

Fixing Your Automation Challenges in the Era of CI/CD

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WHO AM I?

- Co-Founder of Applitools
- Spent the last years working with multiple companies on software development and testing/automation projects



Agenda

- Automation challenges
- Market trends
- How can we fix it?
- Q&A



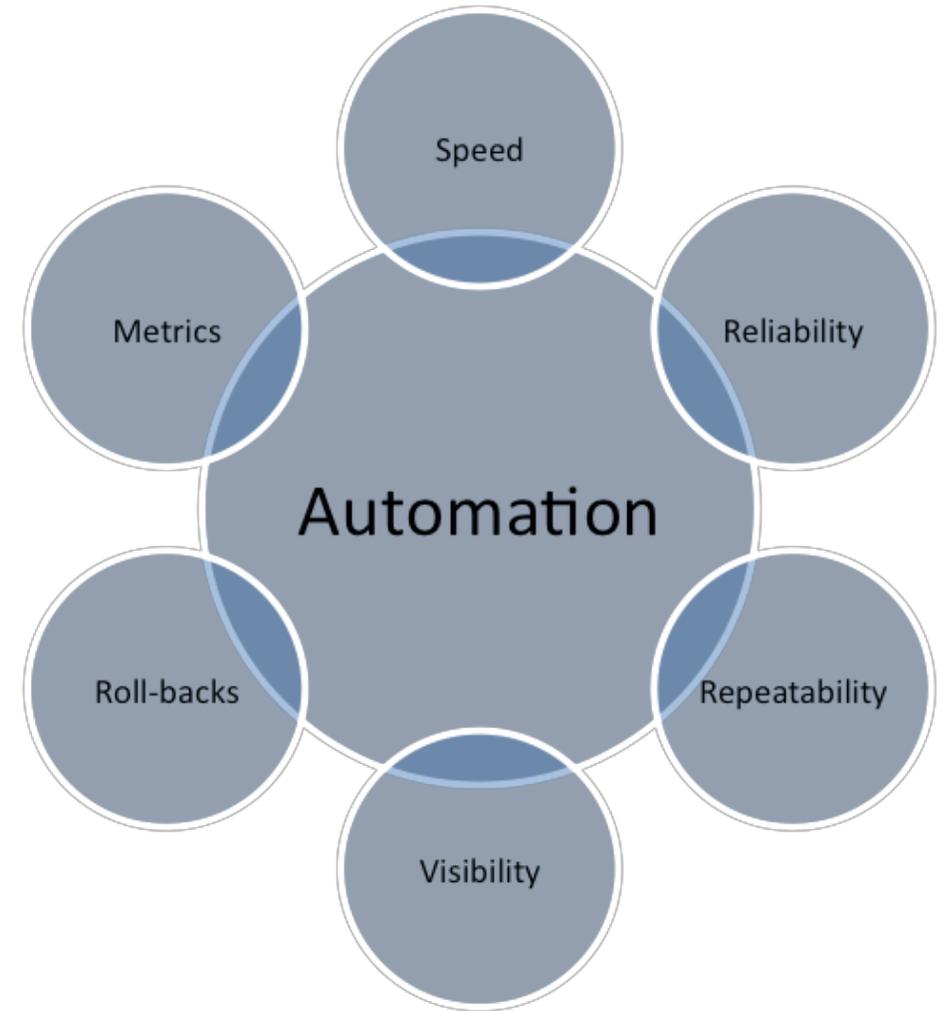


AUTOMATION CHALLENGES

The modern software delivery cycle

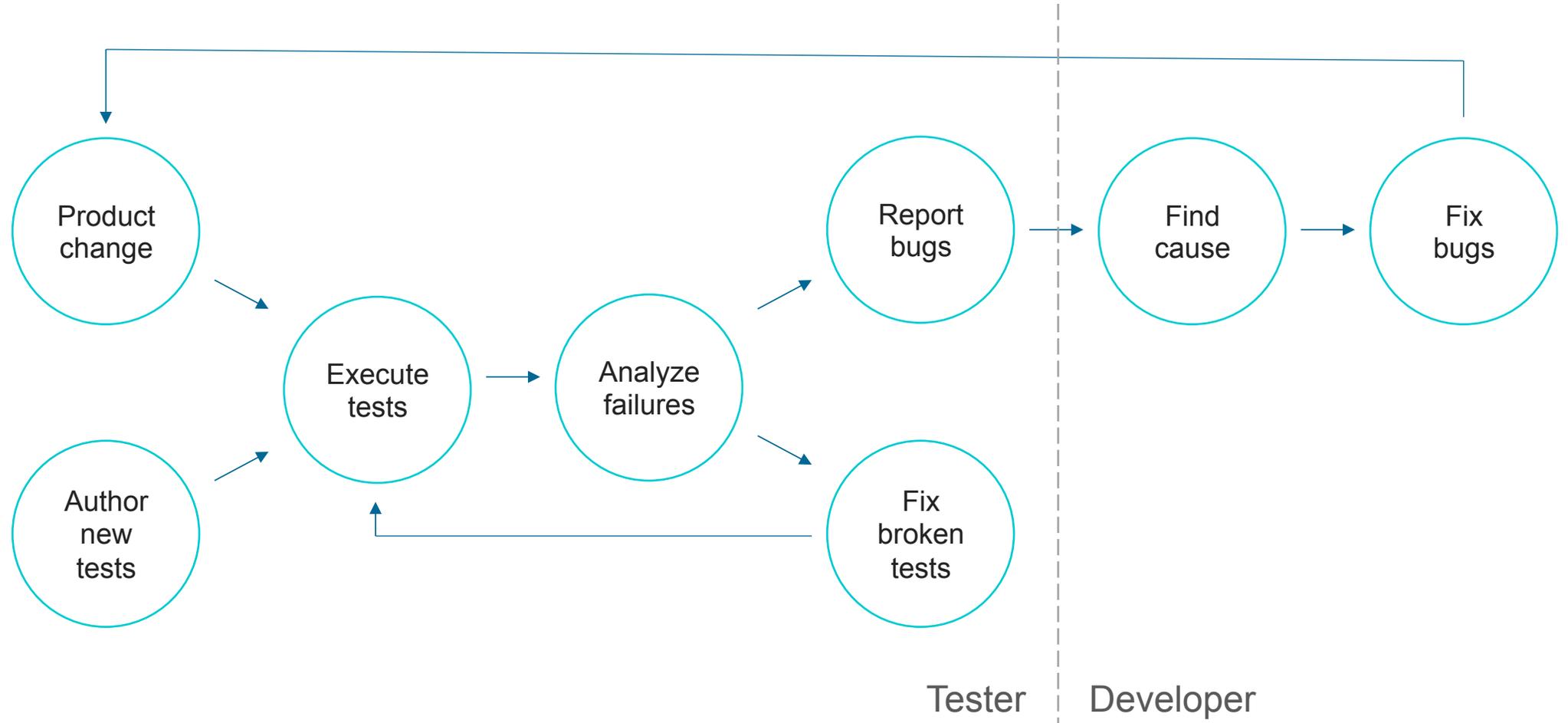


Automation is key!

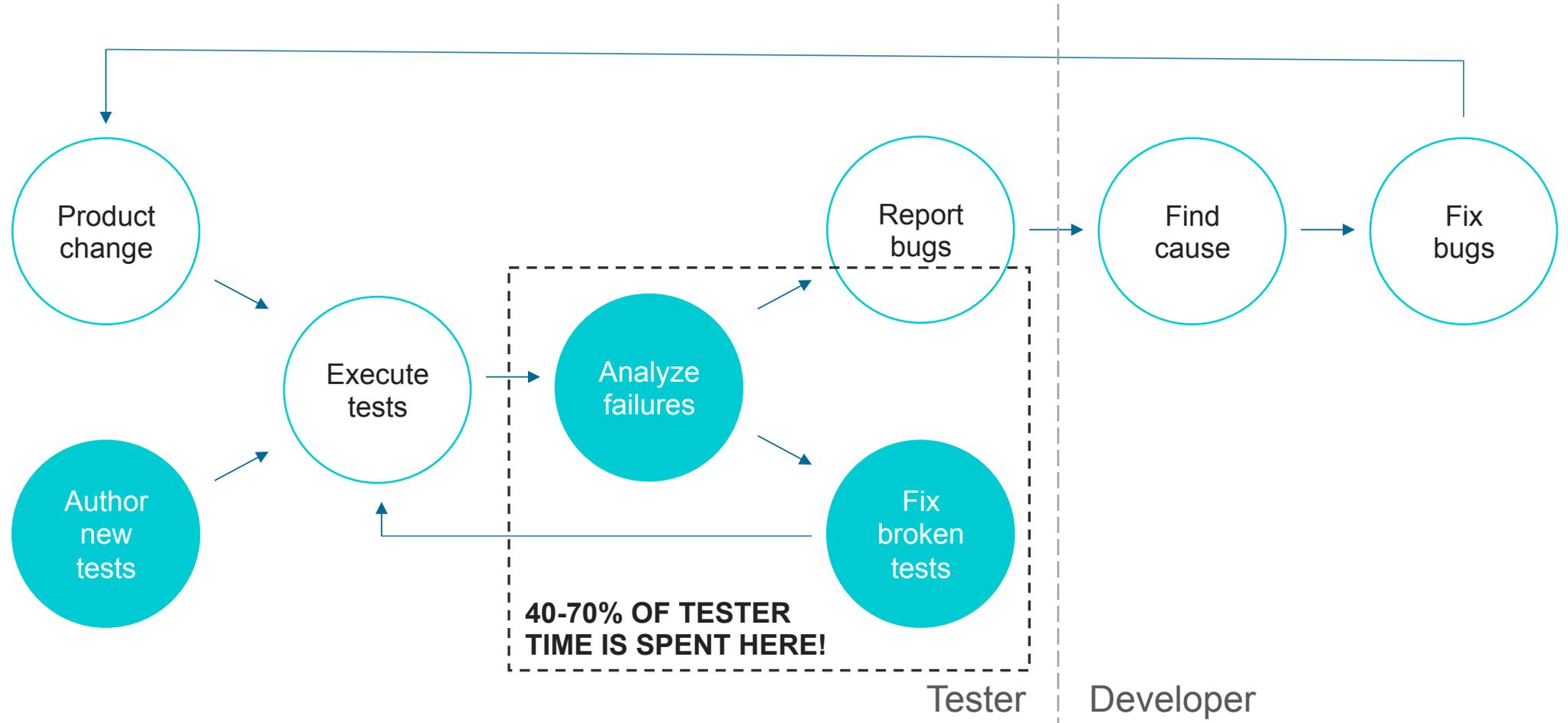




Test automation workflow



Challenge #1: Low test coverage



UI Testing

- The most widespread type of **functional** testing (using Selenium, Appium, Cypress, ...).
- Tests the end-to-end functionality of a system through its UI
- A test is a sequence of steps in which you
 - Simulate user inputs: clicks, swipes, keystrokes, etc.
 - Validate the system output on the page using assertions:

```
assertEquals(browser.getAttribute("//div[@id='container']/div[3]/div[2]/a[1]@class"), "Active");
```

- Problems:
 - A line of code for each UI element attribute assertion
 - What happens when the UI changes?

Every UI page consists of hundreds of UI elements

applitools

AI powered visual testing and monitoring

Deliver visually perfect apps to your customers

GET STARTED

REQUEST A DEMO

span | 84.2 x 18

OUR STORY

Applitools Expands Left!

Ultrafast Visual Testing for Cypress and Storybook.

GET STARTED WITH

 cypress.io

GET STARTED WITH

 storybook

AI Powered Visual UI Testing & M x

https://applitools.com

Elements Console Sources Network

```
</div>
  ><div class="subtitle">...</div>
  ><div>...</div>
</div>
<div class="play-container">
  ><button class="btn-play fa fa-play">...</button>
  <span>Our Story</span>
</div>
  ><div class="expand-left-callout">...</div>
</div>
</div>
<div class="panel client-highlight separator">
  <span class="text">Trusted by hundreds of companies</span>
  ><div class="icon-holder">
    <div class="vendor-icon vendor-salesforce-color">
    </div>
    <div class="vendor-icon vendor-mastercard-color">
    </div>
    <div class="vendor-icon vendor-sap-color"></div>
    <div class="vendor-icon vendor-sony-color"></div>
  </div>
</div>
```

html body div div div div div div div.title span.block

Styles Event Listeners DOM Breakpoints Properties Accessibility

| Filter | :hov .cls + | Filter | Show all |
|--------------------------|-------------|---------------------|----------|
| element.style { | | border-bottom-color | rgb(2... |
| } | | border-bottom-style | none |
| .block { style.min.css:1 | | border-bottom-width | 0px |
| display: | | border-image-outset | 0px |
| block!important; | | border-image-repeat | stretch |
| } | | border-image-slice | 100% |
| a, abbr, style.min.css:1 | | border-image-source | none |
| acronym, address, | | border-image-width | 1 |
| applet, article, aside, | | border-left-color | rgb(2... |
| audio, b, big, | | border-left-style | none |
| blockquote, body, | | border-left-width | 0px |
| canvas, caption, center, | | border-right-color | rgb(2... |
| cite, code, dd, del, | | border-right-style | none |
| details, dfn, div, dl, | | border-right-width | 0px |
| dt, em, embed, fieldset, | | border-top-color | rgb(2... |
| figcaption, figure, | | border-top-style | none |
| footer, form, h1, h2, | | border-top-width | 0px |



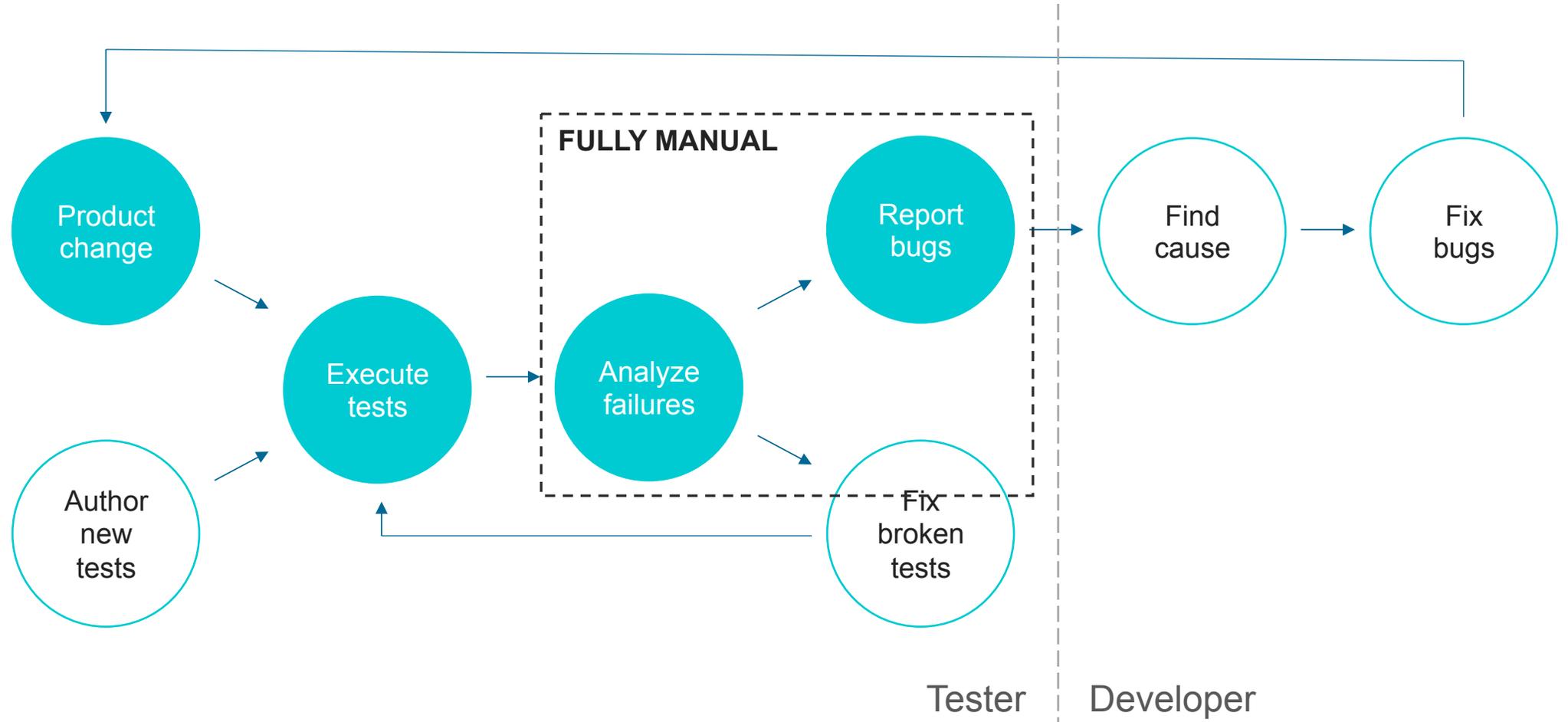
```
08:31:17 Info Selection 103 0 "[Installation Location: {Installation location:=C:\Program Files\Solidworks Corp (Ena
08:31:17 Info Selection 105 0 "Estimated additional installation size: 656 MB; Estimated download size: 386 MB"
08:33:17 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:35:10 Info Selection 37 55611 "The user clicked the button representing the {0: <U>N</U>ext} operation on the {1: Su
08:35:10 Info Selection 39 55613 "The following lines show the selections for the Summary page when the user selected t
08:35:10 Info Selection 99 0 "You are updating 2013 from SP 1.0 to SP 4.0."
08:35:10 Info Selection 102 0 "[Download Options: {Operation:=Download and install (Enabled: 1)}, {Download to:=\\SE
08:35:10 Info Selection 103 0 "[Installation Location: {Installation location:=C:\Program Files\Solidworks Corp (Ena
08:35:10 Info selection 105 0 "Estimated additional installation size: 656 MB; Estimated download size: 386 MB"
08:35:48 Info Status 166 0 "DOWNLOAD SPACE REQUIRED: {0: 641750}, AVAILABLE: {1: 783667496}, folder: {2: \\SERVERNAME\Eng
08:36:10 Error Message 9 55200 "Dialog Shown: {0: Toolbox is currently in use. Make sure that no one is using Toolbox then cl
08:36:10 Info Selection 43 55617 "The source folder that will be used is: {0: \\SERVERNAME\Engineering\Users\USERNAME\S
08:36:10 Info Selection 44 55617 "The Installation Manager source Folder that will be used is: {0: \\SERVERNAME\Enginee
08:36:10 Info Step 25 55502 "User advanced from '{0: Summary}' page to '{1: Download Progress}' page."
08:36:18 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:38:55 Info Step 25 55502 "User advanced from '{0: Download Progress}' page to '{1: Countdown}' page."
08:39:16 Info Step 25 55502 "User advanced from '{0: Countdown}' page to '{1: Install Progress}' page."
08:39:16 Info Selection 107 0 "writing serial numbers to the registry..."
08:39:16 warning selection 110 0 "====> CHANGING {0: solidworks} SERIAL NUMBER IN REGISTRY before installs: {1: XXXXXXXX
08:39:19 warning selection 110 0 "====> CHANGING {0: cae_cwcore} SERIAL NUMBER IN REGISTRY before installs: {1: XXXXXXXX
08:39:20 warning selection 110 0 "====> CHANGING {0: cae_cosmosfloworks} SERIAL NUMBER IN REGISTRY before installs: {1:
08:39:21 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:39:21 Info Status 138 0 "CREATING INSTALL STEP 0 for SLDPS: cost=4096KB"
08:39:21 Info Status 143 0 "CREATING INSTALL STEP 1 to Upgrade: prod=Solidworks, code={B6B5EA7E-B91F-443D-A958-B0062FB53804}, mode={7: 3}, upg=, cost=15061KB, force=0
08:39:21 Info Status 143 0 "CREATING INSTALL STEP 2 to Upgrade: prod=Solidworks, code={B6B5EA7E-B91F-443D-A958-B0062FB53804}, mode={7: 3}, upg=, cost=0KB, forc
08:39:21 Info Status 143 0 "CREATING INSTALL STEP 3 to Upgrade: prod=Solidworks, code={B6B5EA7E-B91F-443D-A958-B0062FB53804}, mode={7: 3}, upg=, cost=0KB, forc
08:39:22 Info Status 143 0 "CREATING INSTALL STEP 4 to Upgrade: prod=Solidworks, code={B6B5EA7E-B91F-443D-A958-B0062FB53804}, mode={7: 3}, upg=, cost=0KB, forc
08:39:22 Info Status 143 0 "CREATING INSTALL STEP 5 to Upgrade: prod=eDrawings, code={2686CB6D-19AF-49A0-ABD2-29D134D7C23}, mode={7: 3}, upg=, cost=0KB, forc
08:39:22 Info Status 143 0 "CREATING INSTALL STEP 6 to Upgrade: prod=Explorer, code={168EB20E-FC09-4D2E-83A9-49483710304C}, mode={7: 3}, upg=, cost=0KB, forc
08:39:22 Info Status 143 0 "CREATING INSTALL STEP 7 to Upgrade: prod=COSMOSFloworks, code={2A6228B3-BB5D-47D9-9BB6-20953A}, mode={7: 3}, upg=, cost=0KB, forc
08:39:22 Info Status 143 0 "CREATING INSTALL STEP 8 to Upgrade: prod=SolidworksPlastics, code={BA812540-2D88-4A6A-A527-E7}, mode={7: 3}, upg=, cost=0KB, forc
08:39:41 Info Status 139 0 "CREATING INSTALL STEP 9 to FINISH: cmd=, cost=72348KB"
08:40:03 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:40:21 Info Step 92 0 "{0: Installing} EXE: {1: \\SERVERNAME\Engineering\Users\USERNAME\Solidworks Downloads\Solidwo
(ID {3: CheckForUpdates}, lang {4: }, pcode {5: }, mode {6: 3}, upg = {7: }, f{8: 0}, costKB {9: 15061})"
08:40:24 Info Step 94 0 "** INSTALLATION SUCCEEDED **"
08:40:38 Info Step 91 0 "{0: Installing} MSP: {1: \\SERVERNAME\Engineering\Users\USERNAME\Solidworks Downloads\Solidwo
(ID {4: Microsoft_VBA_KB2783832}, lang {5: }, pcode {6: }, mode {7: 3}, upg = {8: }, f{9: 0}, costKB {10: 0})"
08:40:41 Info Step 155 0 "** Patch SUCCEEDED **"
08:40:53 Info Step 91 0 "{0: Installing} MSP: {1: \\SERVERNAME\Engineering\Users\USERNAME\Solidworks Downloads\Solidwo
(ID {4: solidworks}, lang {5: }, pcode {6: {B6B5EA7E-B91F-443D-A958-B0062FB53804}}, mode {7: 3}, upg = {8: 20130-40100-1100}, f{9: 0}, costKB
08:42:20 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:45:18 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:48:17 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:51:16 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:54:16 Info Status 58 55803 "Received data from Installation Manager server (Script: {0: http://im.solidworks.com/bin2013/
08:54:22 Error Status 156 0 "***START DUMP OF WINDOWS INSTALLER DATA***"
08:54:22 Error Status 157 0 "=== Logging started: 7/19/2013 8:40:57 ==="
08:54:22 Error Status 157 0 "Action start 8:40:57: INSTALL."
08:54:22 Error Status 157 0 "Action start 8:40:57: ProgramFilesFolder.25459867_D5E7_32F7_9C7A_5EFF02A207F6."
```

Analyzing test results

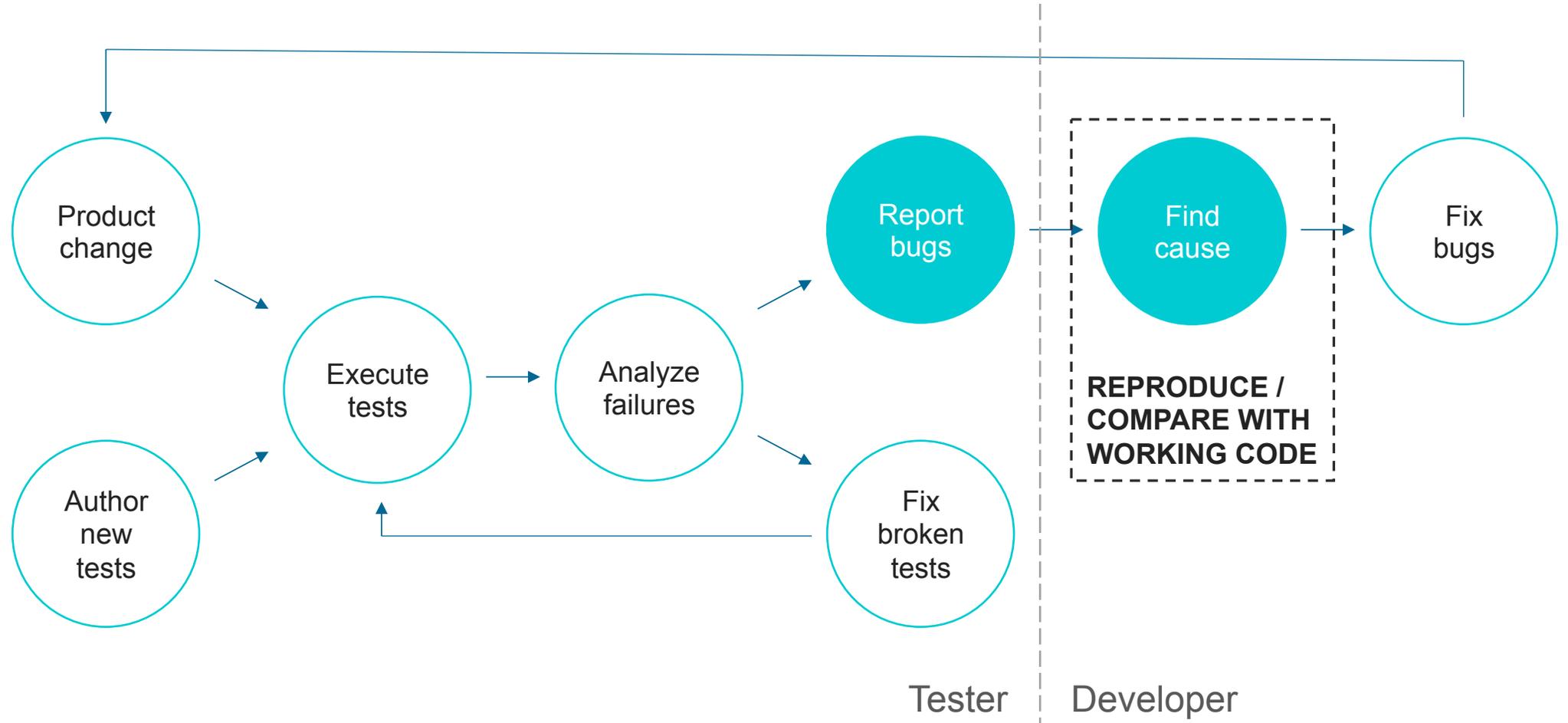
Challenge #1: Low test coverage

- Every assertion increases the maintenance overhead
- Is it really worth automating?
- Checks system functionality via the UI – Not the UI!
- Can only catch expected bugs
- **Manual testing is still needed!**

Challenge #2: Slow feedback



Challenge #3: Root cause analysis



Challenge #4: Ineffective and slow cross env tests

- Test on the same devices and browsers customers are using
- Prolongs test execution and test results analysis
- Requires an expensive test lab with devices and browsers
- What bugs are we trying to find?
 - Server bugs are 99% environment agnostic
 - For example: a broken DB query
 - App bugs are 99% environment agnostic (except for legacy browsers)
 - For example: not validating an input field, reversed sorting order, etc.

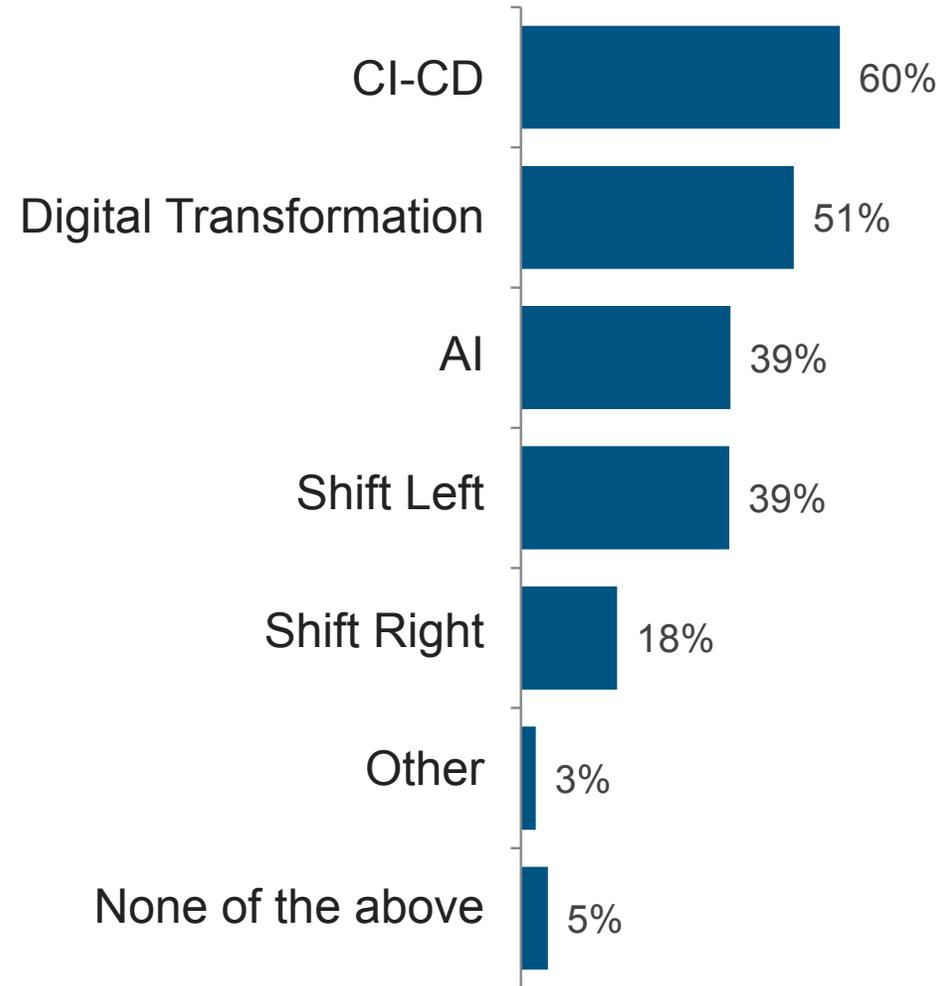
Challenge #5: Lack of skills / experience + Access to Talent



The background is a solid teal color. On the left side, there are three stylized white outlines of smartphones, arranged in a descending staircase pattern from top-left to bottom-right. Each phone has a black screen area. The top phone has a circular home button, the middle one has a larger rectangular home button, and the bottom one has a small circular sensor and a larger rectangular home button.

MARKET TRENDS + STATS

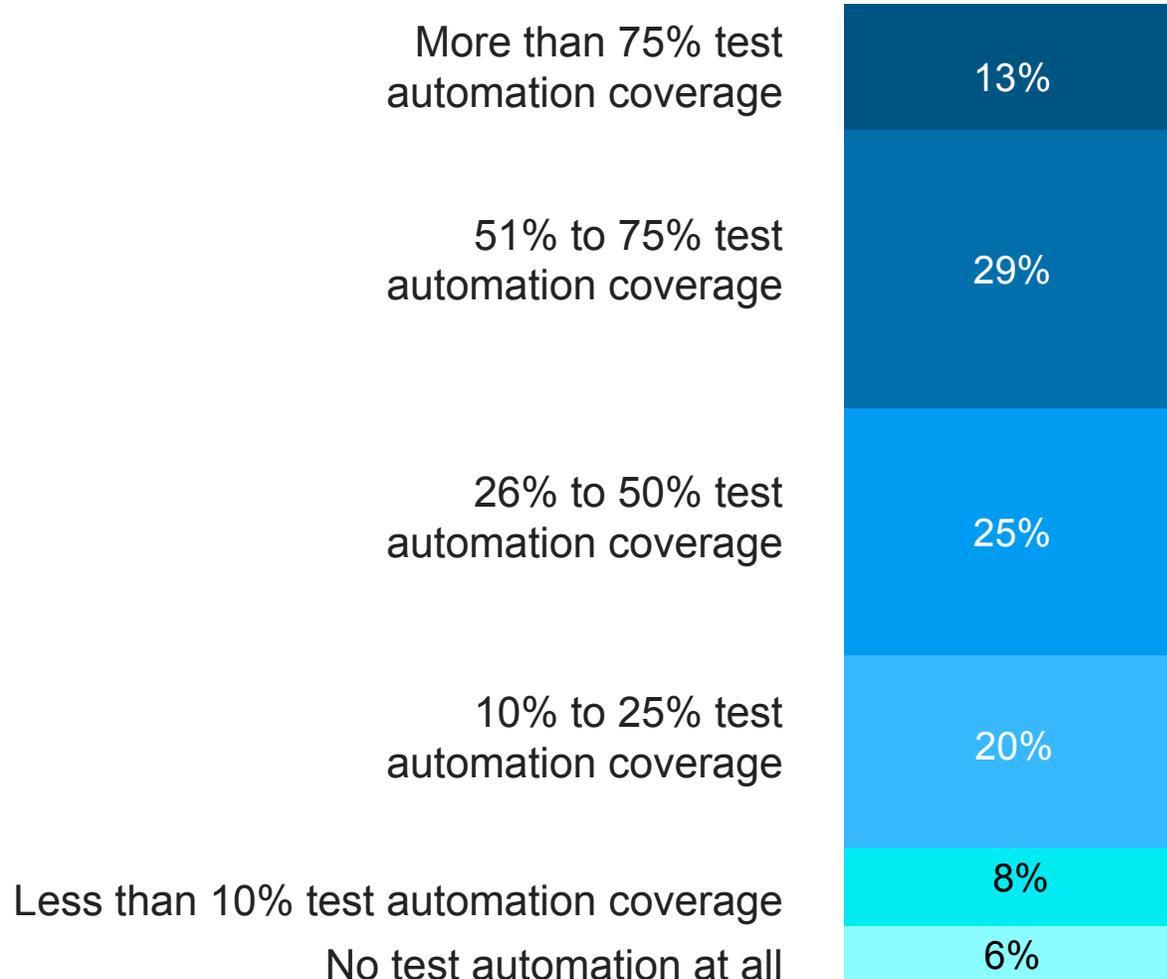
CI-CD and Digital Transformation are top R&D trends



Q1A - Which of the following initiatives were part of your company's plans in 2018?

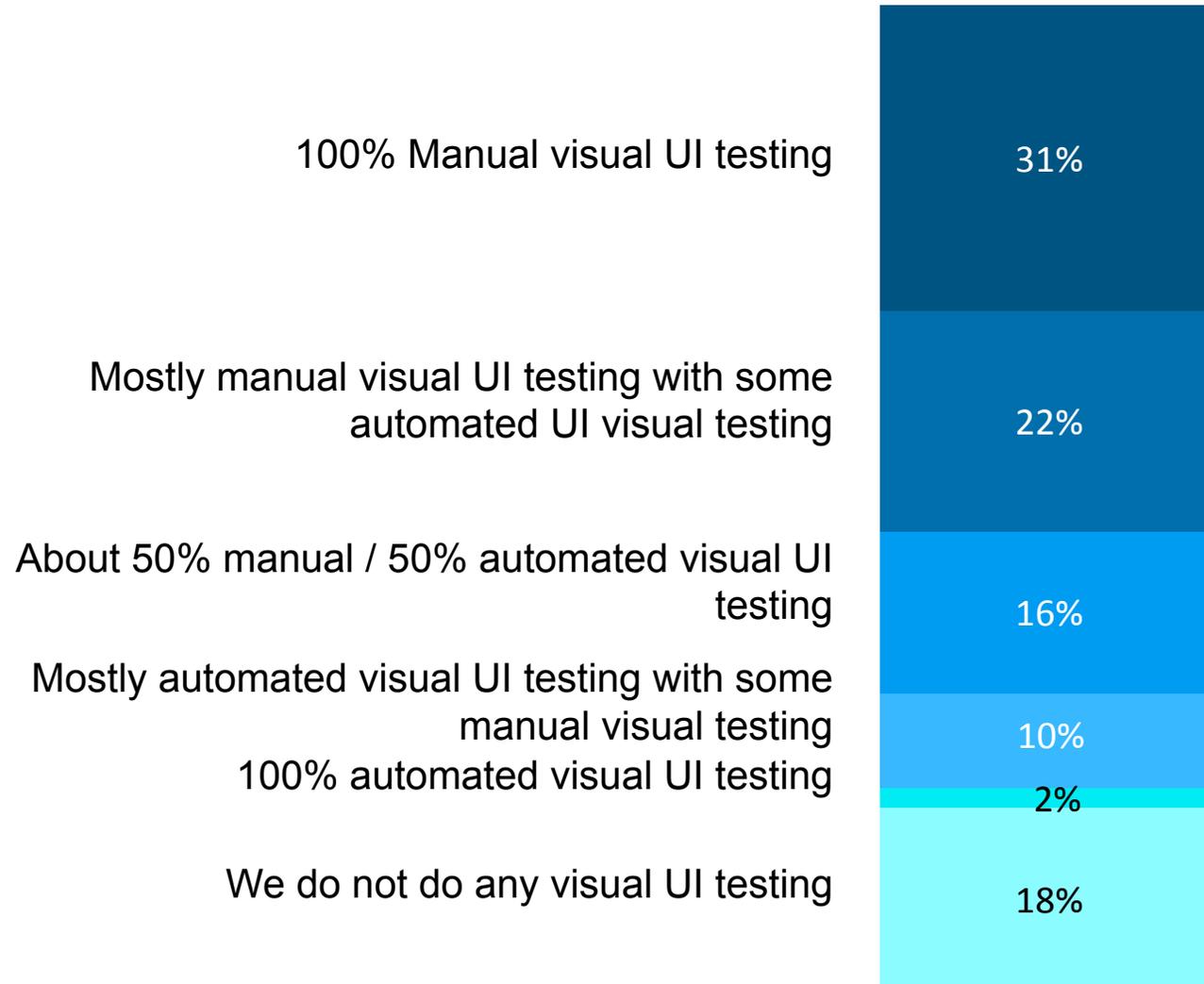


Most companies are in various stages of partial automation



50% still do manual visual testing or none at all

- Banking/finance somewhat more manual than others



The pace of Digital Transformation is accelerating rapidly.

- This is only increasing the workload for already stretched teams

| | Number Currently in Production | Number Planning to Add, Next 12 Months | Percentage Increase |
|------------------|--------------------------------|--|---------------------|
| Apps | 40.4 | 14.9 | +63% |
| Pages or Screens | 203.2 | 163.3 | +20% |
| Viewports | 5.3 | 3.6 | +33% |
| Languages | 6.5 | 3.5 | +46% |
| Releases | 16.0 | 11.9 | +26% |

Q2a. Now we would like to understand more about your brand's UI. Please enter in your best estimate in each of the lines below.
 Q2b. Are you planning to add any new applications, sites or screens in the next 12 months?



AI assisted testing

- Reduce the test maintenance overhead
 - Self healing tests
 - Timing anomalies
 - Smart crawlers

Codeless testing

- Codeless testing is re-gaining traction
- Adopted for various use cases
- Selenium IDE is back!



More developers write tests

There's a need for speed

**There is
no release**

Realize the truth

There is no release





“throwing things over the wall” is fading away



The QA Gateway is fading away

Developers MUST Test

**Tests must be part of the
development cycle**

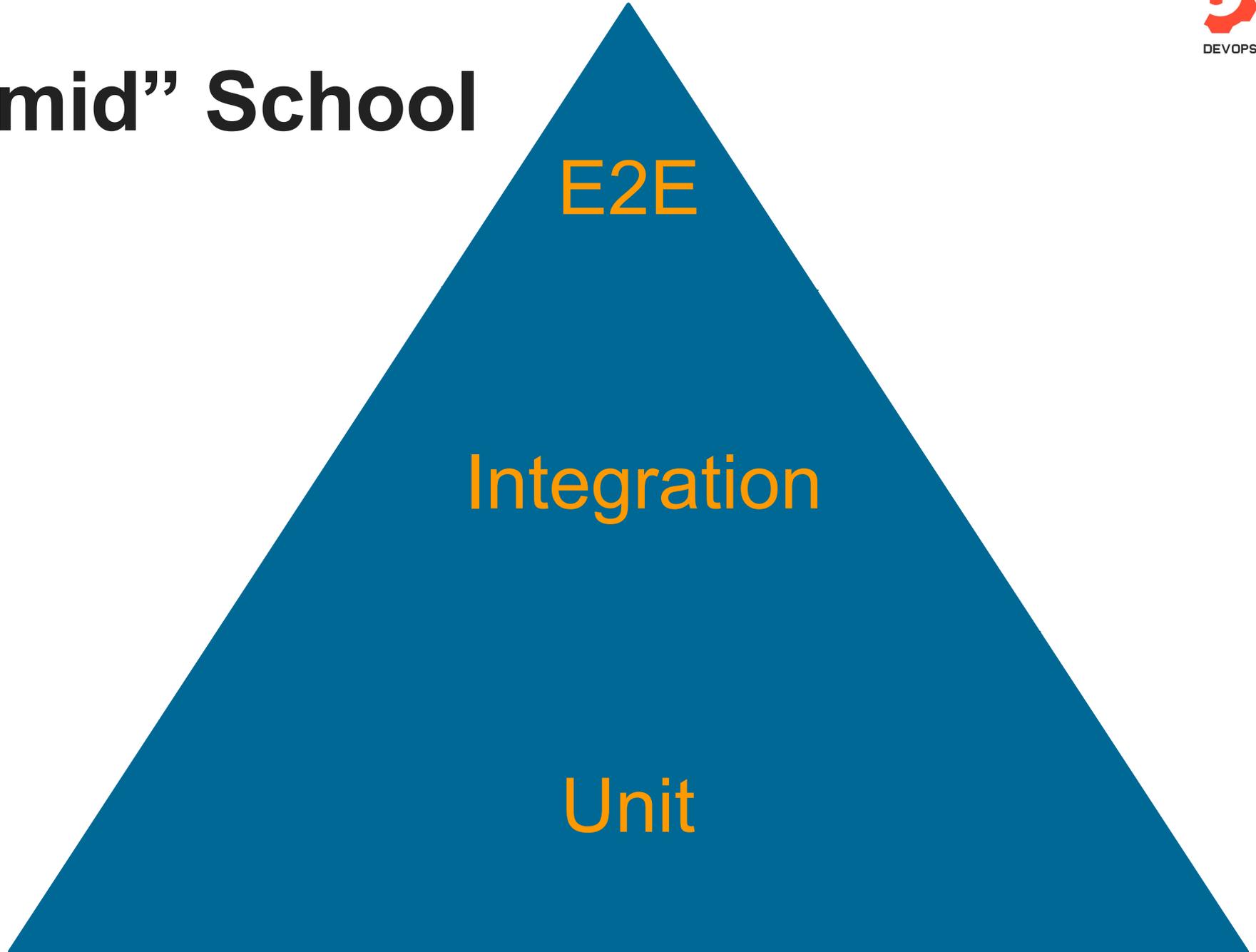
Tests must be fast

- Developers shouldn't wait
- They have to commit and push *now*
- They need to know *now* that the code runs

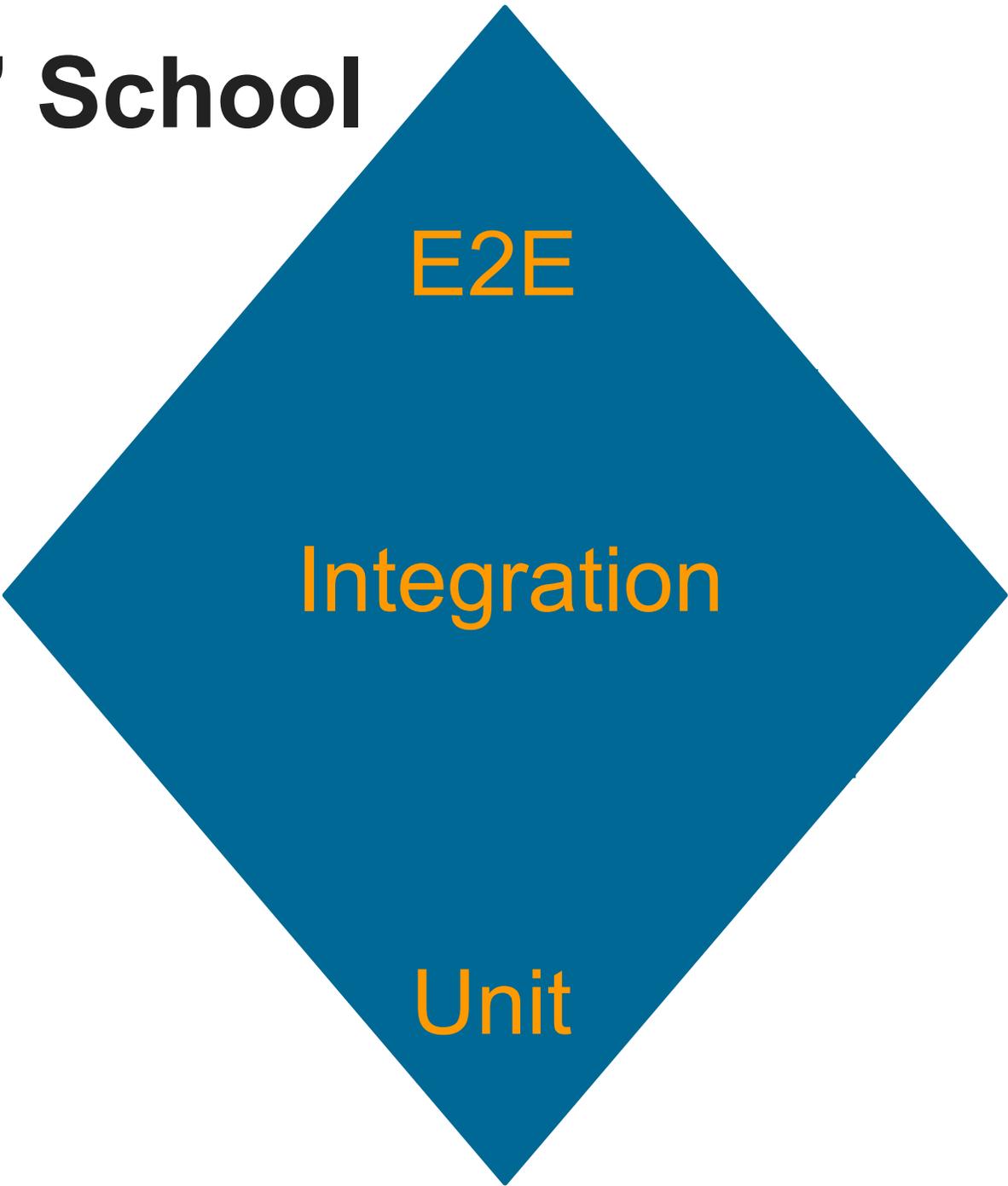
So they've started writing tests!

There are two main schools of testing

The “Pyramid” School



The “Diamond” School



Which is better?

**It's a
Religion!**



Commonalities

- The need for speed
- Few E2E tests
- Currently, functionality only

**Developers finally
have a (somewhat)
common methodology**



Guillermo ▲ ✓

@rauchg

Write tests. Not too many. Mostly integration.

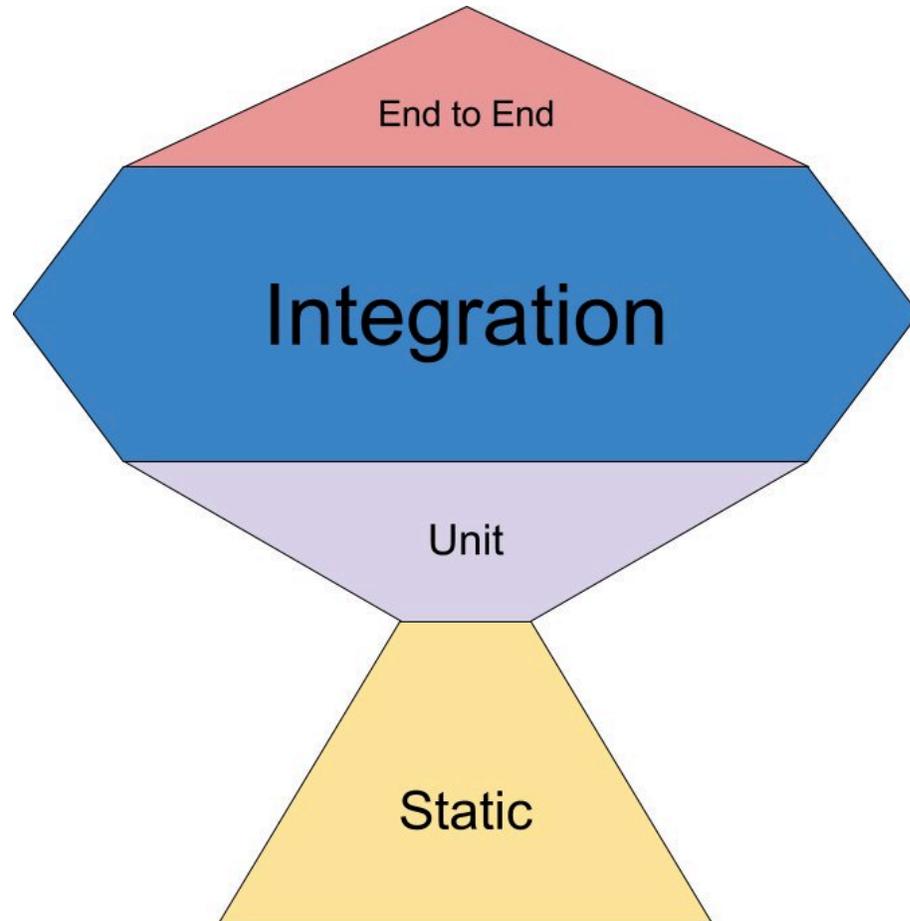
6:43 PM · Dec 10, 2016 from [San Francisco, CA](#) · [Twitter Web Client](#)

219 Retweets

617 Likes



Kent C. Dodds and [The Trophy of Testing](#)



Cross-browser testing is declining

There are only 3 main browsers today

- Chrome
- Firefox
- Safari

What about Mobile?

- Chrome
- Safari

What about IE/Edge?

- IE: mostly dead
- Edge: will move to Chrom(ium) in 2019

**For most applications,
browsers are functionally the same**

Finding browser-specific bugs is getting rarer

But the time and money needed to do so is not getting cheaper!

Except for Visual Bugs!

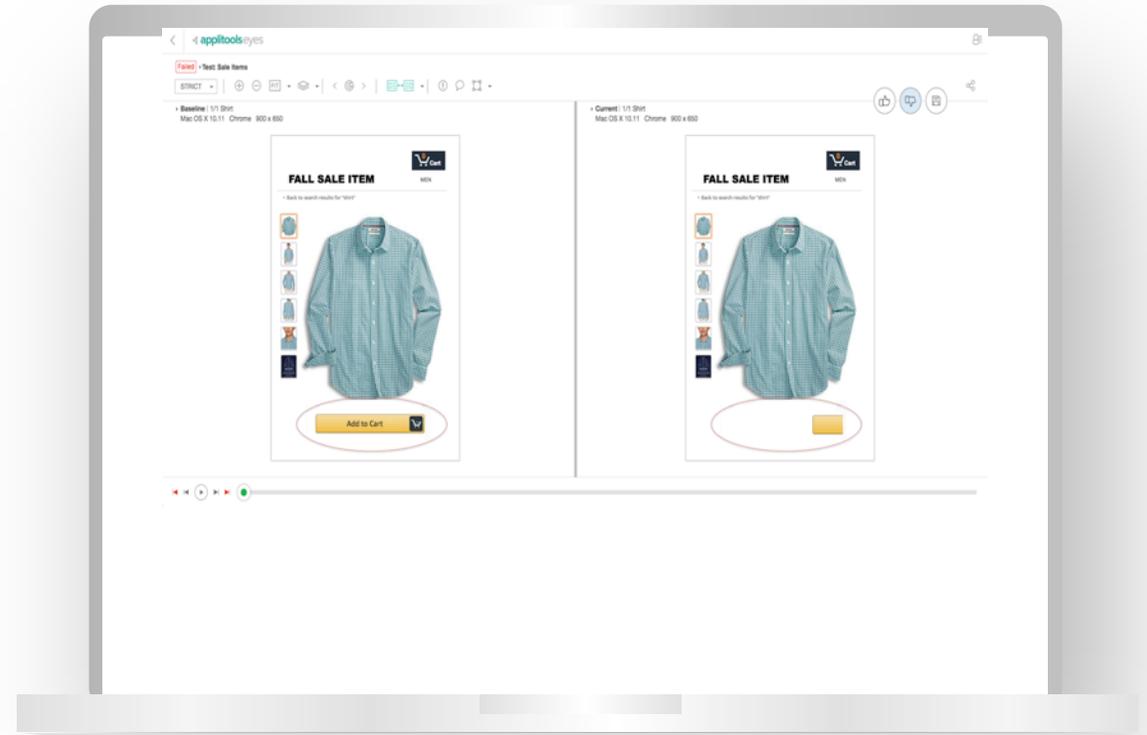
- Still differences between browsers
- Add to that responsive design, for cross-width testing
 - iPhone size
 - iPad size
 - Desktop size
 - Retina size

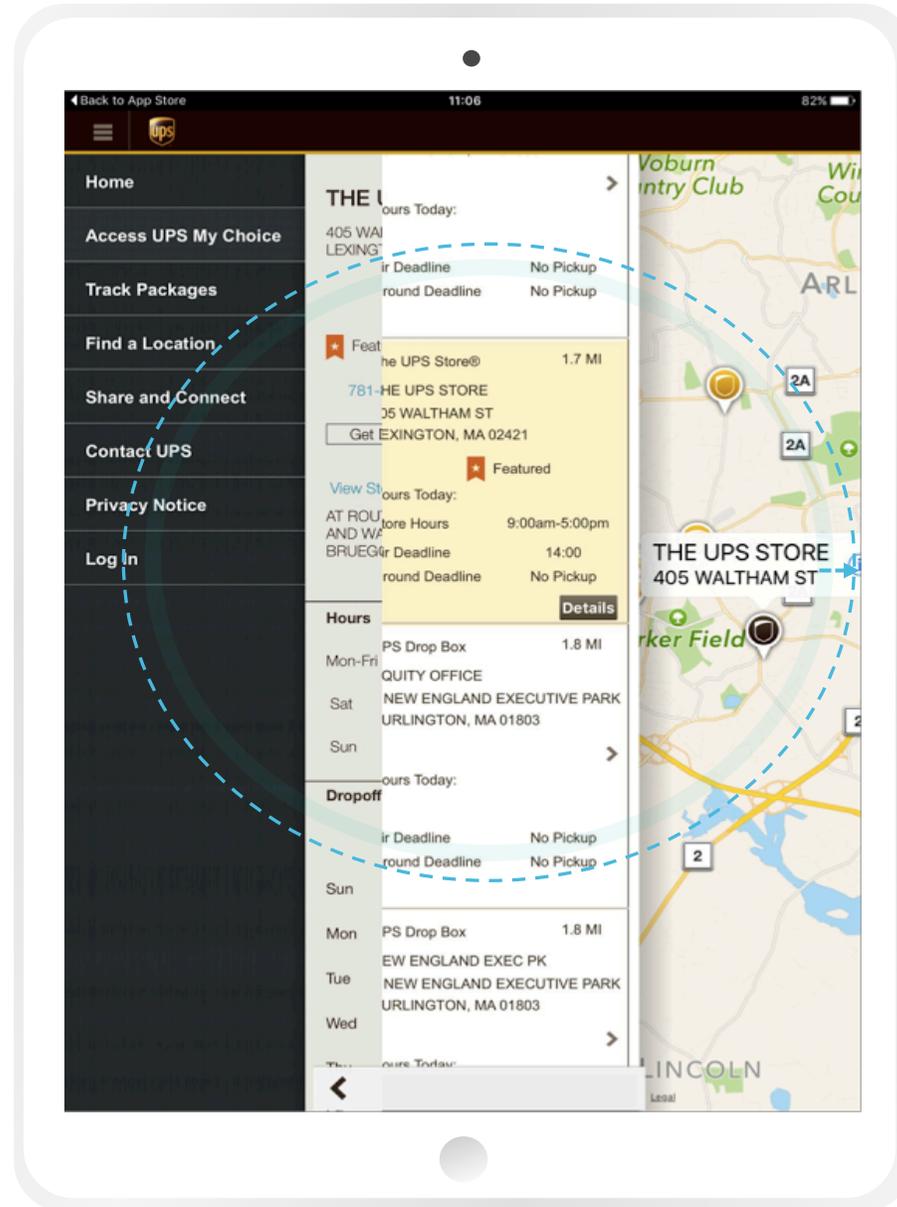
The background is a solid teal color. Overlaid on this are three stylized white outlines of smartphones, arranged in a zig-zag pattern. The top phone is tilted downwards to the right, the middle one is tilted upwards to the right, and the bottom one is tilted downwards to the right. Each phone has a circular home button on the bottom edge. The screens of the phones are solid black.

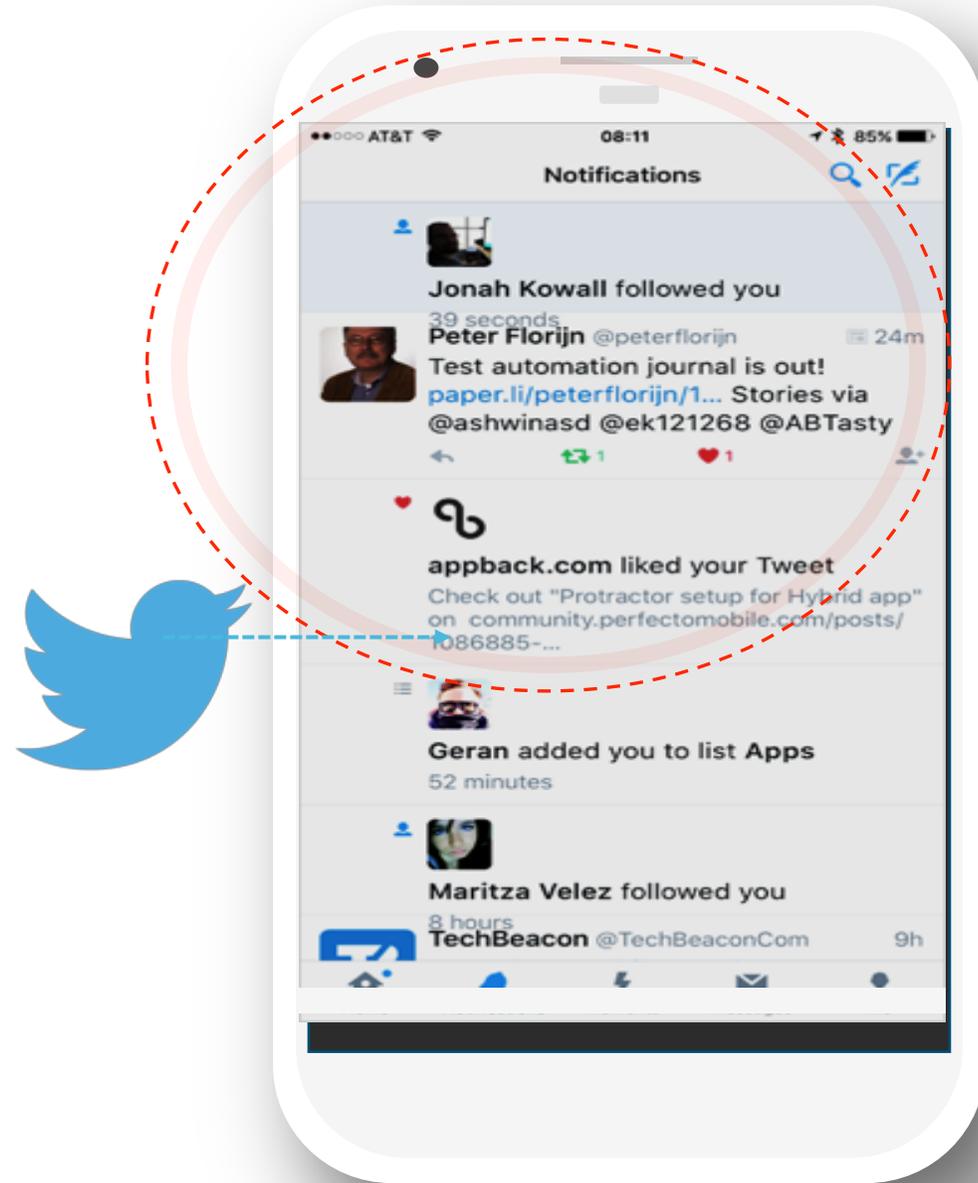
HOW CAN WE FIX IT?

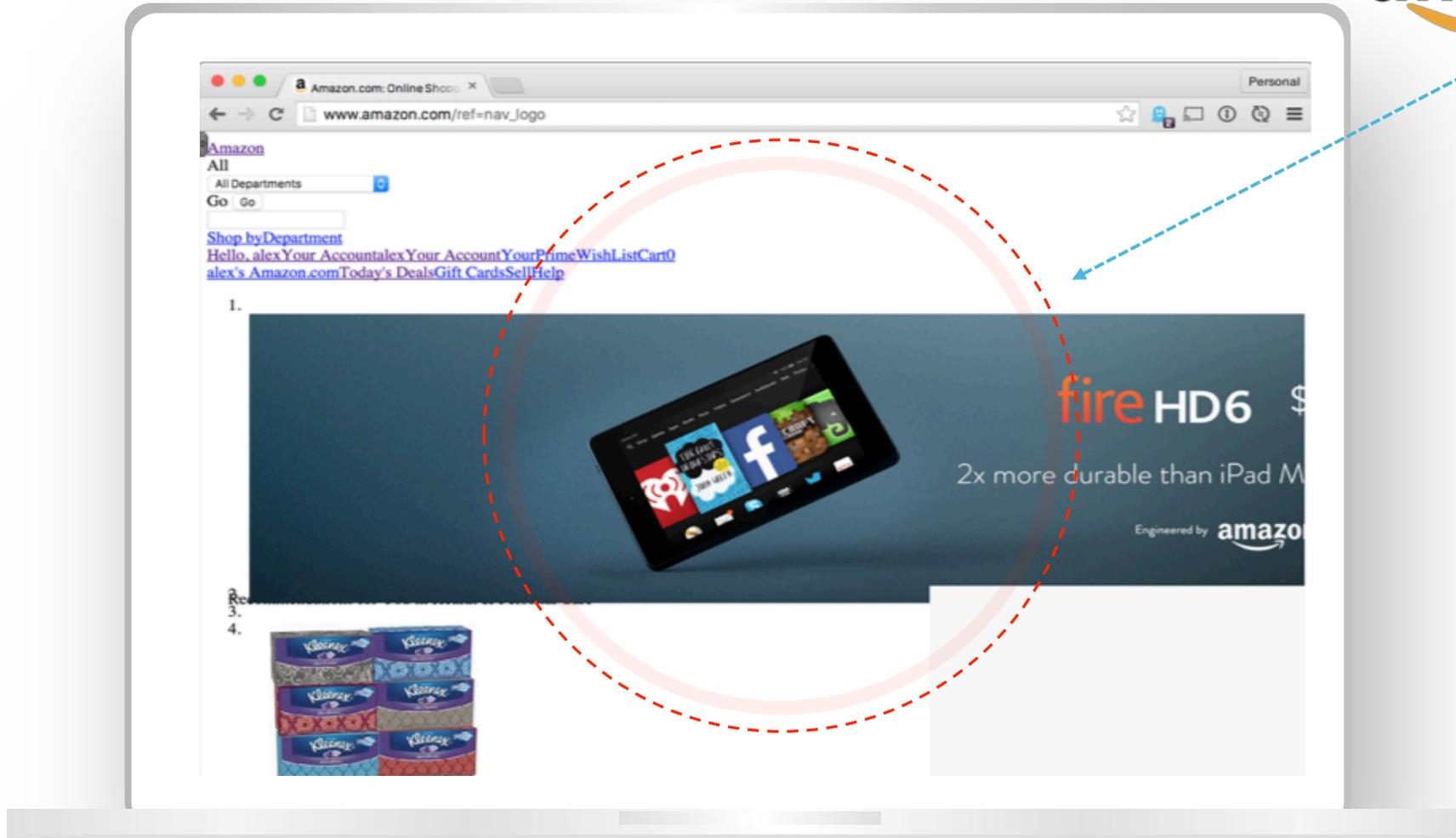
Visual Testing???

- **Visual Testing** is the process of validating all the visual aspects of an application's UI on all platforms
- **Goes beyond functional testing** tools like Selenium to ensure things like colors, fonts, buttons appear correctly









Challenges #1,#2: Low test coverage and slow feedback



Full page (functional) validation

```

[Test]
0 references
public void TestResponsiveness()
{
    driver.Url = "https://github.com";

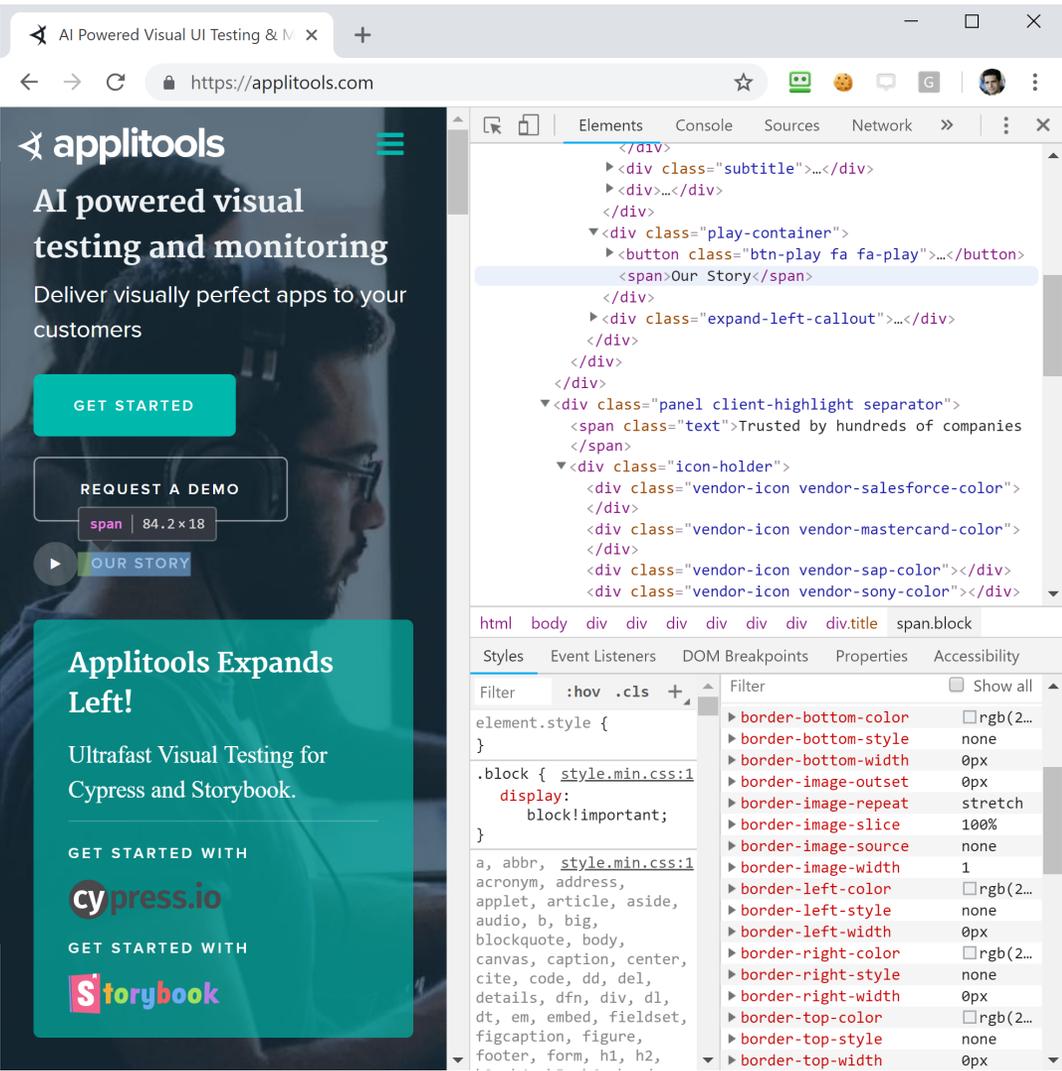
    var home = new HomePage(driver);

    var personalPage = home.GoToPersonalPage();

    var openSourcePage = personalPage.GoToOpenSourcePage();
}

[TearDown]
0 references
public void TearDown()
{
    driver.Quit();
    eyes.Close();
}

```



The screenshot shows a browser window at <https://applitools.com>. The website content includes the AppliTools logo, the tagline "AI powered visual testing and monitoring", and a "GET STARTED" button. A news item titled "AppliTools Expands Left!" is visible, mentioning "Ultrafast Visual Testing for Cypress and Storybook" and featuring logos for "cypress.io" and "Storybook".

The browser's developer tools are open, showing the DOM tree. The selected element is a `span` with the text "Our Story". The DOM tree shows a nested structure of `div` and `span` elements. The Styles pane is open, showing the default styles for the selected `span` element, including `border-bottom-color`, `border-bottom-width`, `border-image-outset`, `border-image-repeat`, `border-image-slice`, `border-image-source`, `border-image-width`, `border-left-color`, `border-left-style`, `border-left-width`, `border-right-color`, `border-right-style`, `border-right-width`, `border-top-color`, `border-top-style`, and `border-top-width`.





99.9999%
accuracy
...
and
improving!

Sections
Columns
Images
Text
Paragraphs
Patterns
Galleries
Tables
Trees



Gold 1,242.90 -0.06% Crude Oil 94.72 -0.75% EUR/USD 1.3557 -0.02%

[Finance Home](#)
[My Portfolio](#)
[Market Data](#)
[Company News](#)
[Economic News](#)
[Personal Finance](#)
[Yahoo Originals](#)
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[Market Data](#)
[Currencies](#)
[More Currencies](#)

[Yahoo Finance](#)

[All Finance](#) [Top News](#) [My Quotes](#) [Yahoo Originals](#) [CNBC](#)

A 'Second Wind' for Earnings Could Quiet the Bears' Huffing
 S&P 500 1,804.76 +8.91 (0.50%)
 Talk of a stock bubble is premature, but further corporate-profit growth is necessary to support the market near record highs

- One Key Slice of the Market Is Crumbling While Stocks Set Record Highs
- What a Yellen Taper Really Means for Stocks

Obamacare: Your Questions Answered
Why Best Buy May Be the Worst Play at Christmas
Black Friday Ain't What It Used to Be
Here's Where You Can (and Can't) Buy a Home Or Your Salary

Newbie Investors: Listen Up
 Seasoned investing hands share what financial and investing wisdom they wish they had learned
 Morningstar

Insight: Kim Jong Un, North Korea's master builder
 By Jack Kim and James Pearson SEOUL (Reuters) - North Korea's Kim Jong Un has rattled the United States with his nuclear threats and bemused traders

Big Insurance Can Now Bypass Obamacare Website; Tech Companies Still Waiting
 As the federal government struggles to regain hope that it can get enough

Low test coverage and slow feedback

SOLVED!

- Visual and functional coverage
- Every team member can easily analyze test results and fix tests
- Automated maintenance facilitates scale
- Easy to author new tests
- Easy to review test results

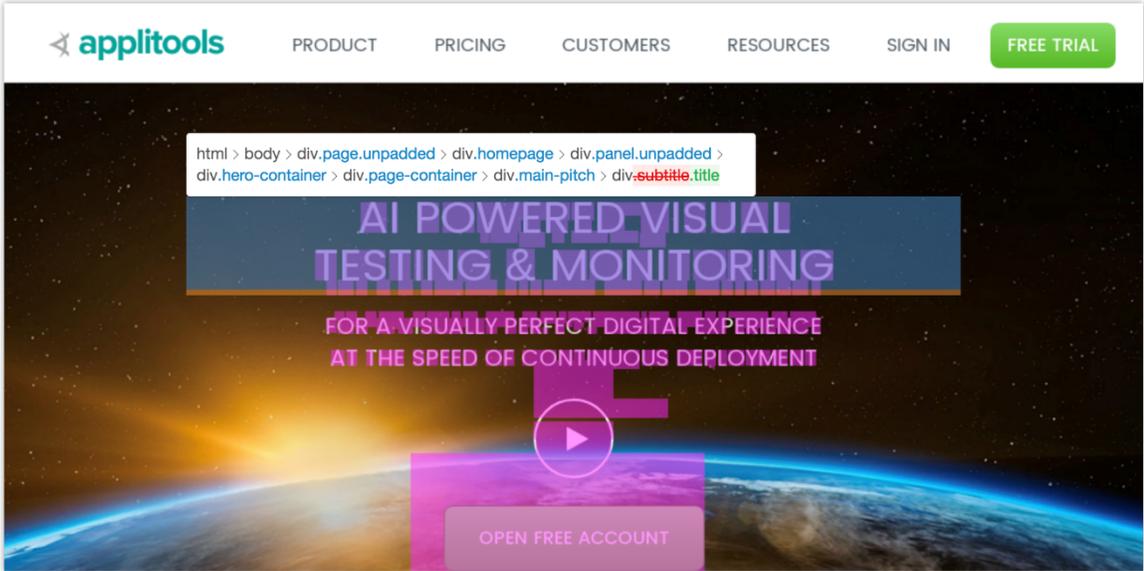


Challenge #3 - Root cause analysis

Test: Changed div's class from 'title' to 'link'
Steps: 1 | Unresolved: 1

Strict

Checkpoint | 1/1 http://localhost:3000
Strict | Linux | Chrome | 1000x500



html > body > div.page.unpadded > div.homepage > div.panel.unpadded > div.hero-container > div.page-container > div.main-pitch > div.subtitle.title

AI POWERED VISUAL TESTING & MONITORING

FOR A VISUALLY PERFECT DIGITAL EXPERIENCE AT THE SPEED OF CONTINUOUS DEPLOYMENT

OPEN FREE ACCOUNT

Challenge #3 - Root cause analysis – SOLVED!

Test: Changed div's class from 'title' to 'link'
Steps: 1 | Unresolved: 1

Strict

DOM Diffs

Checkpoint | 1/1 http://localhost:3000
Strict | Linux | Chrome | 1000x500

ATTRIBUTES

- class: subtitle
- + class: title

CSS RULES

```

- .homepage .main-pitch .subtitle {
-   margin: 20px 0px;
-   padding: 0px 10px;
-   font-size: 20px;
-   line-height: 28px;
-   text-transform: uppercase;
- }
+ .homepage .main-pitch .title {
+   margin-bottom: 5px;
+   line-height: 40px;
+   font-size: 40px;
+   font-weight: 400;
+   text-transform: uppercase;
+ }
  
```

html > body > div.page.unpadded > div.homepage > div.panel.unpadded > div.hero-container > div.page-container > div.main-pitch > div.subtitle.title

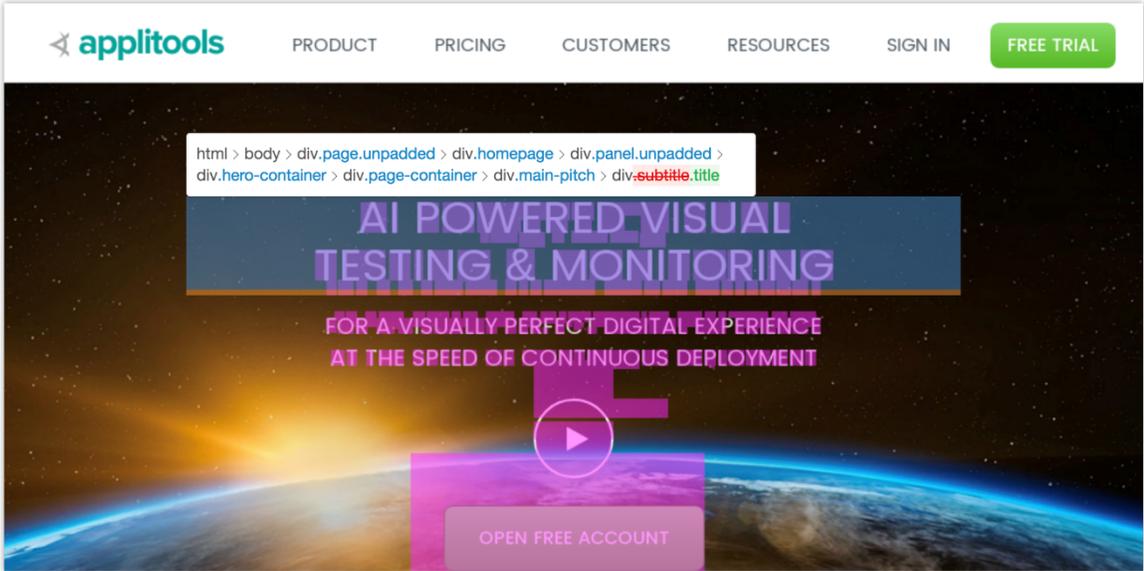
html > body > div.page.unpadded > div.homepage > div.panel.unpadded > div.hero-container > div.page-container > div.main-pitch > div.title > span.block > span.ampersand

GENERAL

- Tag Name: div
- + Tag Name: span

POSITION 170 208

160 680 x 48




Challenge #4: Ineffective and slow cross-env tests



This is how test code looks like

Navigate

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot



Simple, Right?



Because you need to visually test for...

- Different browsers
 - Chrome, Firefox, Safari
- Different responsive widths and pixel densities
 - iPhone width and pixel density
 - Tablet width
 - Regular desktop width
 - Retina display width and pixel density

So...

Navigate

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot



1024

Navigate

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot



2500

Navigate

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot



1024



**Run each test ten
times?**



Run each test ten times?

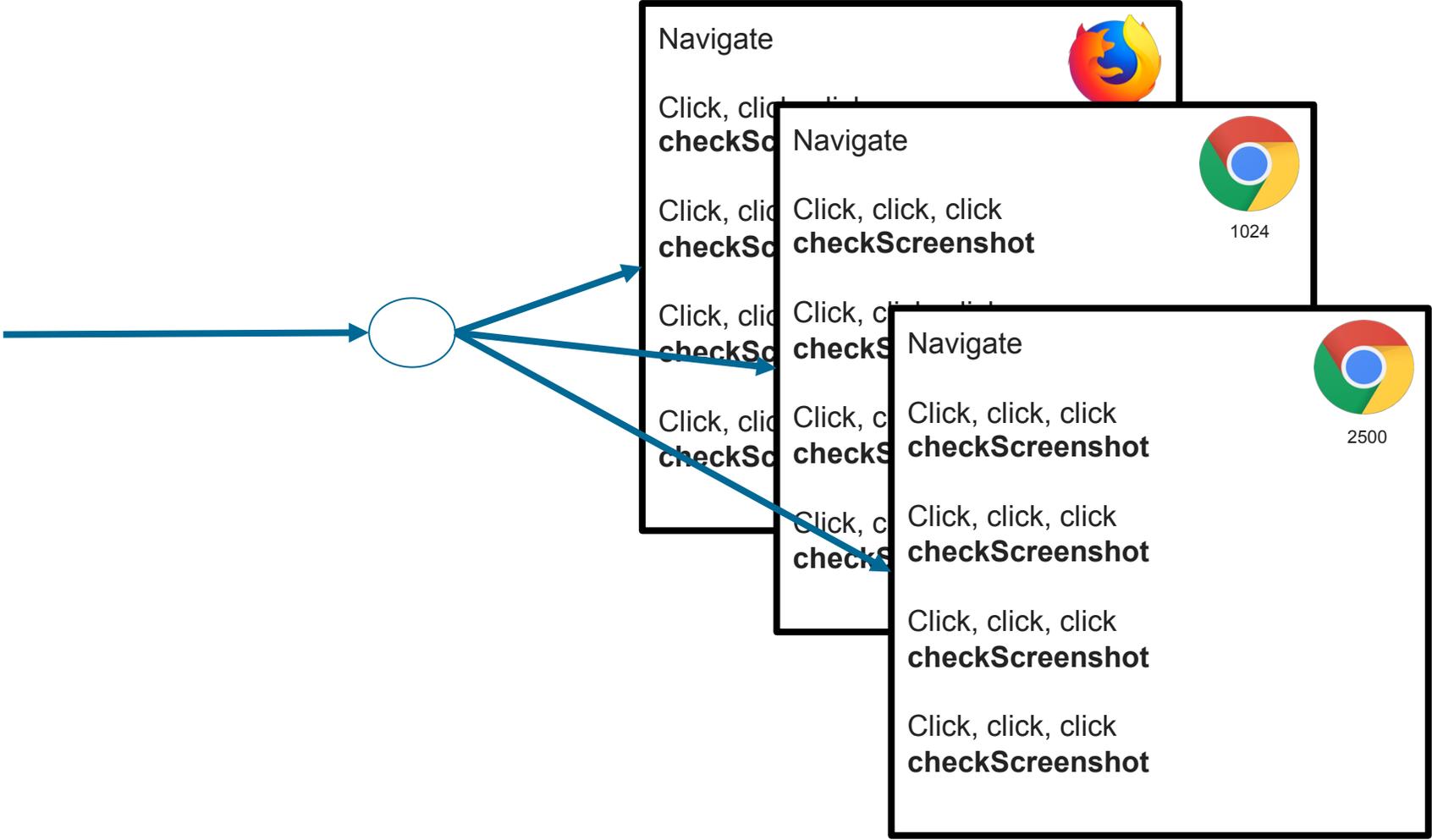
(not even with Cypress...)



How do we solve this problem?

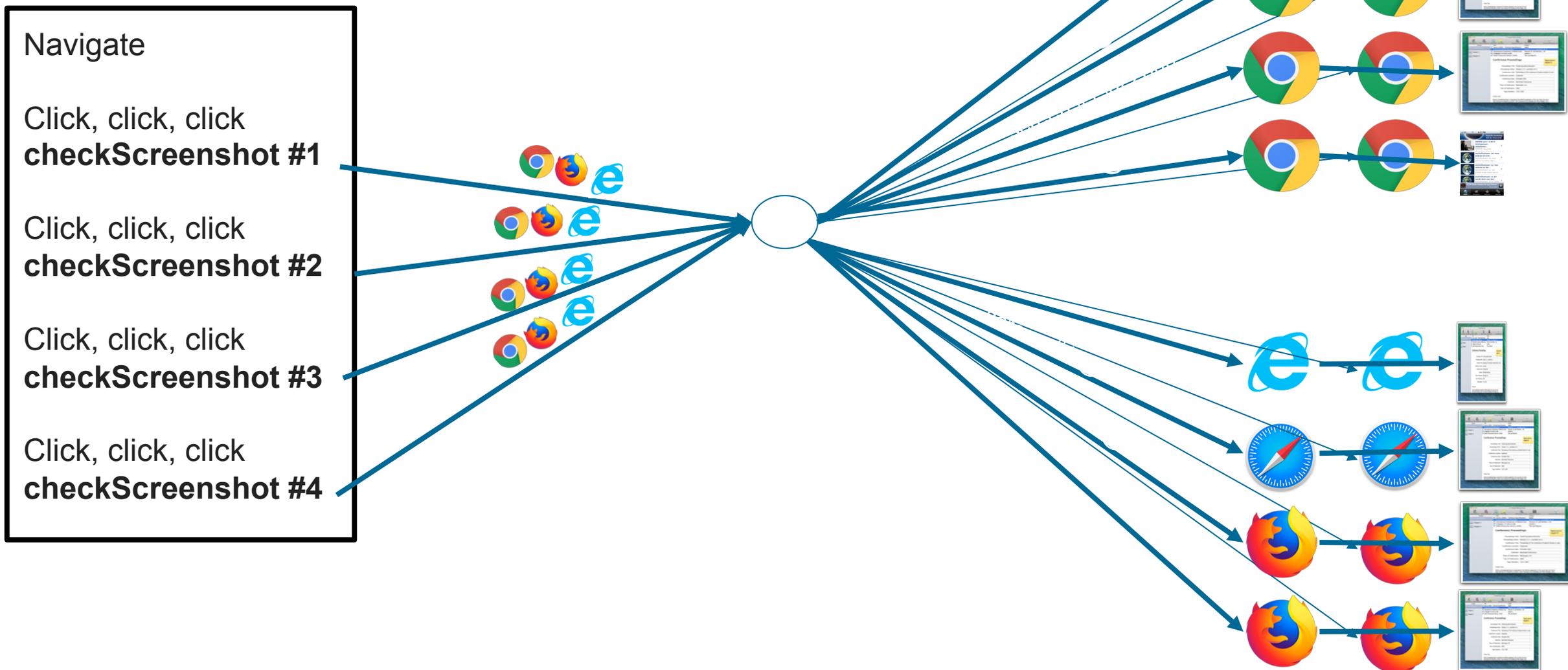
We parallelize

Solution: Parallelizing the tests



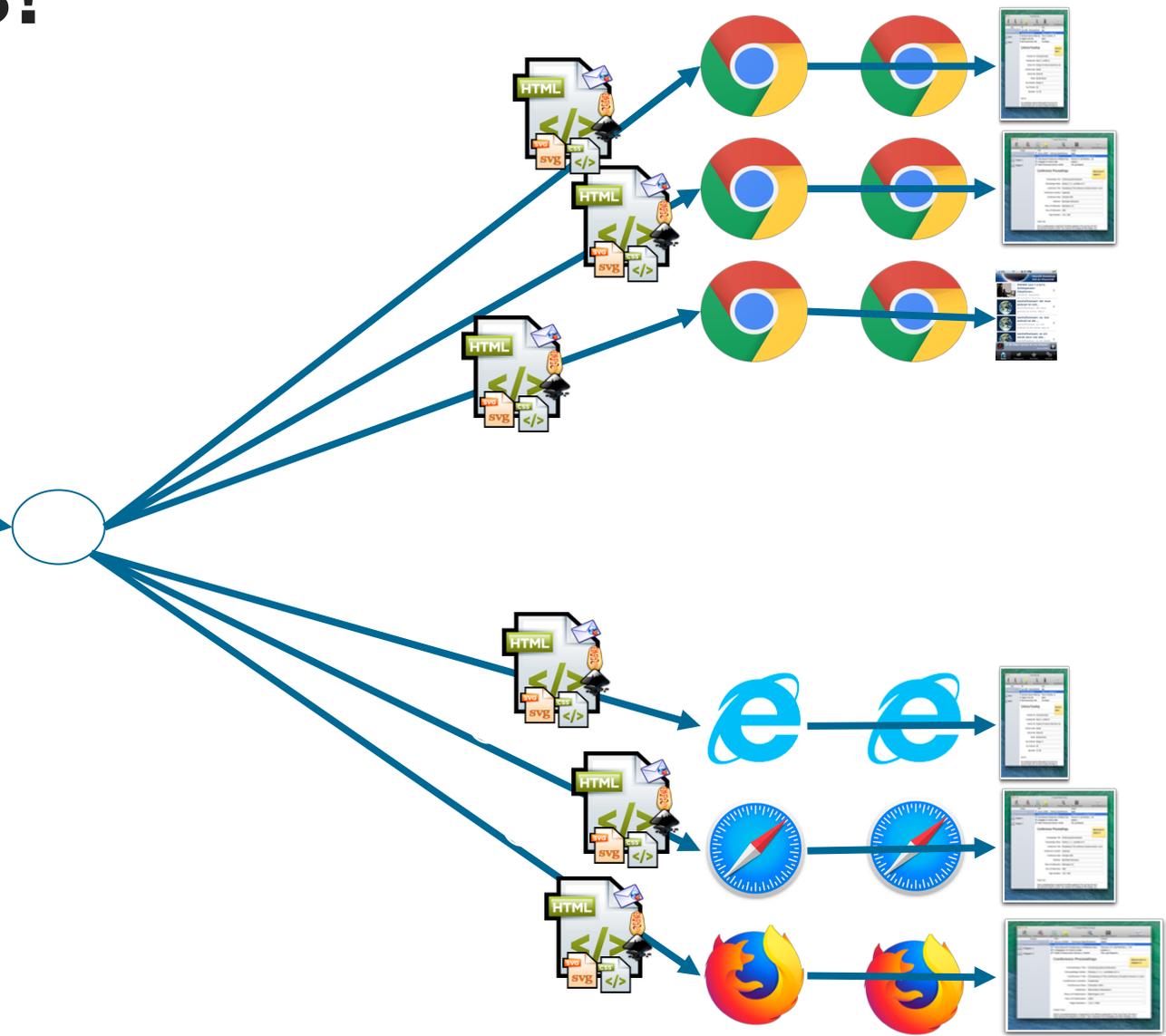
There's a better solution

Parallelize the screenshots!

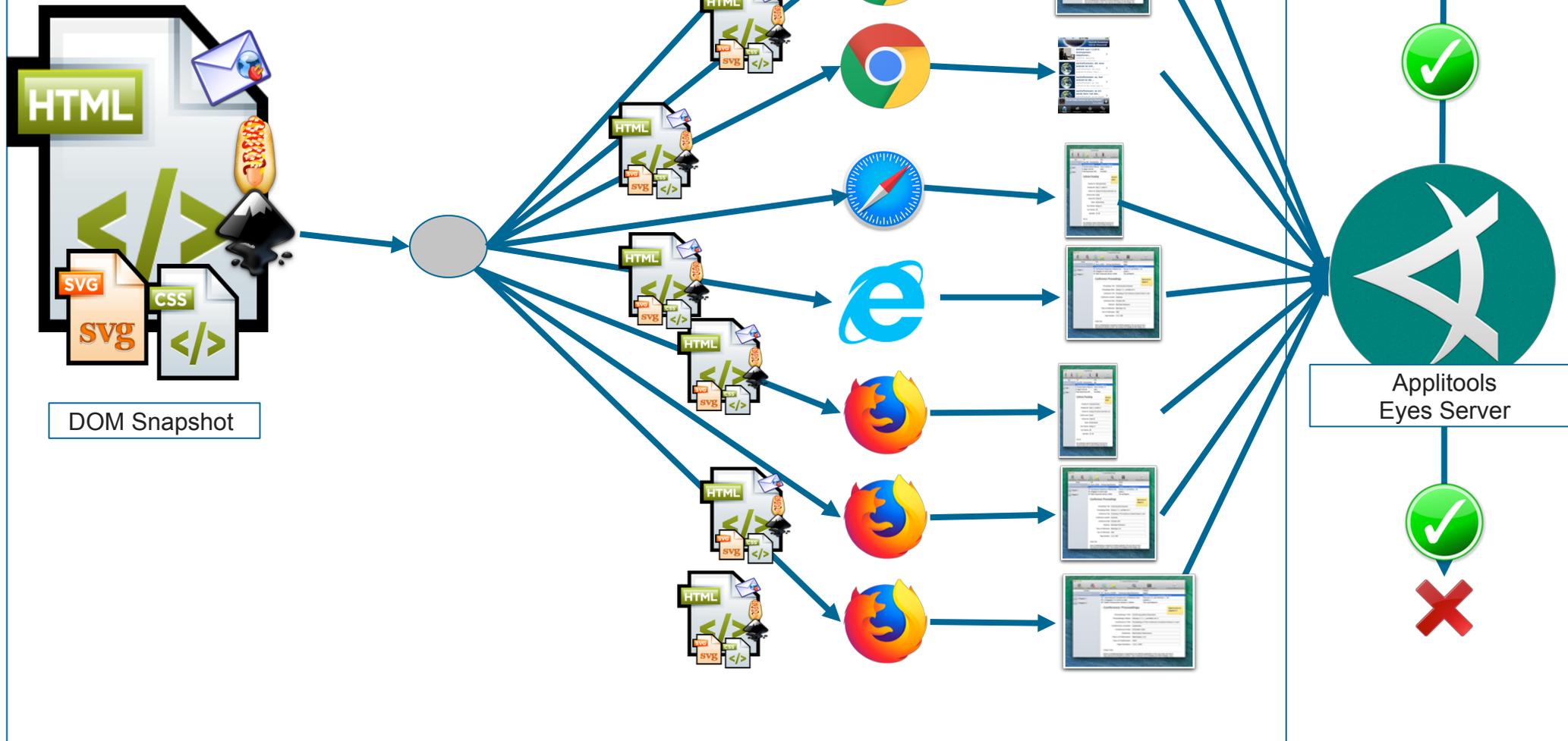


How? DOM Snapshots!

Navigate
Click, click, click
checkScreenshot #1
Click, click, click
checkScreenshot #2
Click, click, click
checkScreenshot #3
Click, click, click
checkScreenshot #4



And what do we do with the screenshots?



Challenge #4: Ineffective and slow cross-env tests - solved!

- Cover all environments at the speed of running a single test
- Find visual bugs which are likely to be env specific
- Fraction of the cost&speed penalty of a full featured physical browser / device farm



SH

**OK, OK.
But how?**

**How do I
write tests?**

**Show me
some code!**



One more thing...

Actually two 😊

Applitoools Test Automation University

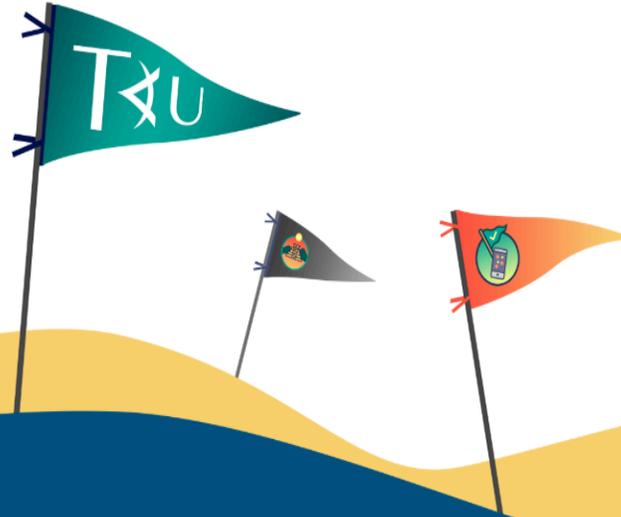
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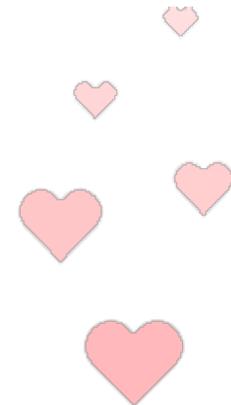
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Thank You

Stay in touch!
@MosheMilman