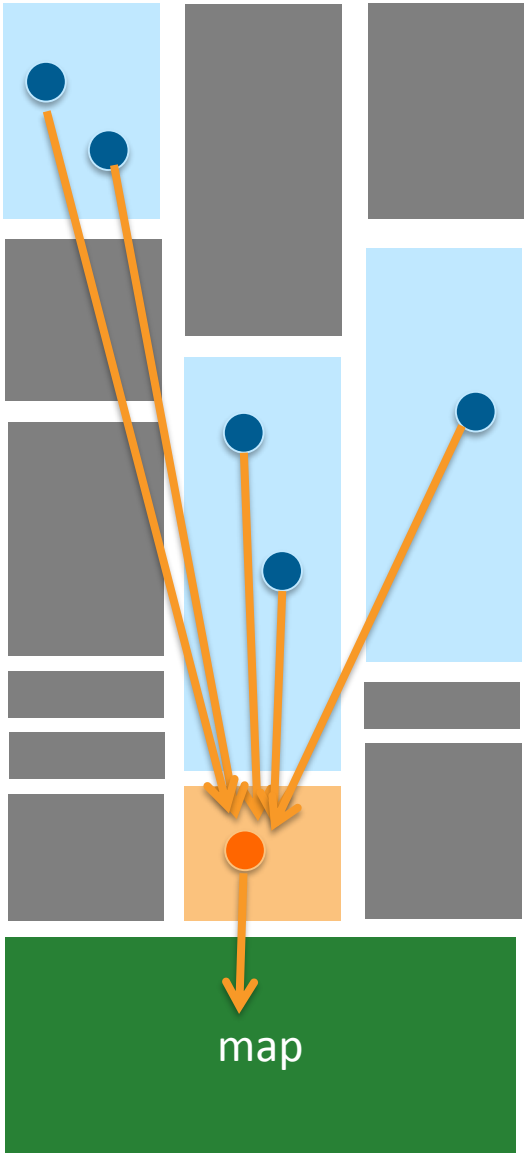
spies & fakes!

spy:

how many times was the fn() called?
what parameters were passed?

fake (a.k.a stub):

replace implementation of a fn()
can also spy on the fake



spies & fakes!

```
var stub = sinon.stub(mapService, “newMap”);

controllerUnderTest.showMap();

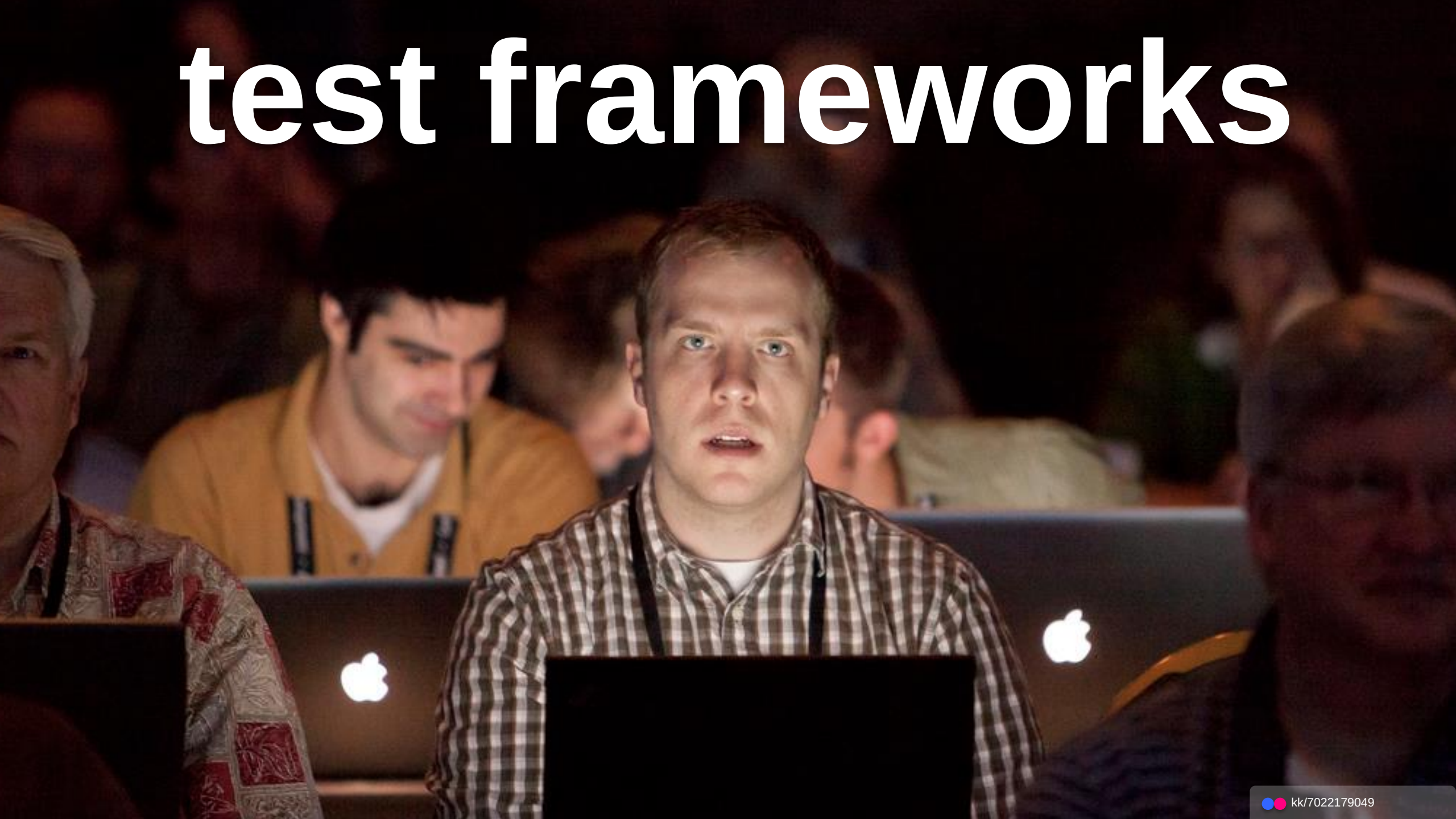
assert.ok(stub.calledOnce, 'newMap was called once');
```

Demo: Stubbing a Map Service

const stub = this.stub(mapService, 'newMap');

@tomwayson/ambitious-arcgis-app

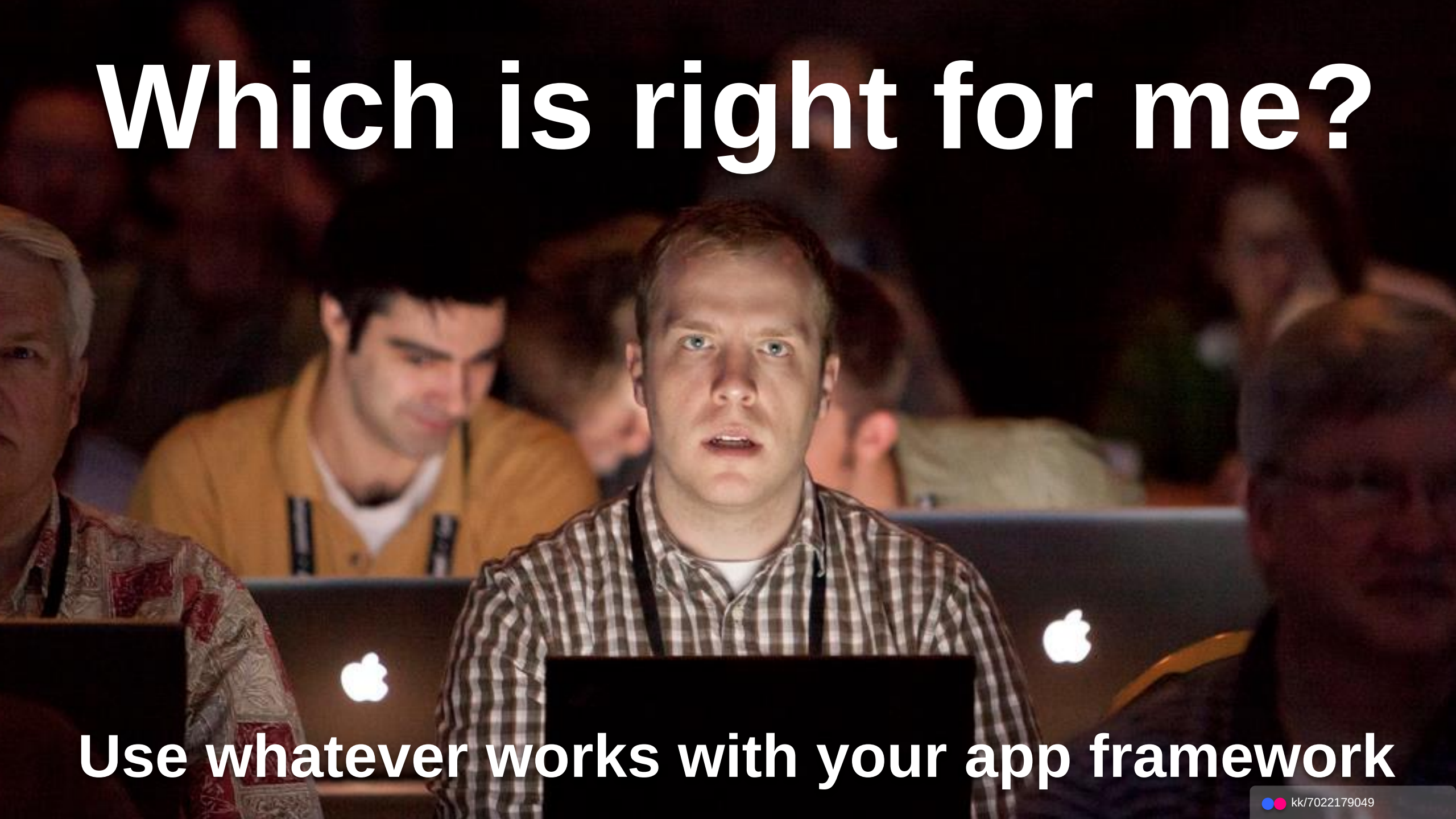
test frameworks



Jasmine

KARMA

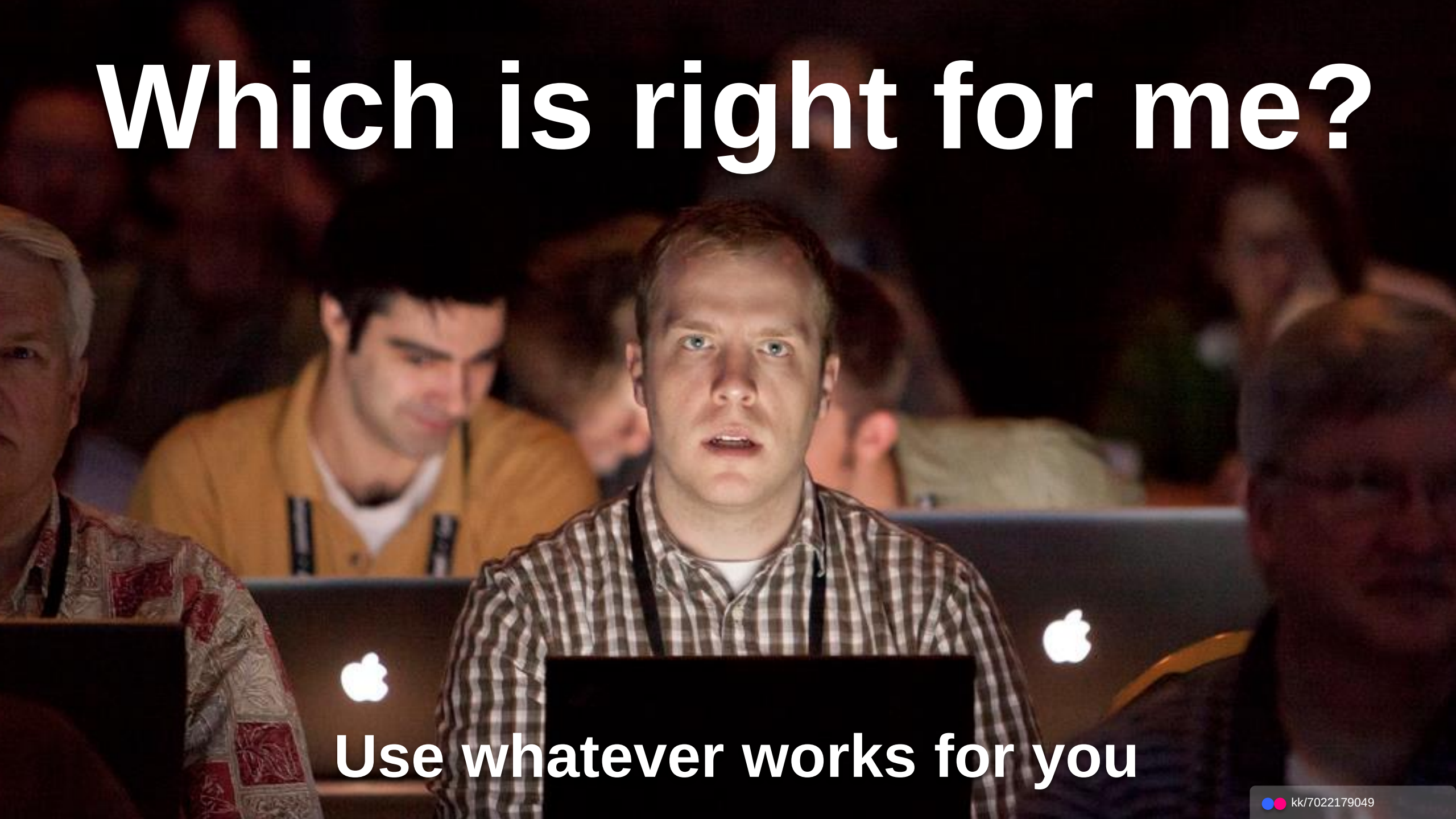
Which is right for me?



Use whatever works with your app framework

kk/7022179049

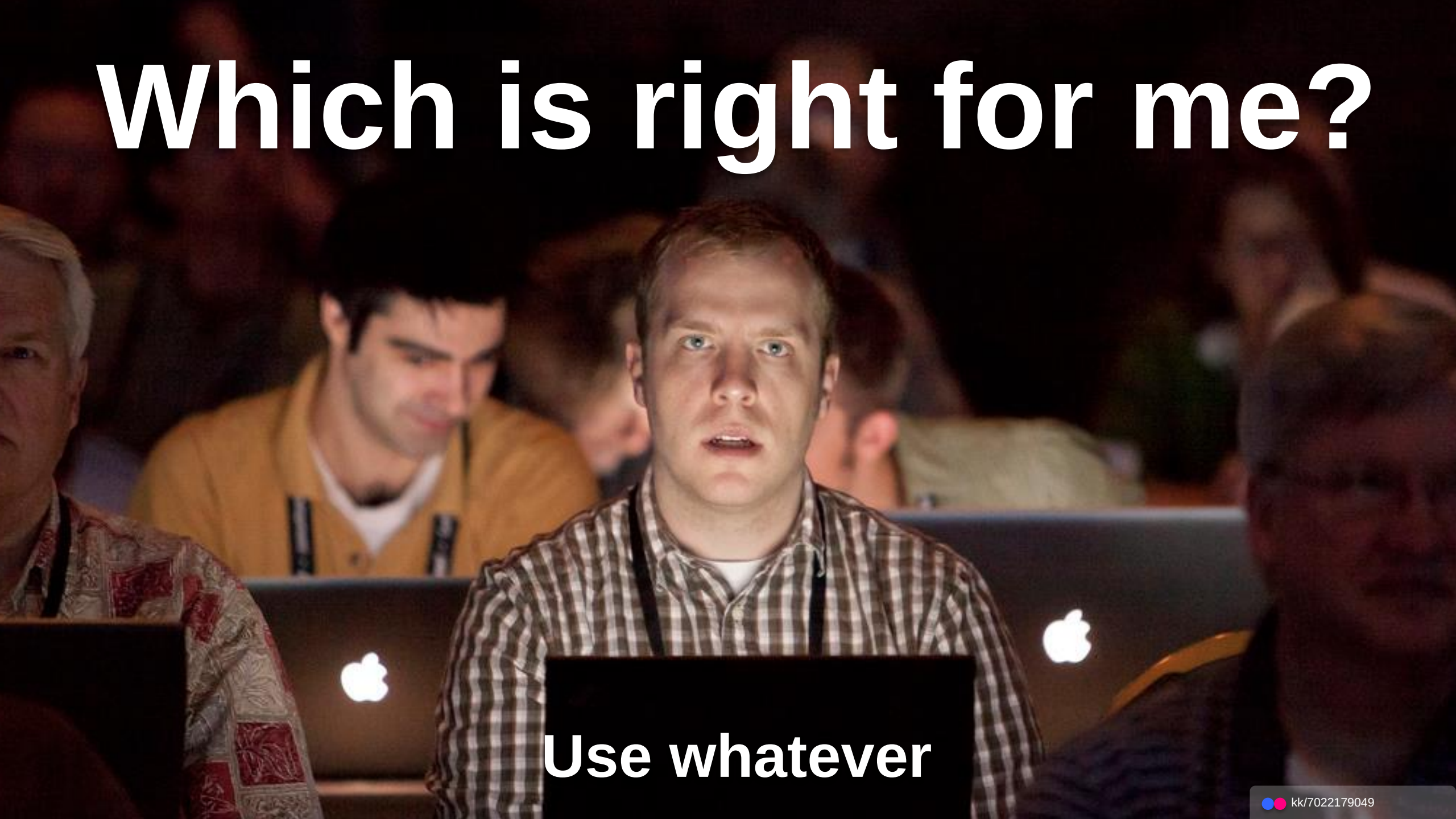
Which is right for me?



Use whatever works for you

kk/7022179049

Which is right for me?



Writing tests makes your code better.

Writing tests makes you code better.

Testable code is more robust.

Testable code is more understandable.

Testable code is more modular.

Testable code is more reusable.

Component Tests

“mini” e2e tests

mimic user interaction

ArcGIS Open Data Administrati ×

Tom

Secure https://opendataqa.arcgis.com/admin/layout/a1fc06f11b4746698a352b3244a251a3/edit

Admin

Site Editor

My Data

Only for a part of the page

Publishing

Updated 8 days ago

Save View Site

Header Settings

- Use logo and site title
- Use custom HTML/CSS

Site Title

My Open Data Site

Logo URL (50px max-height)

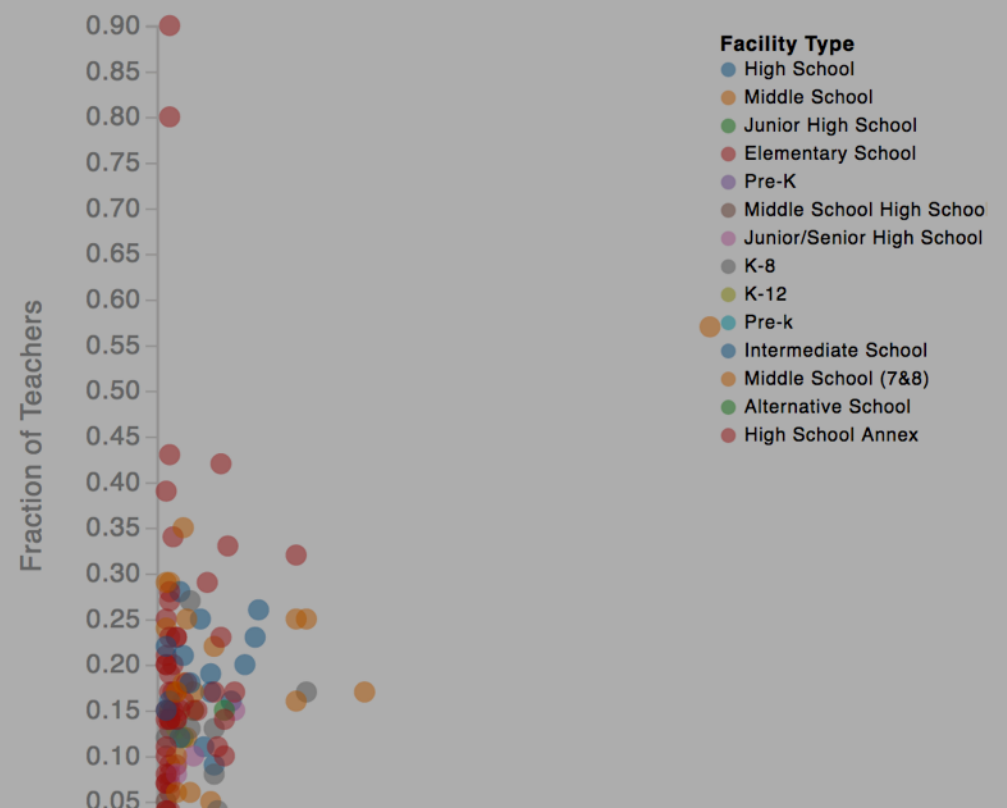
http://...

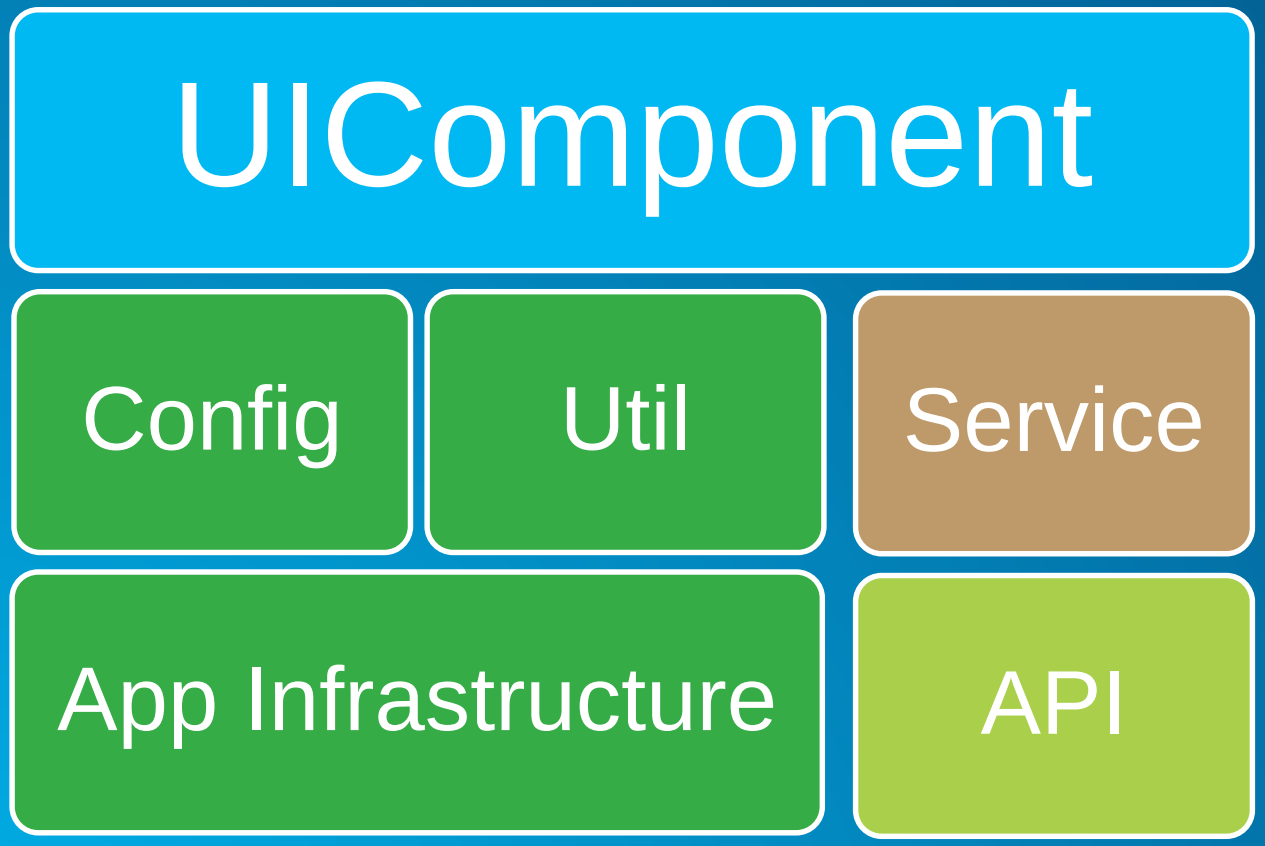
Theme Builder

Layout Builder

Footer Settings

New Chart





partial isolation

fake expensive operations (async API calls, etc)

makes this easy

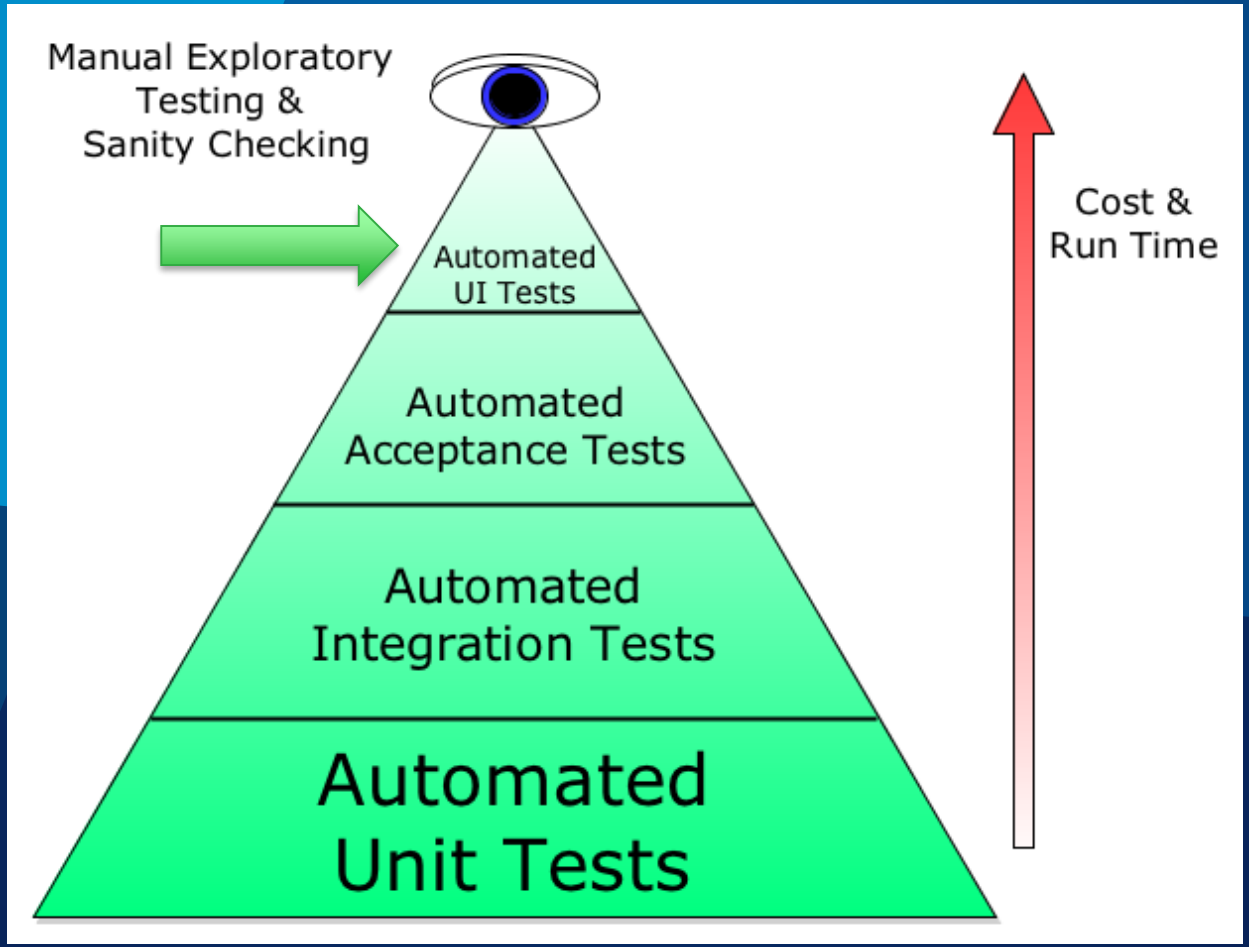
Thank you!

https://github.com/tomwayson/dev-summit-2017-front-end-testing

Browser-based Web Mapping Application Testing

Jeremy Schneider

Top of Testing Pyramid



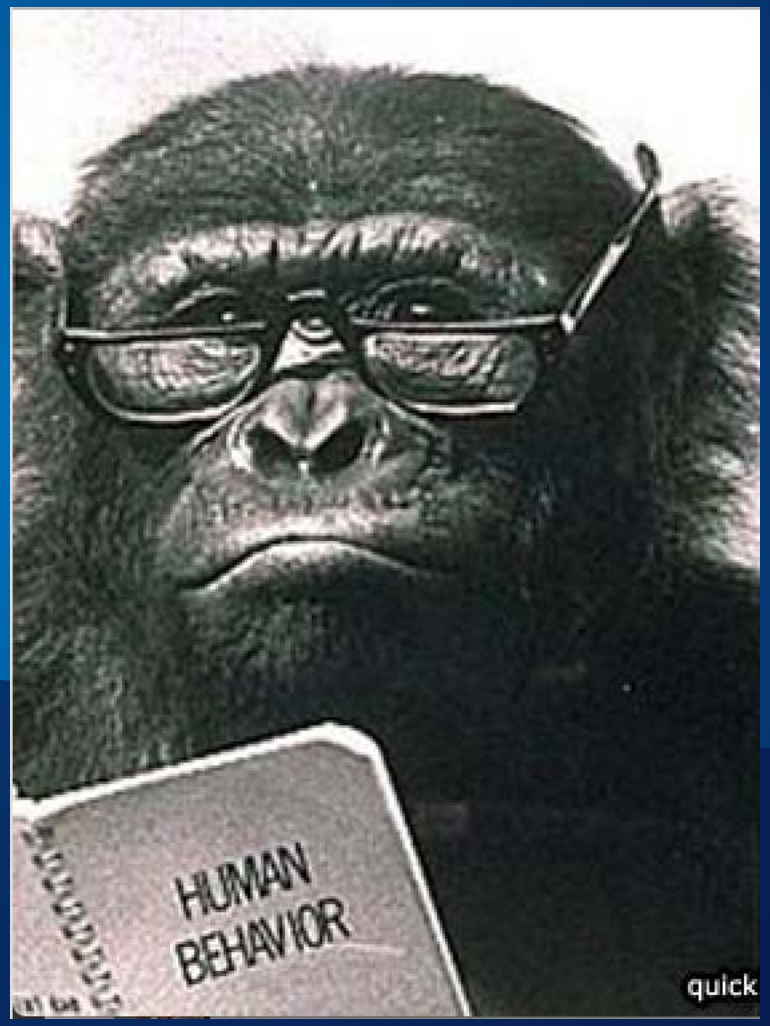
Browser & Visual Testing

- Selenium/WebDriver
- Screenshot Comparison

Selenium Testing

Human-ish tool to drive browser and verify application behavior

- Hands/Fingers
- Eyes
- Brain
- Voice



Selenium

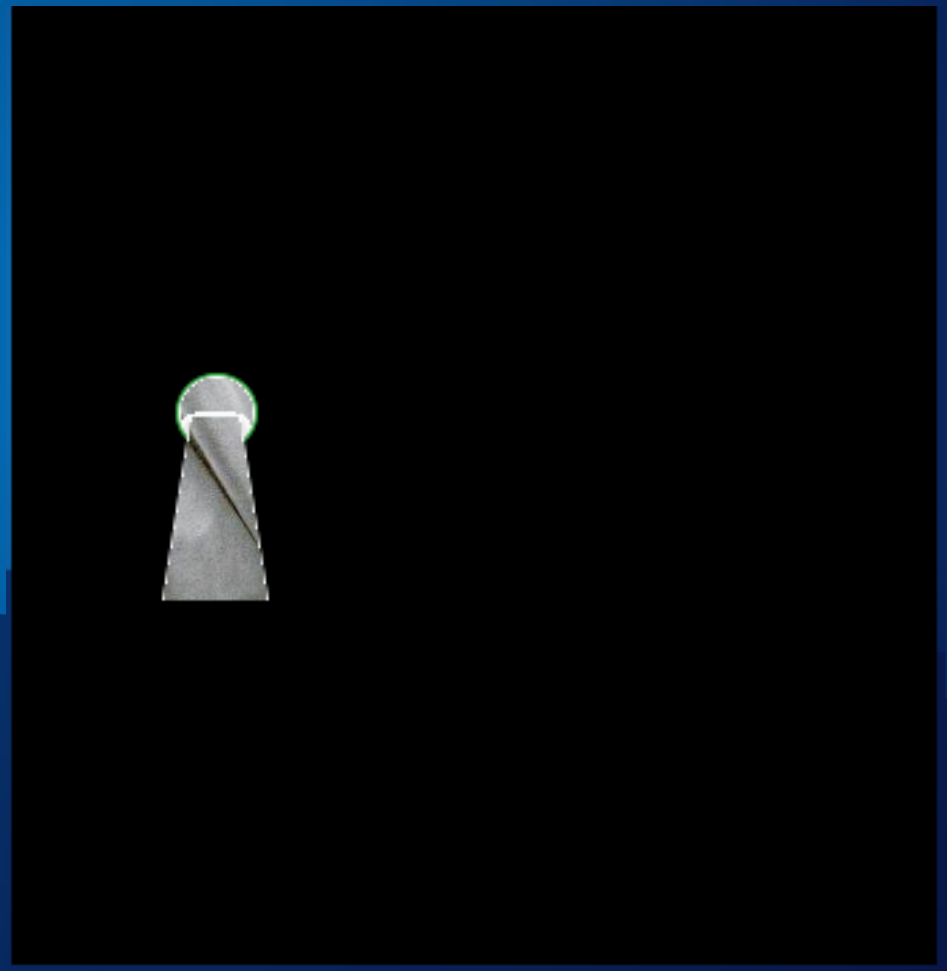
Hands:

- Navigate to sites – type into URL Bar
- Type stuff in fields
- Move mouse
- Click buttons

Selenium

Eyes:

Look at page (DOM) *through small keyhole!*



Selenium

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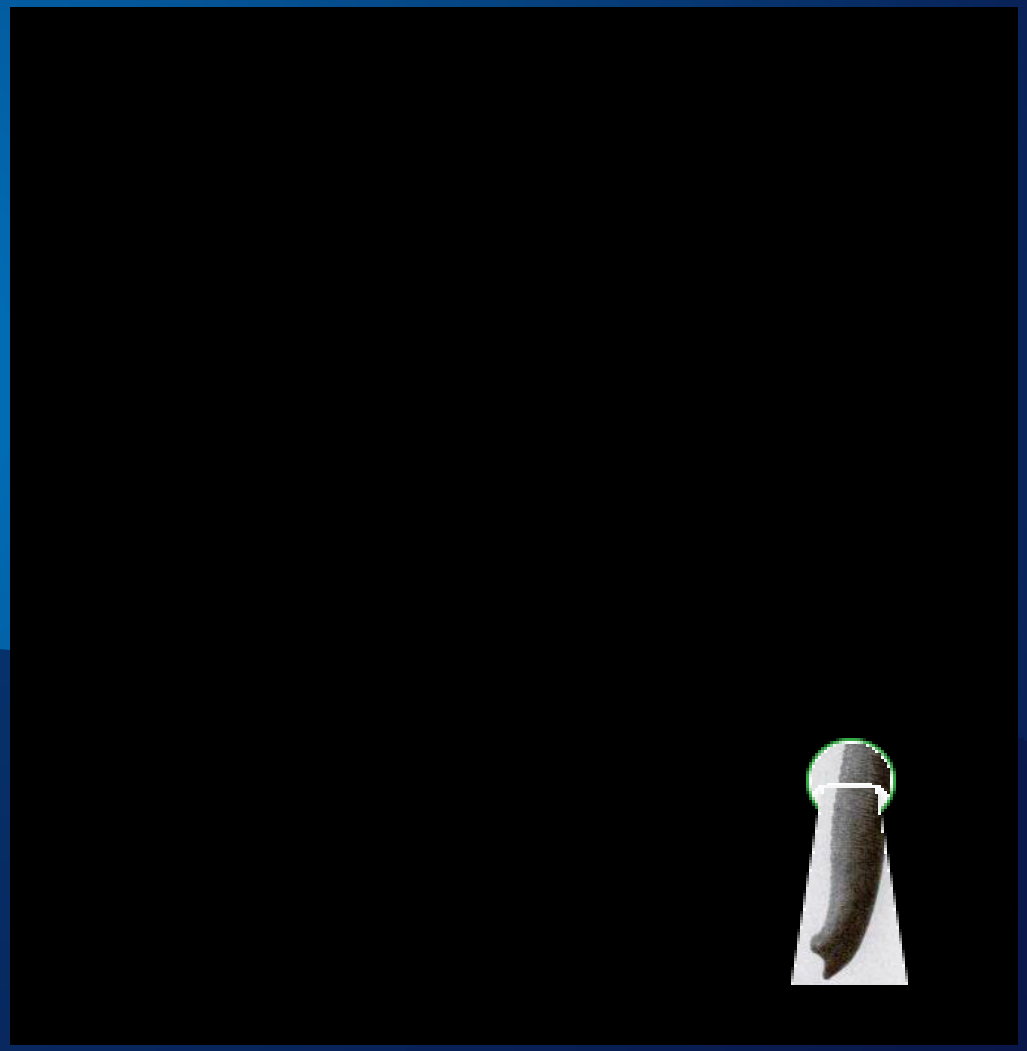

Selenium

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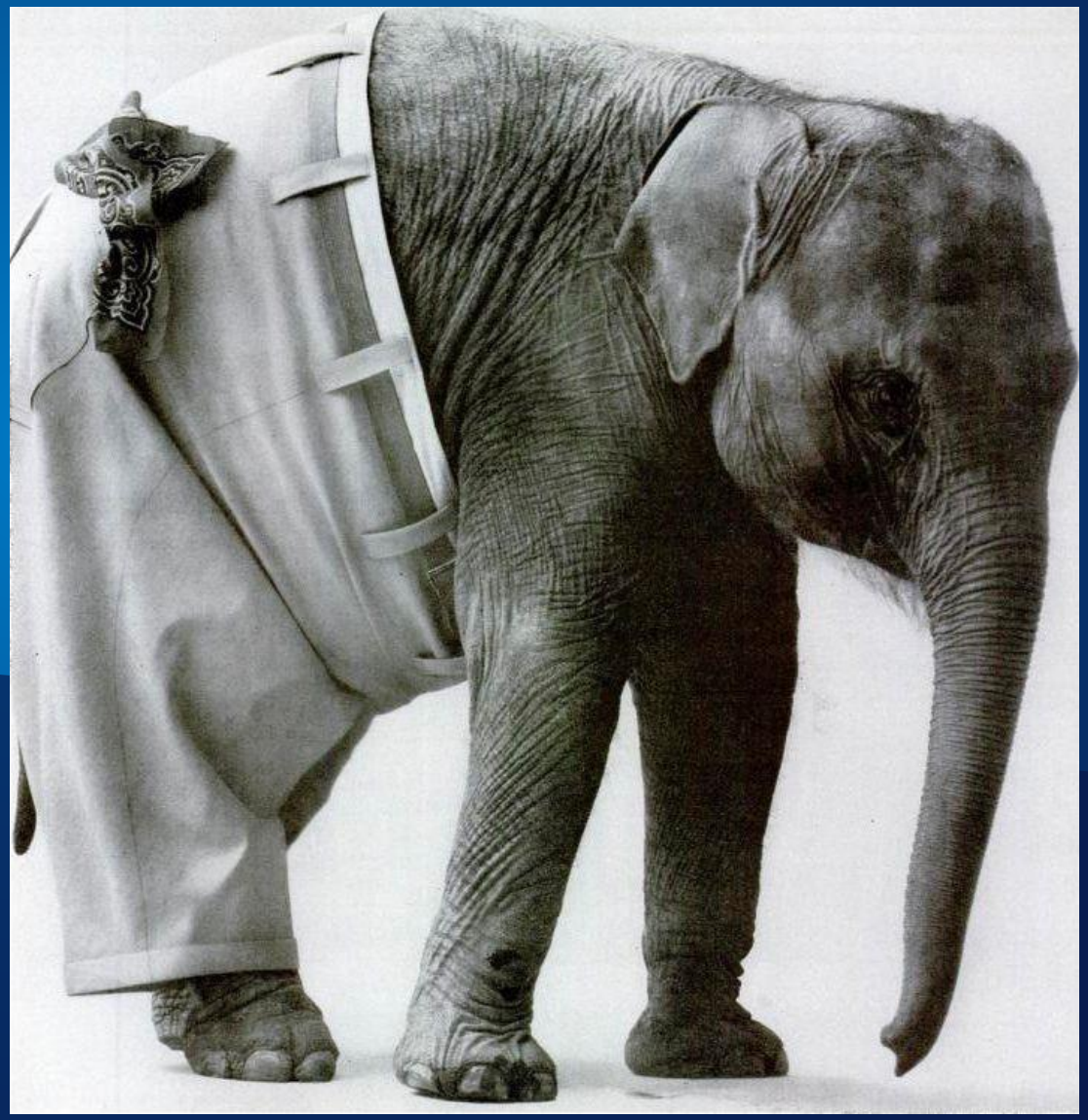

Selenium

Brains/voice – Test Framework:

- RSpec, Cucumber, Junit, Test::Unit, TestNG…
- API bindings in many languages

Basic Selenium Flow

- Get driver
- Go to page
- Find element and interact with it
- Verify expected new page contents

Get driver

```
# run like this: PATH=.:$PATH ruby basic_selenium_example.rb
require 'selenium-webdriver'

# download geckodriver from https://github.com/mozilla/geckodriver/releases
# and put it in this directory.
driver = Selenium::WebDriver.for :firefox, marionette: true

driver.navigate.to "http://google.com"
element = driver.find_element({name: 'q'})
element.send_keys "Selenium Tutorials"
element.send_keys :enter
sleep 2 # not recommended to use sleep; we should use an implicit wait

if /toolsqa.com/.match(driver.page_source)
  puts "YAY!"
else
  puts "BOO!"
end

driver.quit
```

Go to page

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Locate elements

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Interact with elements

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Verify page changes

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end

driver.quit
```

Visual Regression Testing

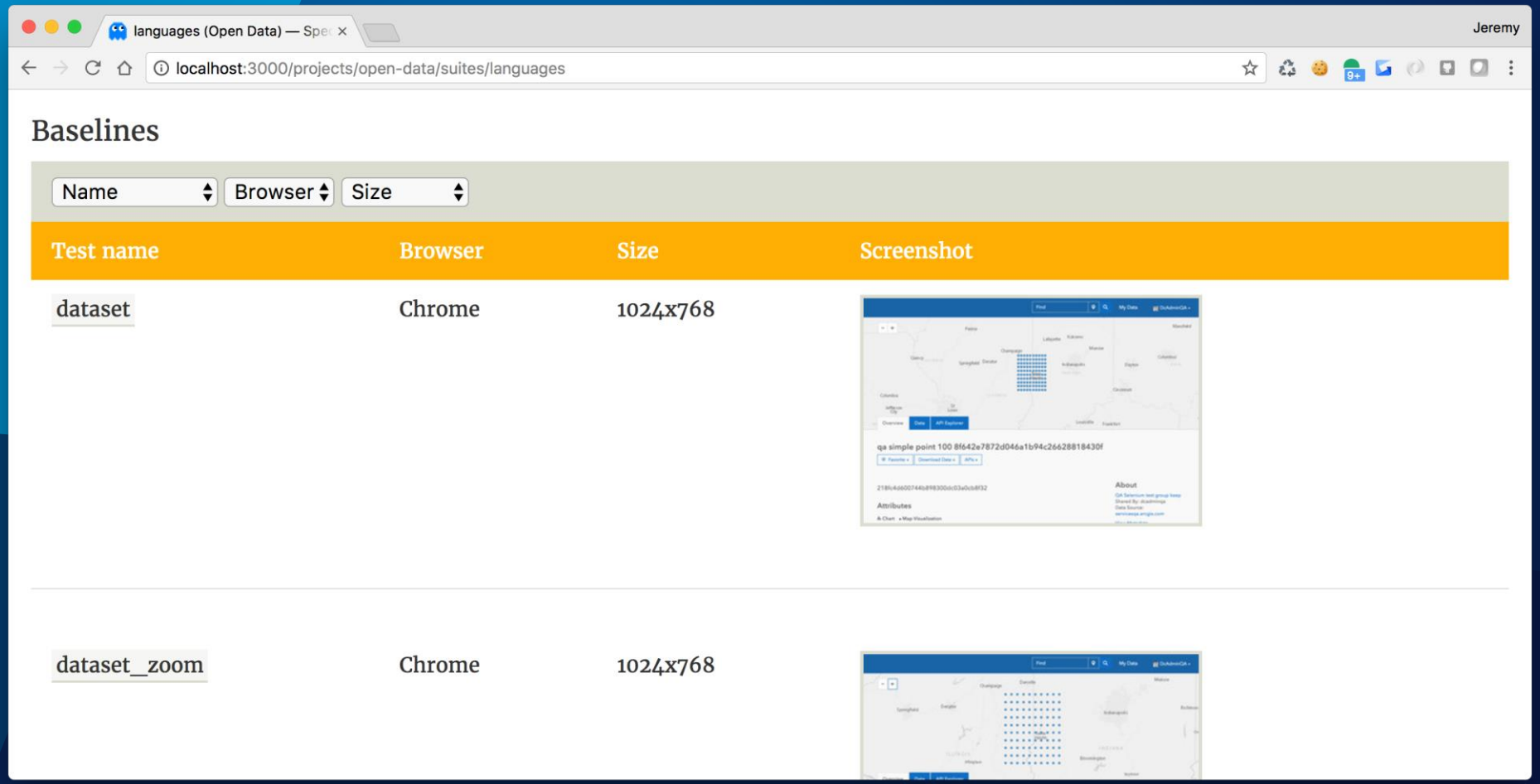
- Create baseline screenshots
- Perform scenarios
- Capture and compare screenshots to known-good baseline

Visual Testing

- **Easy! Doesn't know or care *how* page is built**
- **Powerful! Lots of bang for your buck – equivalent to many laboriously-created DOM-based assertions**

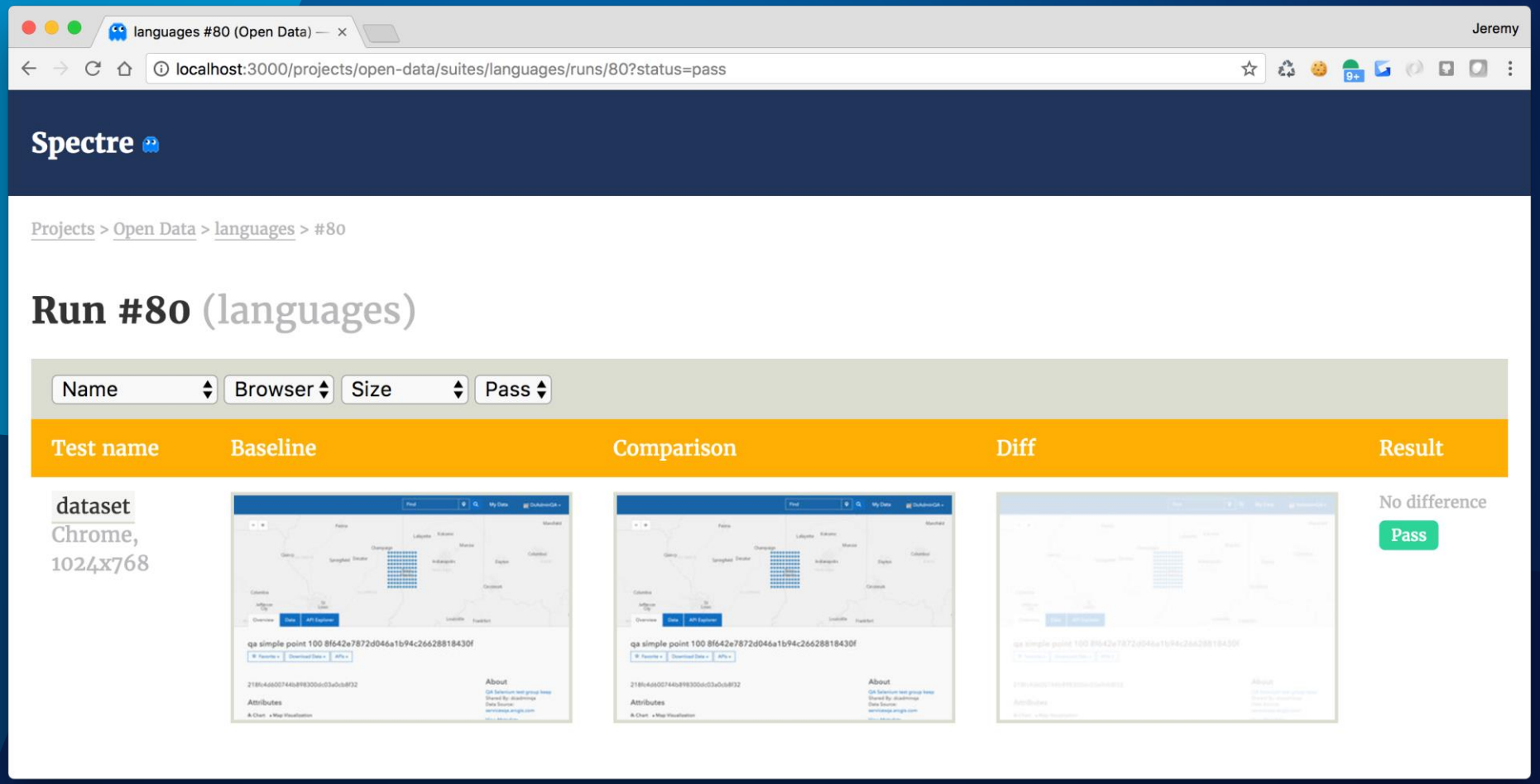
Visual Testing

(example baseline)



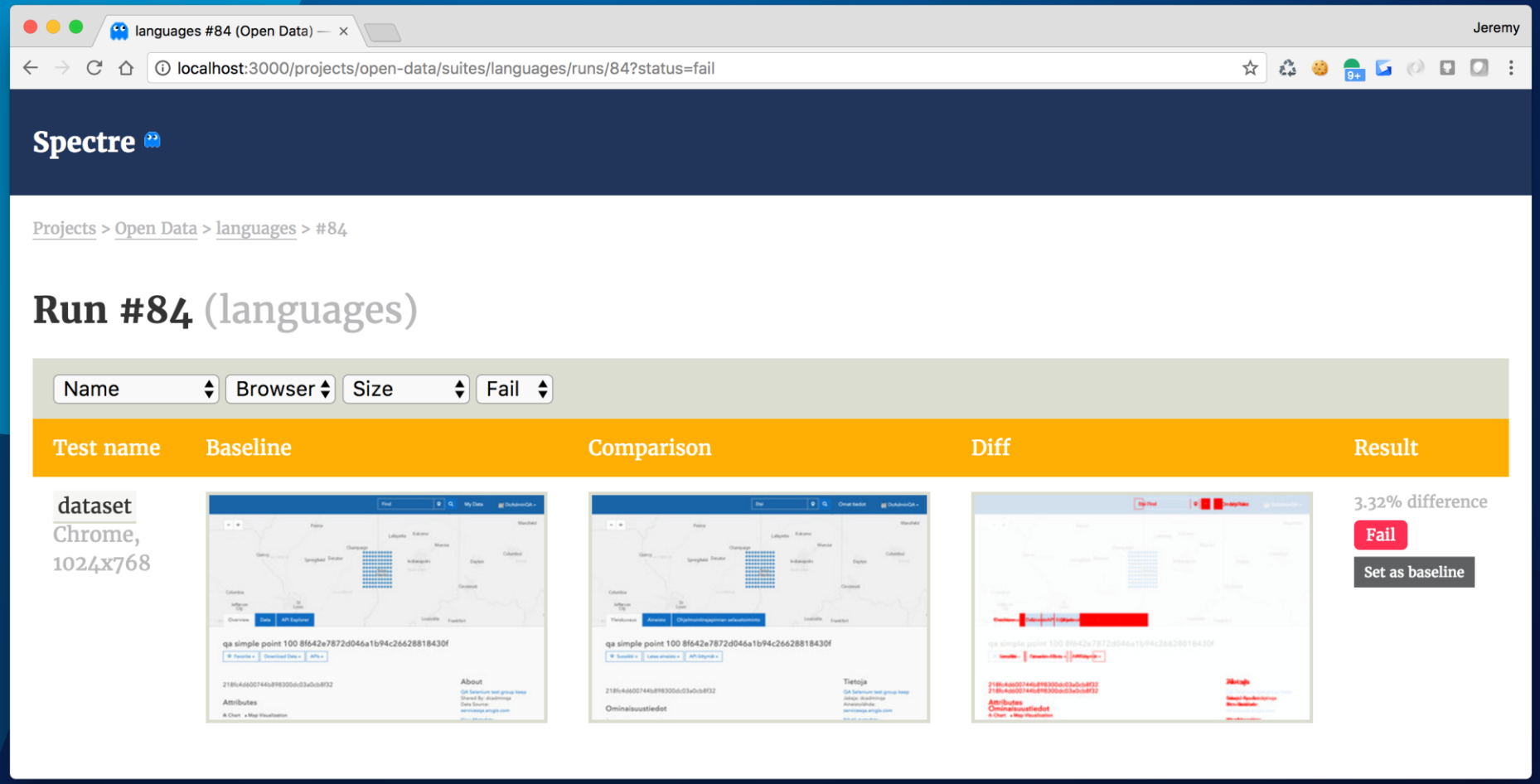
Visual Testing

(example pass)



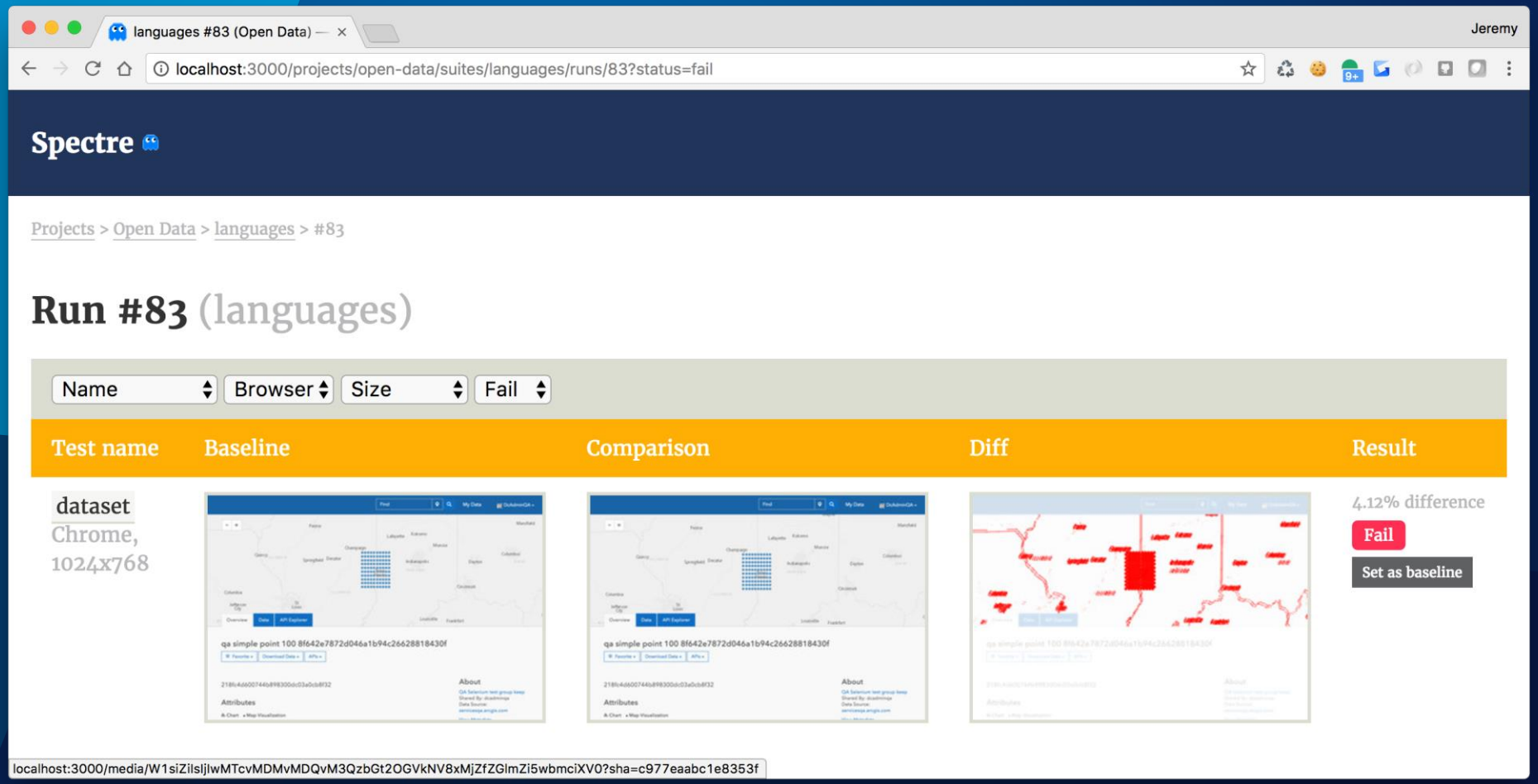
Visual Testing

(example failure in text)



Visual Testing

(example failure in graphic)



Visual Testing

- **Screenshots of the same scenario can differ slightly at the pixel level**
- **Captures *everything* in the browser window**
  - 3/1/17 4:13:15 PM
- **Image only – what about target of a link?**

Visual Testing

- **Screenshots of the same scenario can differ slightly at the pixel level**
- **Captures *everything* in the browser window**
  - 3/16/2017 9:14:06 AM
- **Image only – what about target of a link?**

Visual Testing

Drawback Mitigations:

- Tune “fuzz-factor” to allow for small pixel diffs
- Hide uninteresting elements before taking screenshot
- Pay for full-featured system (ex: Applitools Eyes)
- Use Selenium to check targets

Browser and Visual Testing

Cons:

- **Expensive to write**
- **Slow to run**
- **Require maintenance – “transparent” DOM changes *will* break locators**

Browser and Visual Testing

Considerations:

- Better for regression tests
- Be selective in what to test
- Coordinate with dev for testability
- Use “page object model”

Browser and Visual Testing

Pros:

- **Enables testing of full stack, end-to-end**
- **Can test in multiple browsers**
- **Validates the app *and* deploy/env**
- **Exercises the web app the same way a user does**

Demos

Let’s test some Web Mapping!

- Selenium in action
- With visual testing added

Resources

Selenium

- Official Selenium site: http://www.seleniumhq.org/
- Dave Haeffner: http://elementalselenium.com/
- Sauce Labs (ex: https://saucelabs.com/resources/articles/selenium-tips-css-selectors)
- https://gist.github.com/YmerejRedienhcs/28ec449f758056223076fa55d0954a72#file-selenium-cheat-sheet-md-
- Page Object model: http://elementalselenium.com/tips/7-use-a-page-object

Visual Testing

- Spectre Open Source visual testing: https://github.com/wearefriday/spectre
- Applitools Eyes visual testing SAAS: https://applitools.com/

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