applitools

Fixing Your Automation Challenges in the Era of CI/CD

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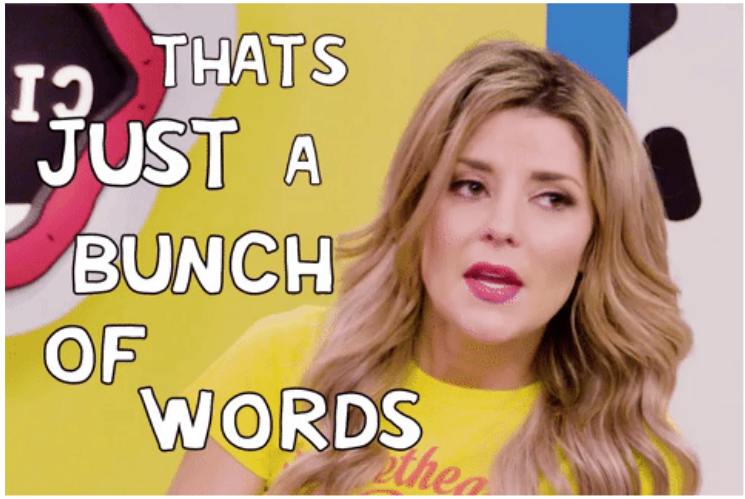
@MosheMilman

WHO AM I?

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

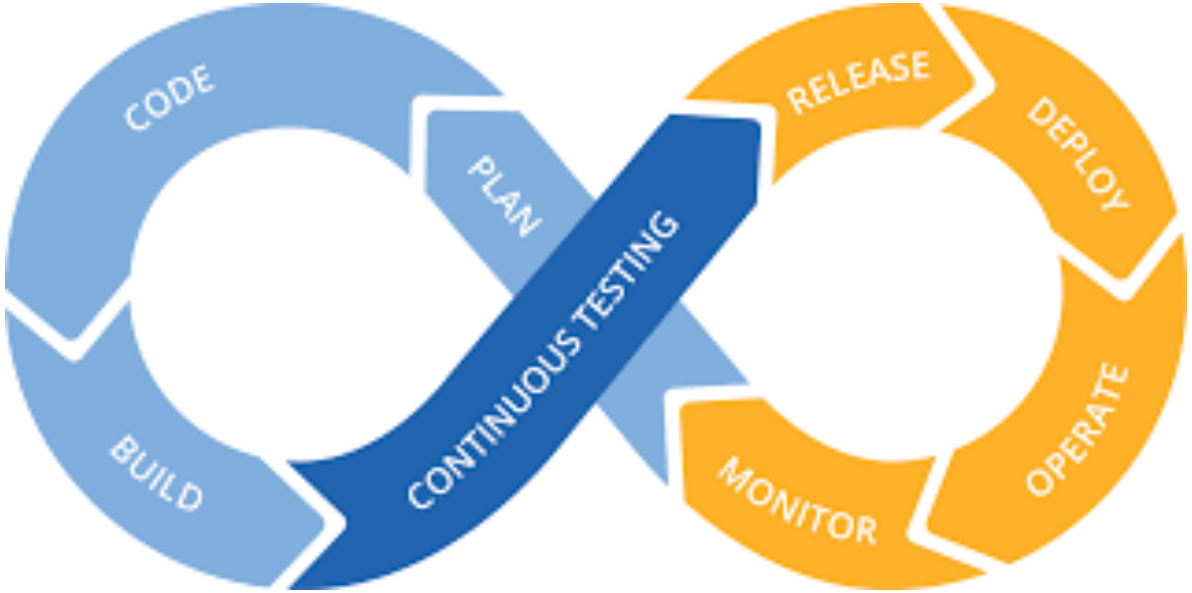
Agenda

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

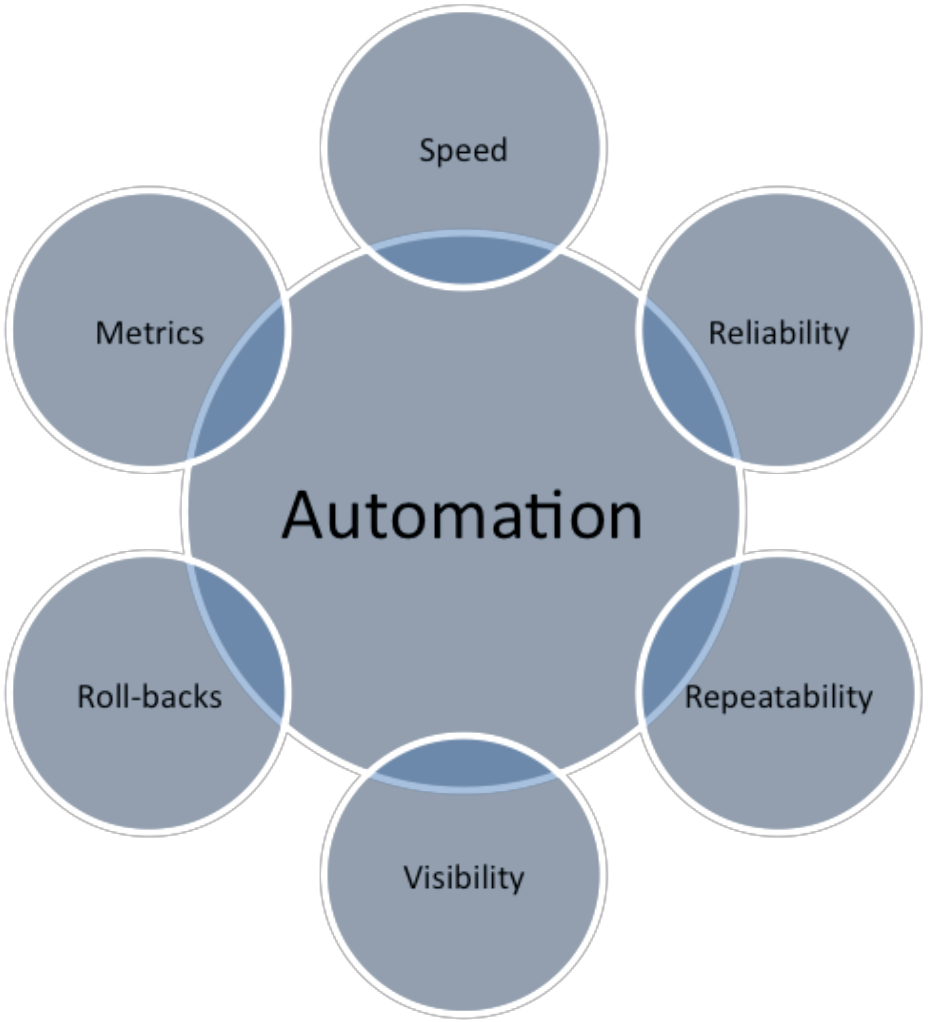


AUTOMATION CHALLENGES

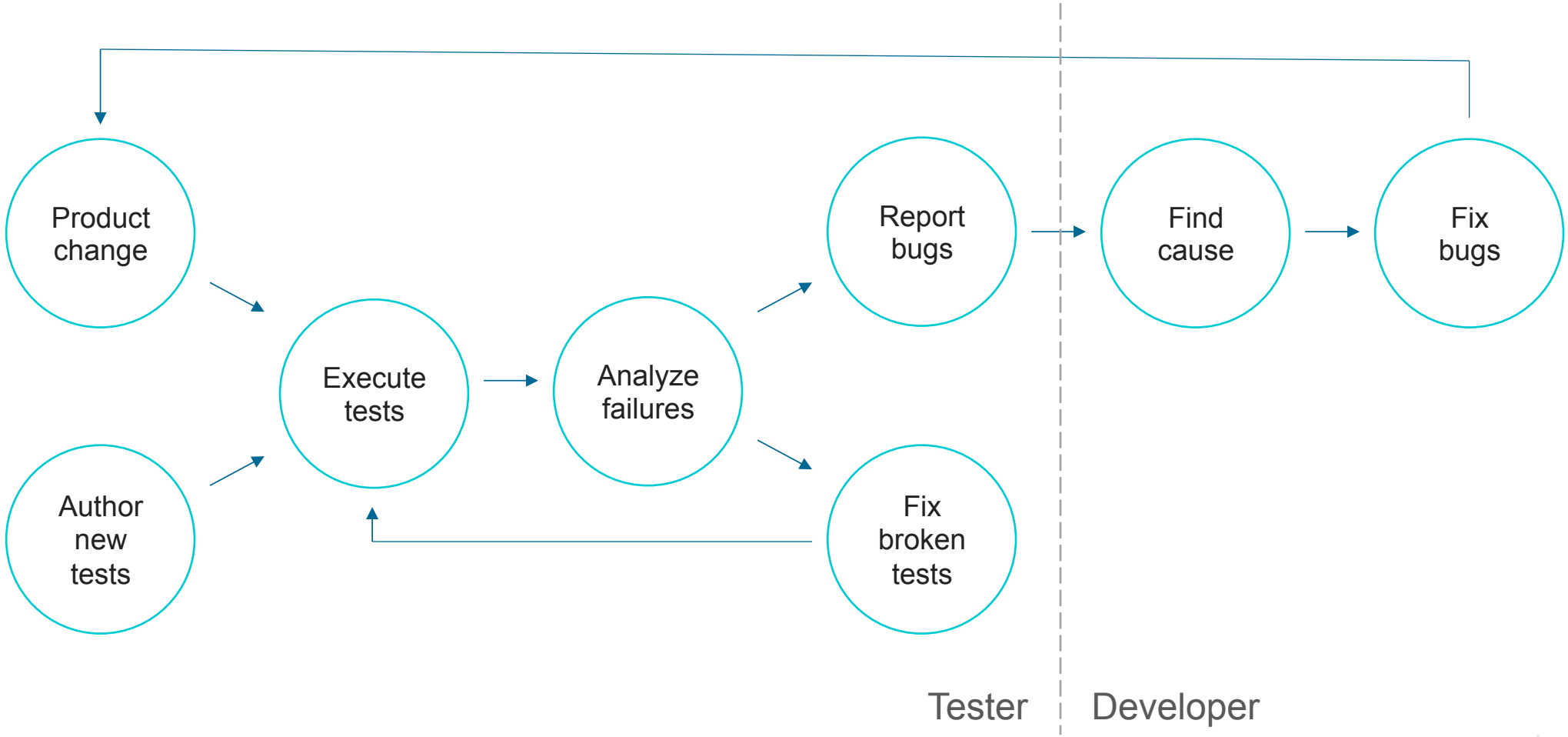
The modern software delivery cycle



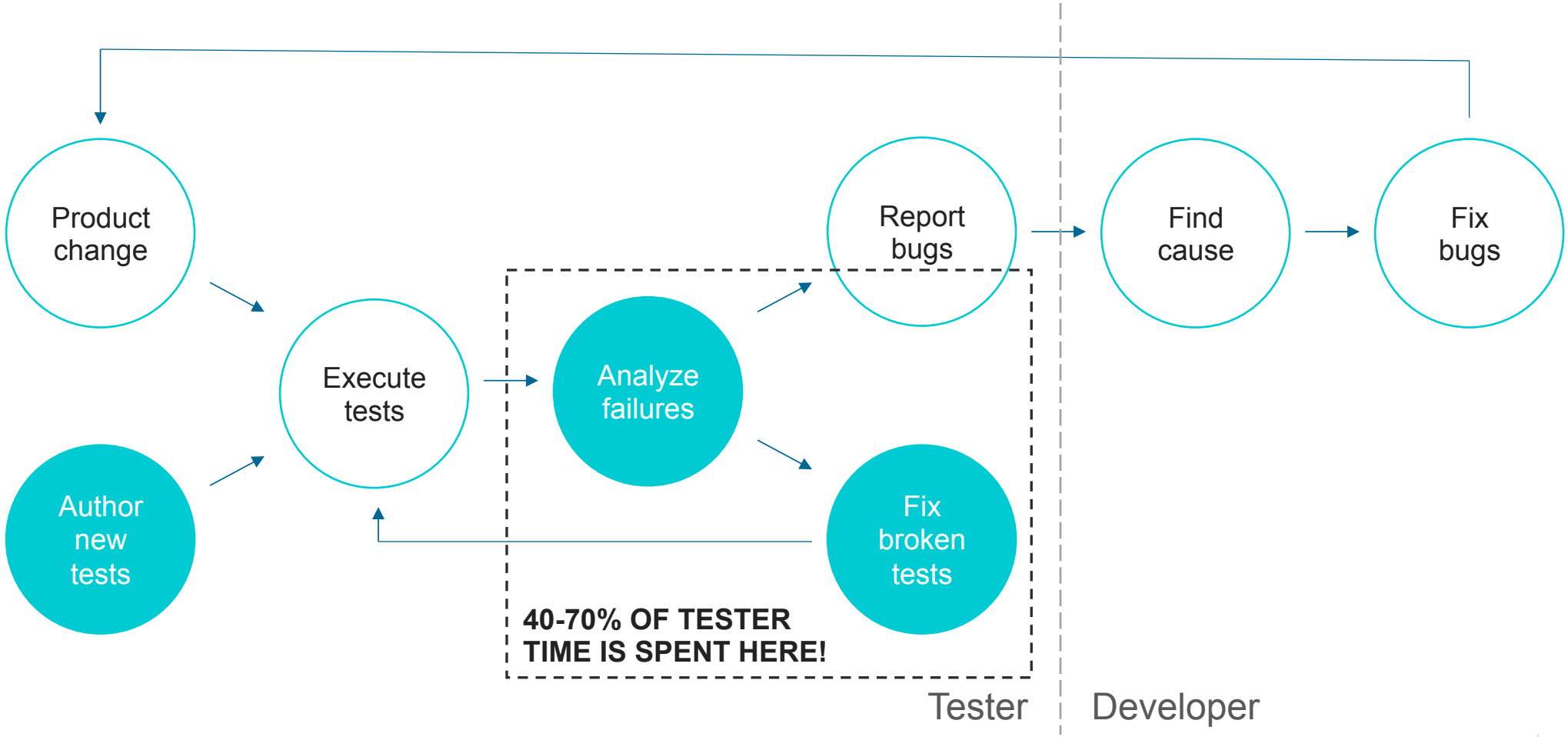
Automation is key!



Test automation workflow



Challenge #1: Low test coverage



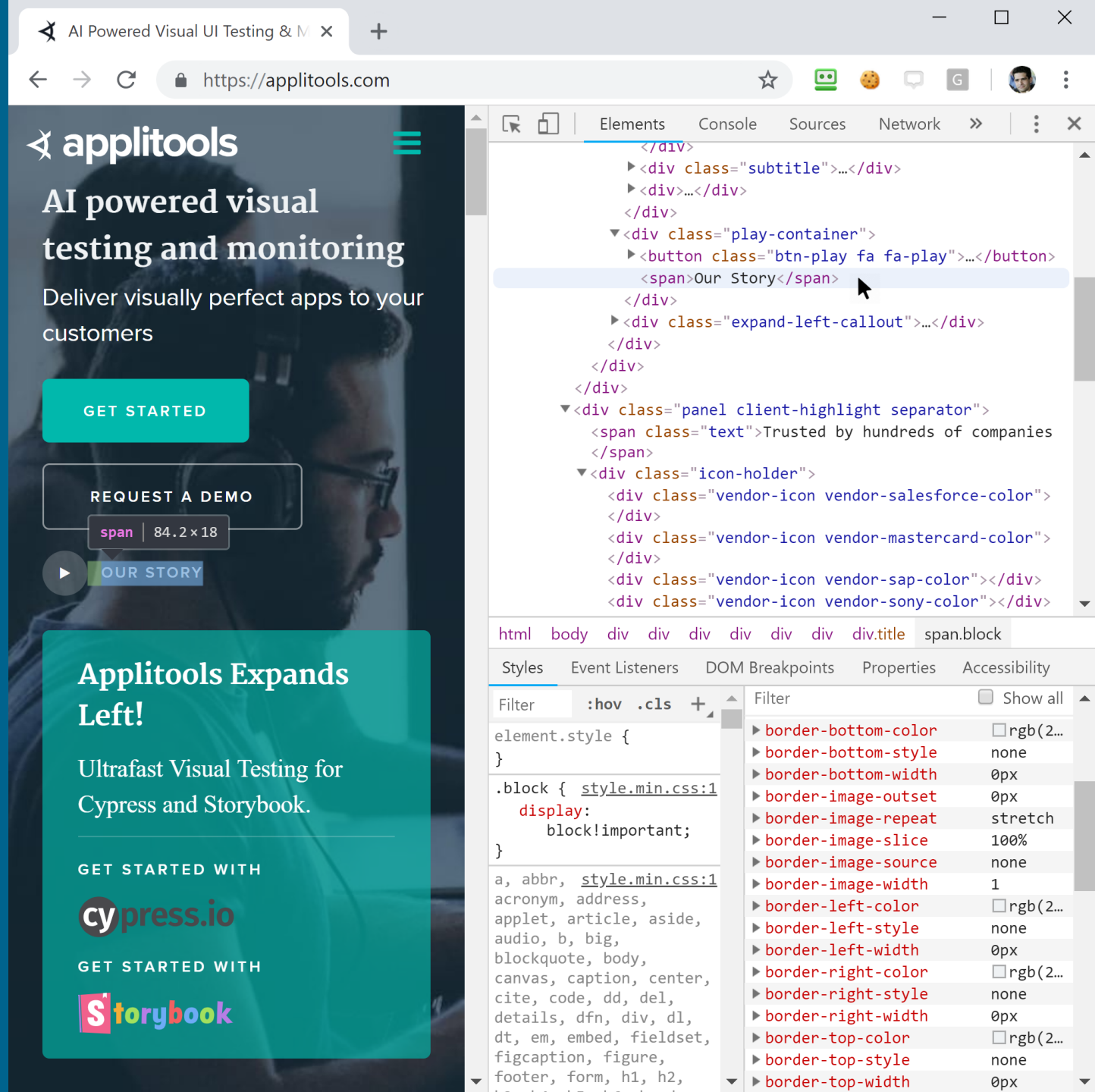
UI Testing

- 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



Analyzing test results

```
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 Uninstall: prod=SolidWorks, code=, upg=, cost=15061KB, force=0,
08:39:21  Info     Status  143    0       "CREATING INSTALL STEP 2 to Uninstall: prod=Microsoft_VBA_KB2783832, code=, upg=, cost=0KB, forc
08:39:21  Info     Status  143    0       "CREATING INSTALL STEP 4 to Upgrade: prod=SolidWorks, code={B6B5EA7E-B91F-443D-A958-B0062FB538
08:39:22  Info     Status  143    0       "CREATING INSTALL STEP 5 to Upgrade: prod=eDrawings, code={2686CB6D-19AF-49A0-ABD2-29D134D7C23
08:39:22  Info     Status  143    0       "CREATING INSTALL STEP 6 to Upgrade: prod=Explorer, code={168EB20E-FC09-4D2E-83A9-49483710304C
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08:39:22  Info     Status  143    0       "CREATING INSTALL STEP 8 to Upgrade: prod=SolidWorksPlastics, code={BA812540-2D88-4A6A-A527-E7
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."
```
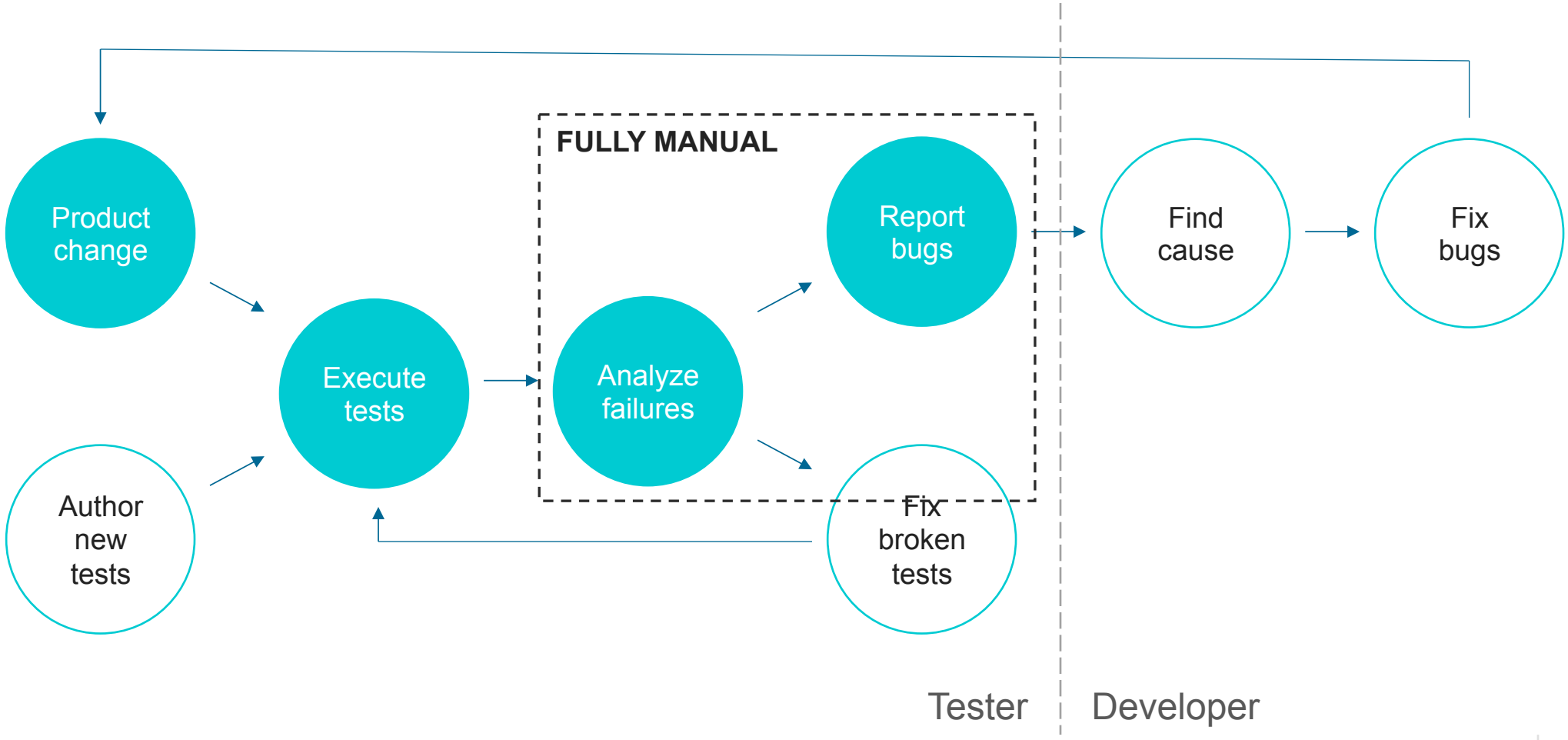
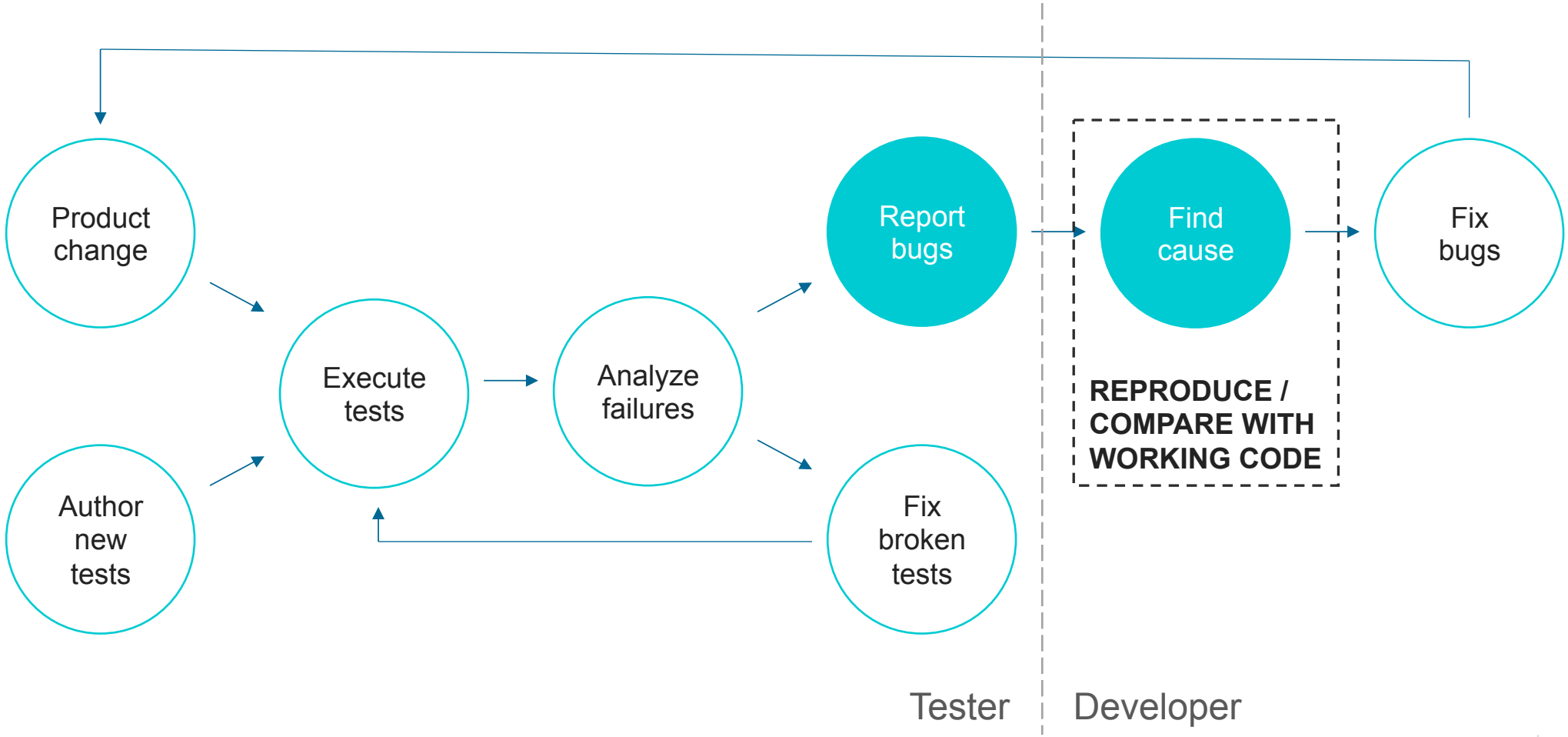

Challenge #1: Low test coverage

- 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



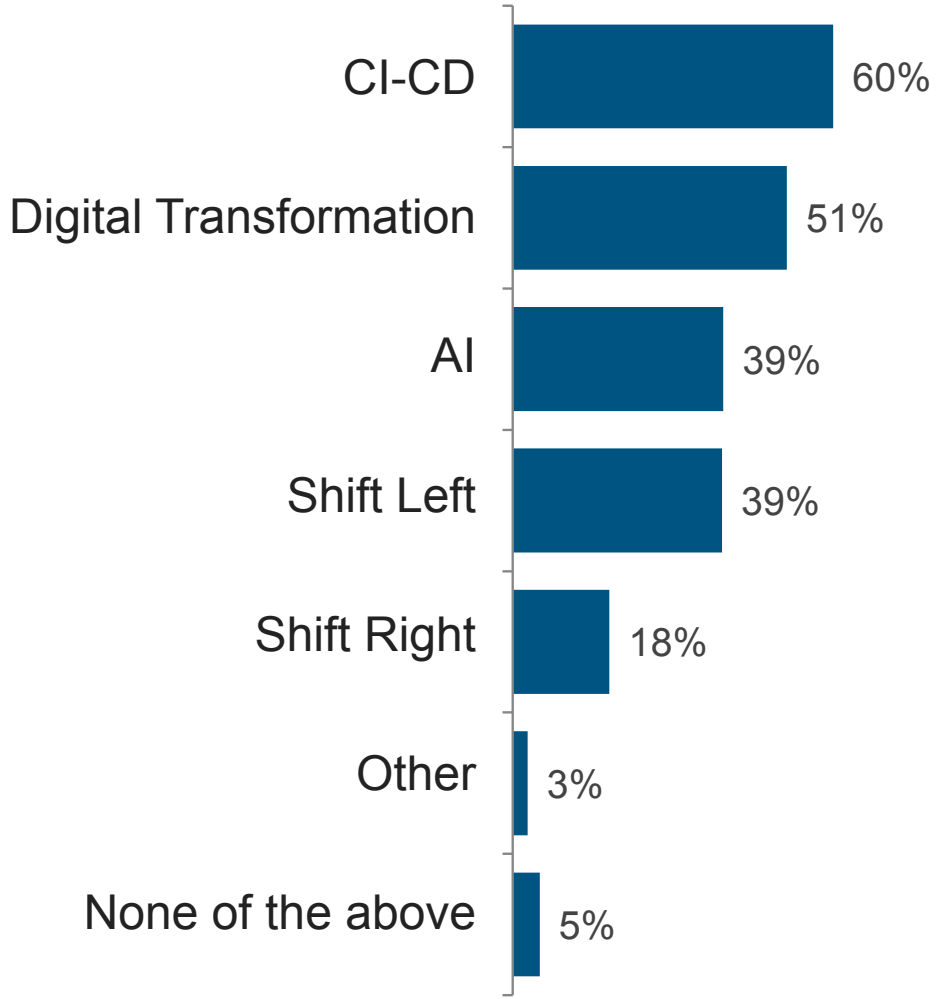
Challenge #4: Ineffective and slow cross env tests

- 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

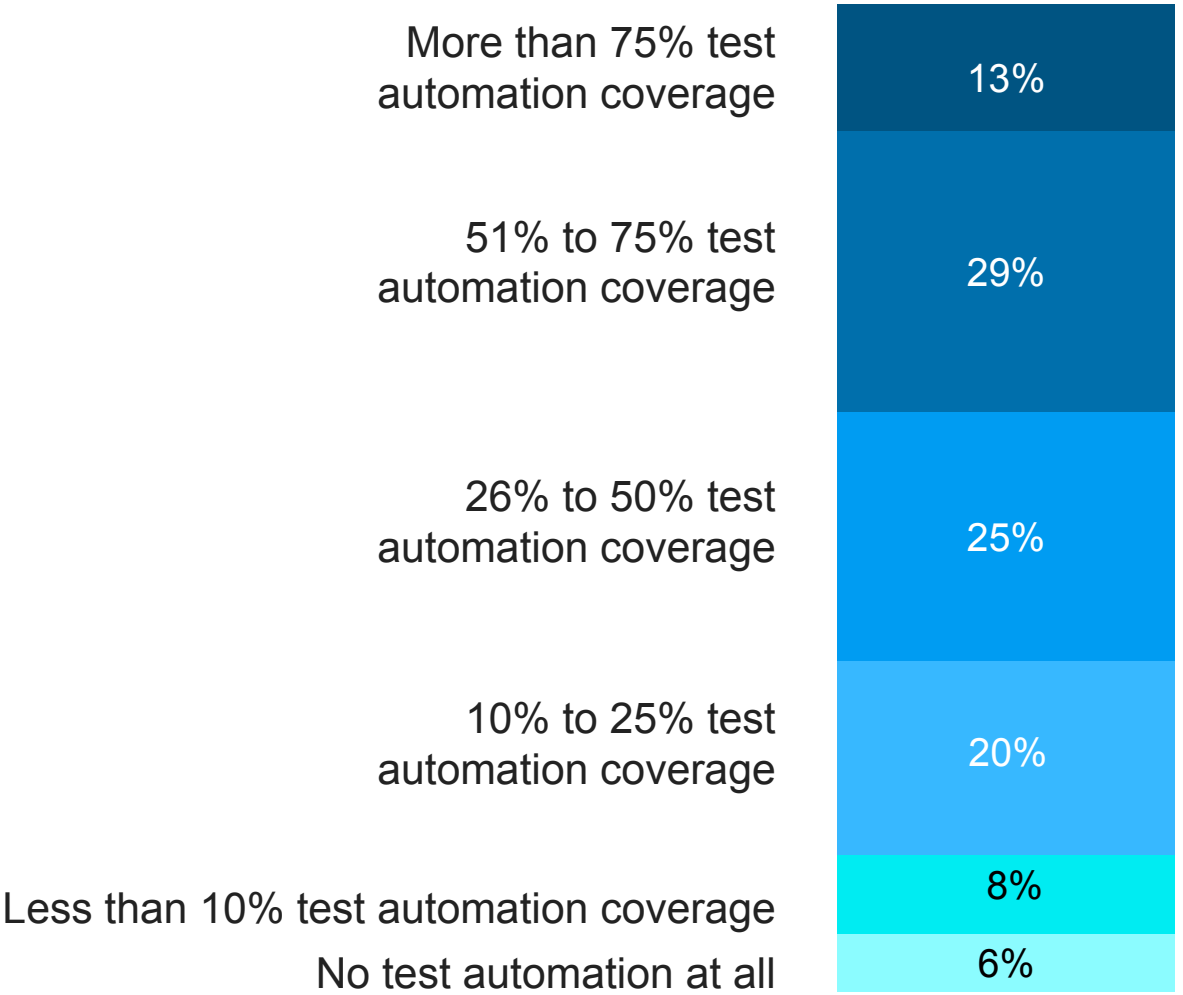
MARKET TRENDS + STATS

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



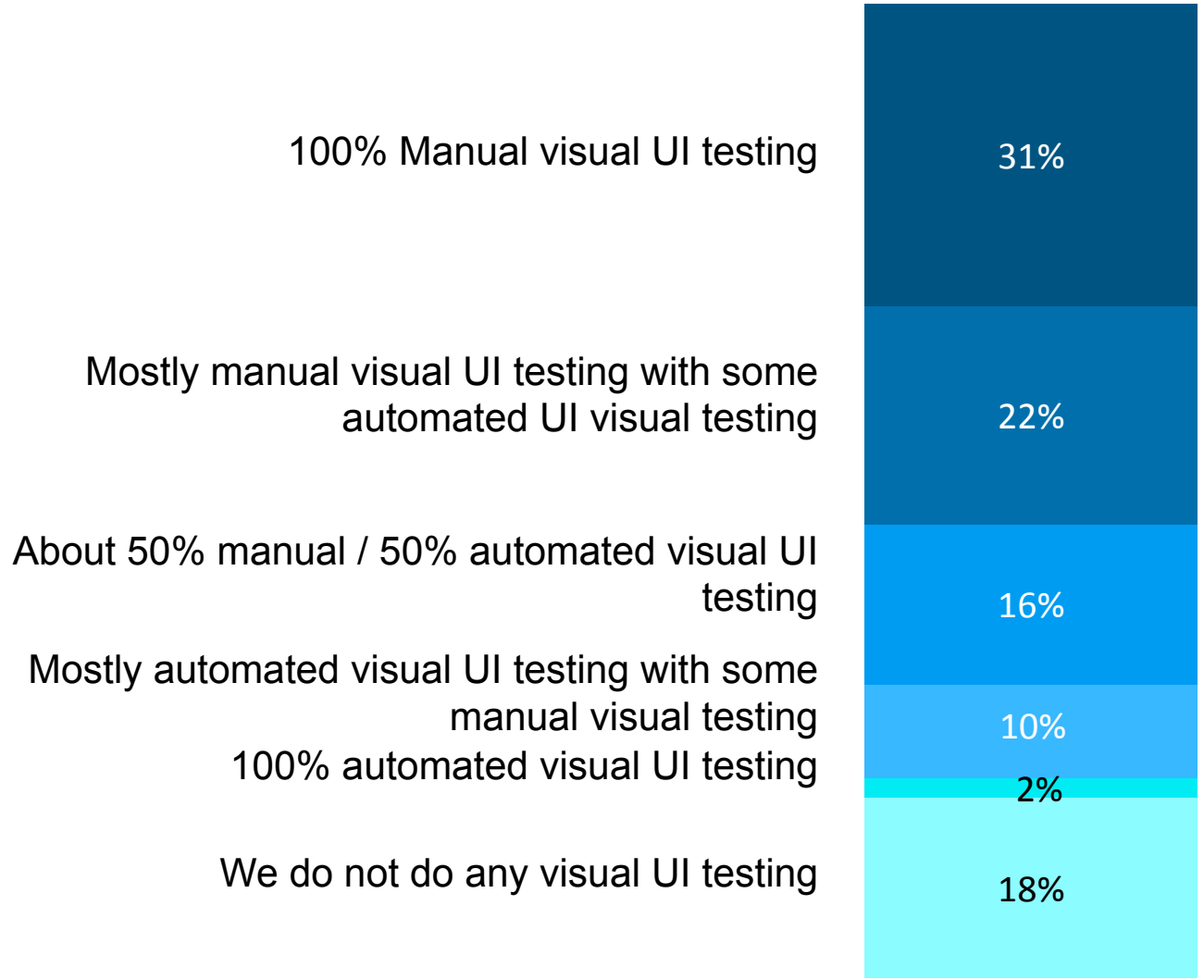
Q1A - Which of the following initiatives were part of your company's plans in 2018?

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



Q3L - How do you manage visual UI testing today?

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

“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

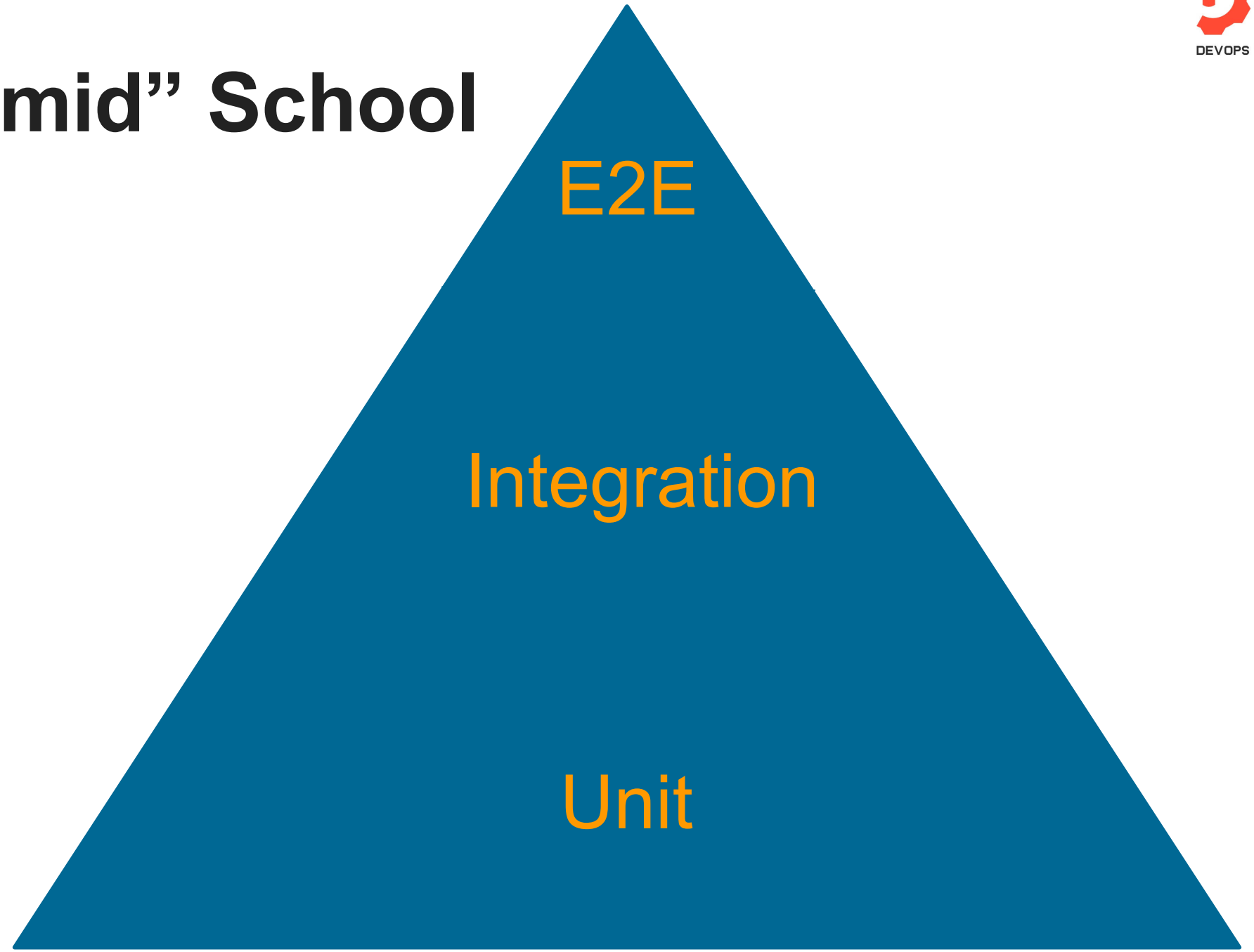
Tests must be fast

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

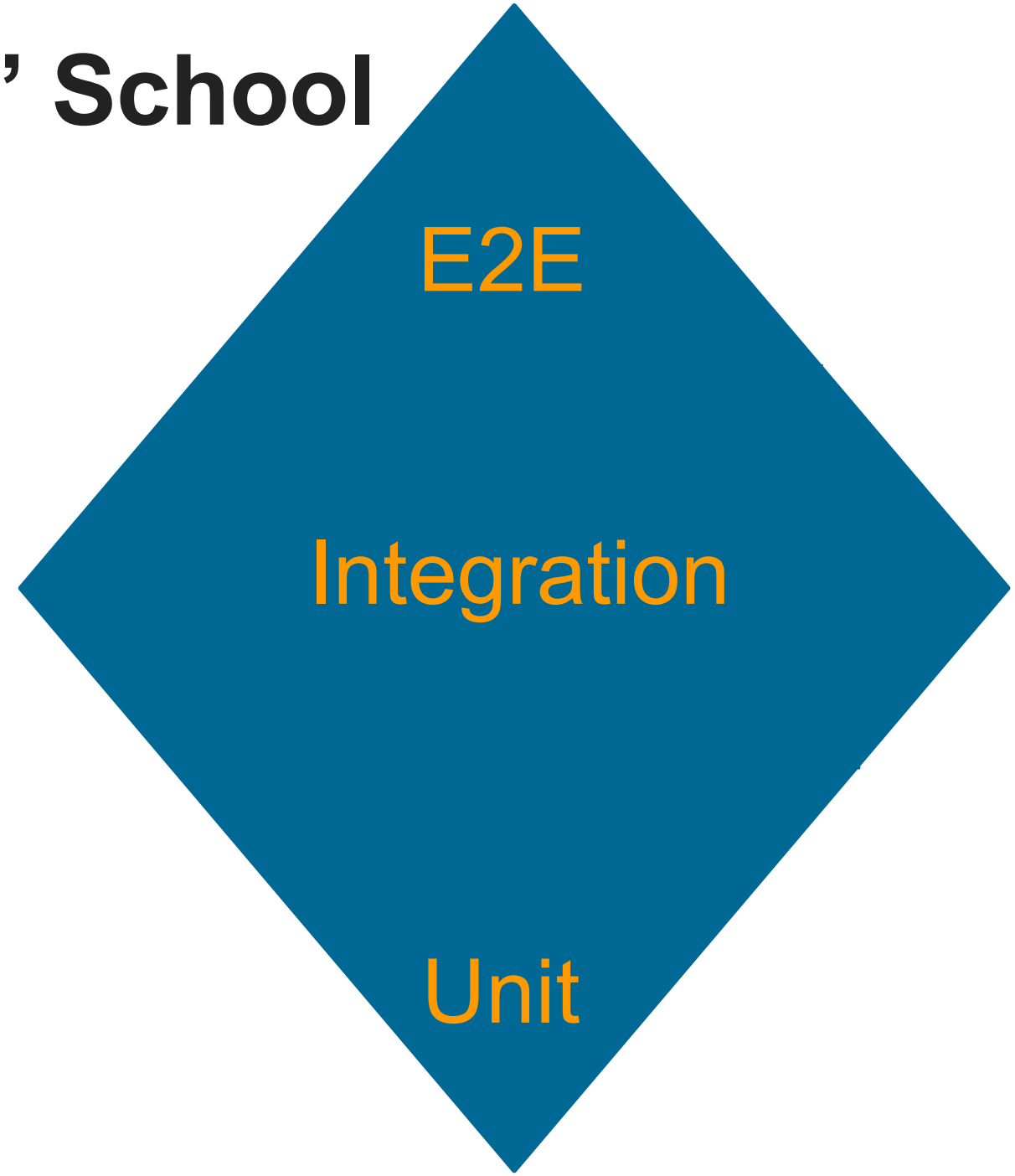
So they've started writing tests!

There are two main schools of testing

The “Pyramid” School



The “Diamond” School



DEVOPS TALKS CONFERENCE

Which is better?

It’s a Religion!

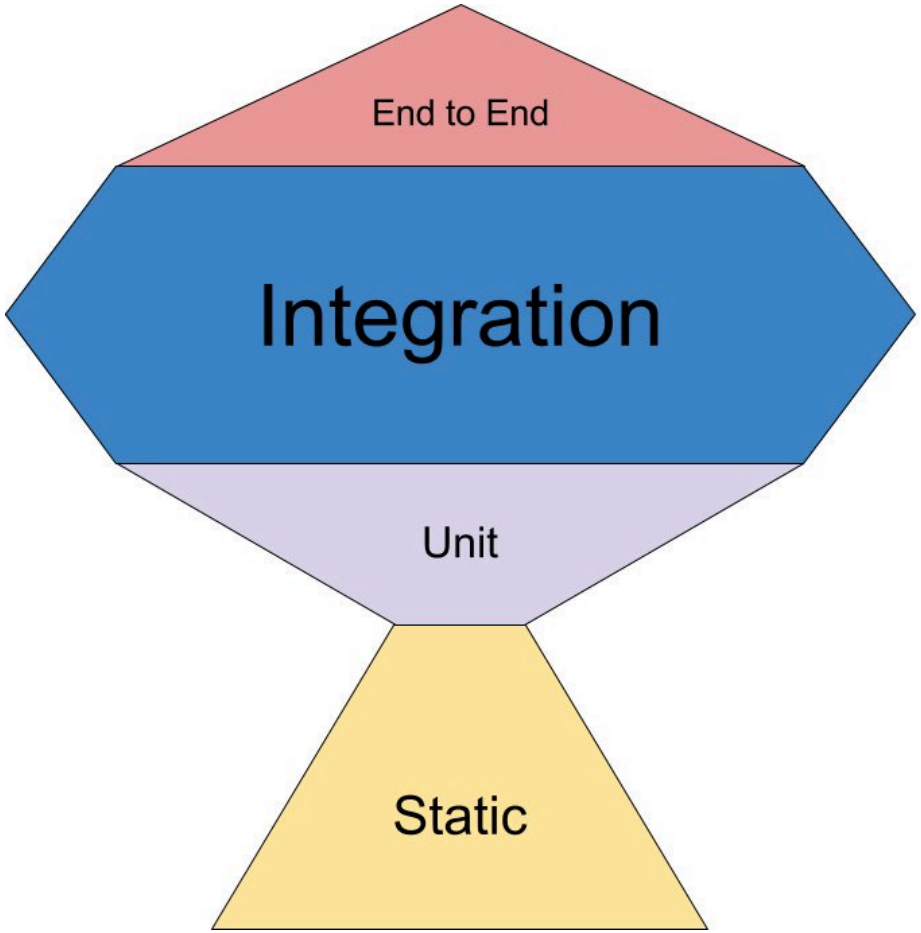
Commonalities

- 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!

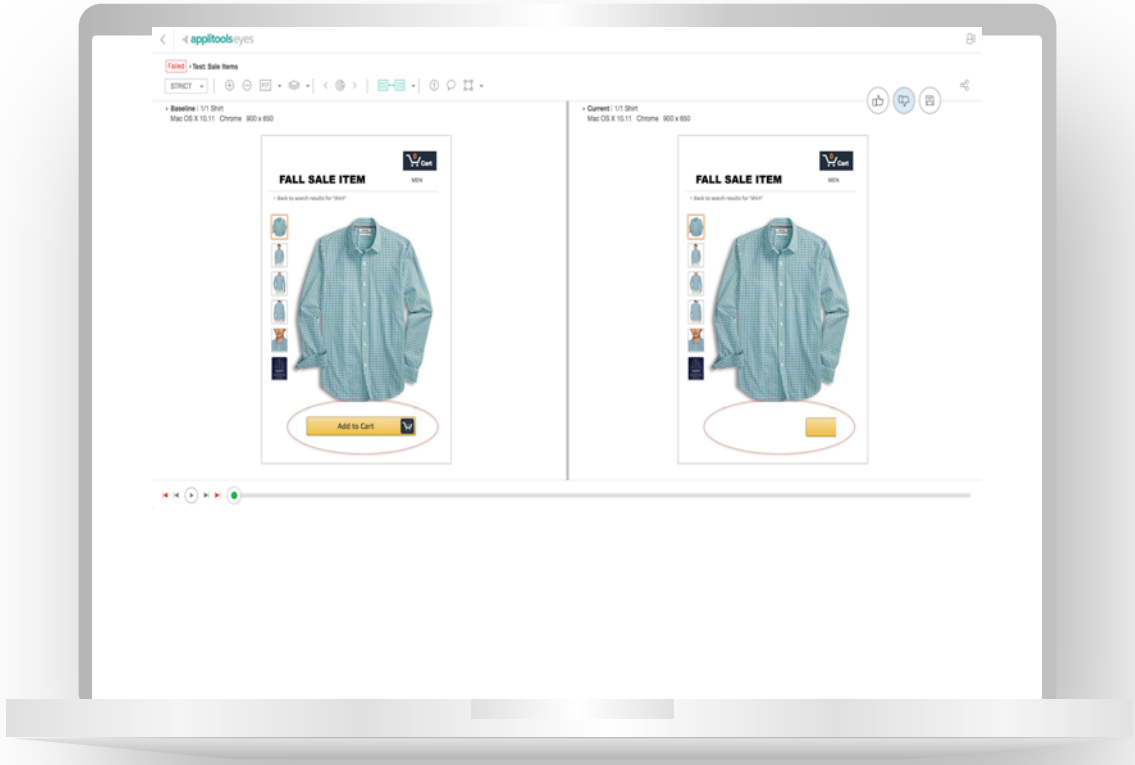
- Still differences between browsers
- Add to that responsive design, for cross-width testing
  - iPhone size
  - iPad size
  - Desktop size
  - Retina size

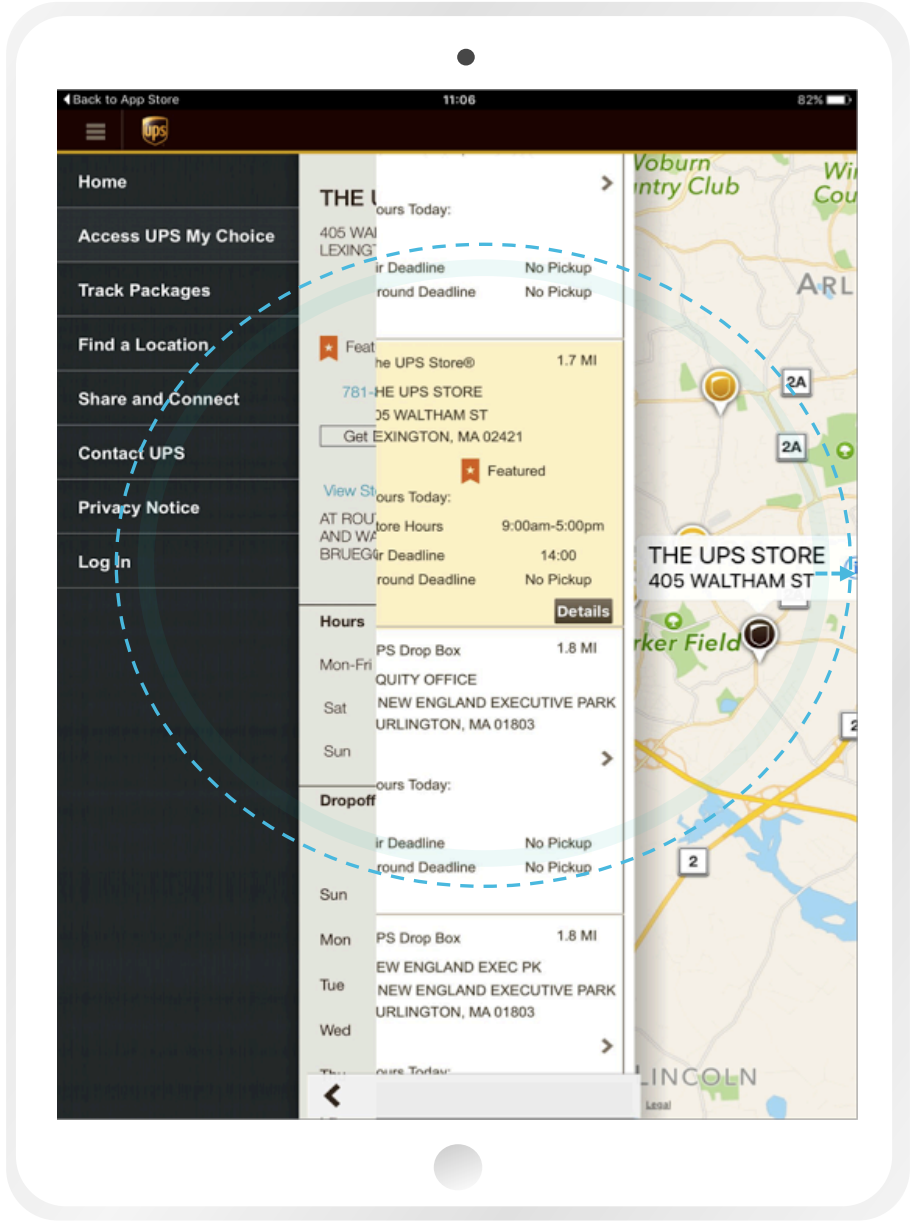
HOW CAN WE FIX IT?

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




Back to App Store
11:06
82%
Home
Access UPS My Choice
Track Packages
Find a Location
Share and Connect
Contact UPS
Privacy Notice
Log In
Hours
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Sat
Sun
Dropoff
Sun
Mon
Tue
Wed
No Pickup
No Pickup
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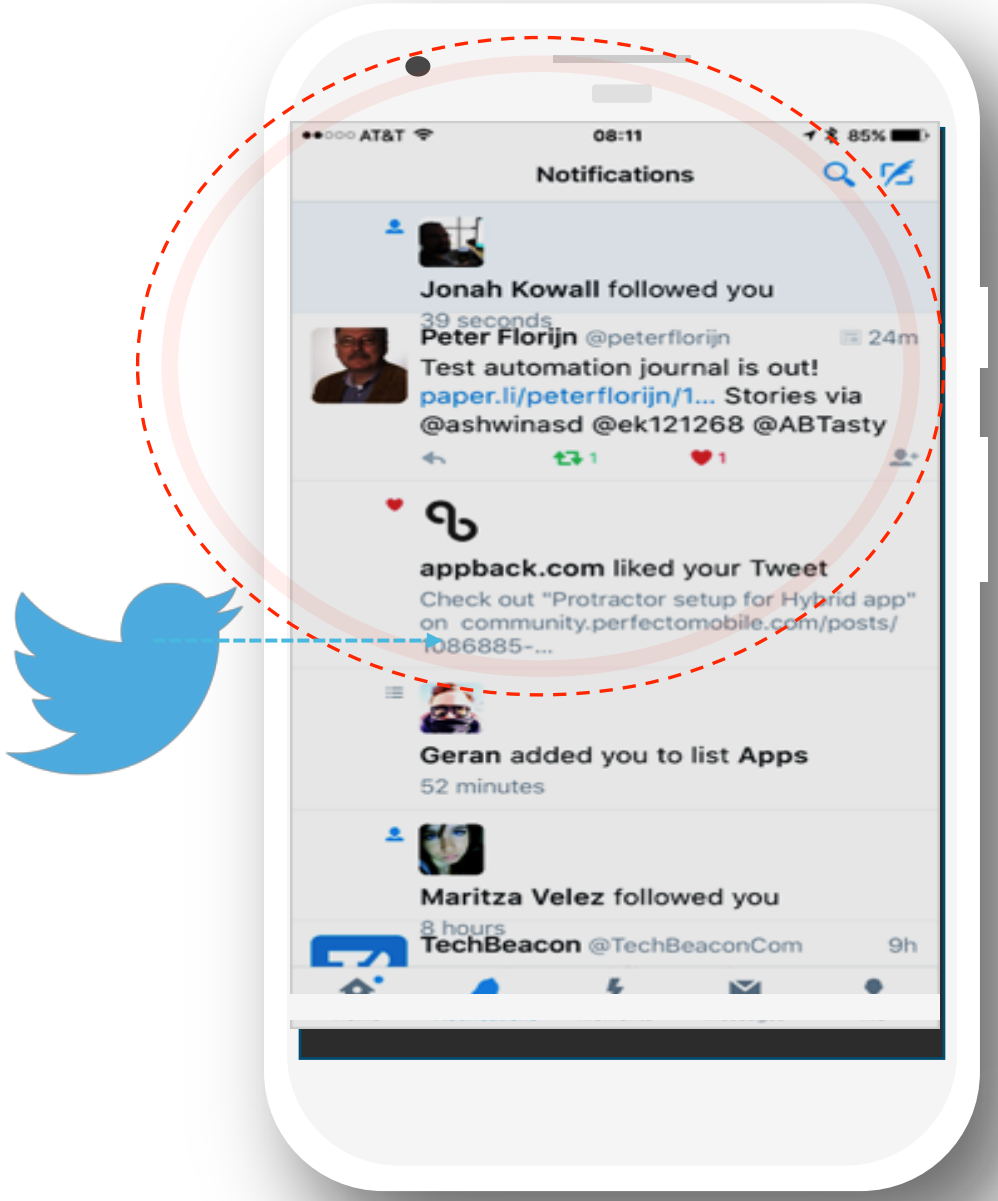
AT&T
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Notifications
Jonah Kowall followed you
39 seconds
Peter Florijn @peterflorijn
24m
Test automation journal is out!
paper.li/peterflorijn/1... Stories via
@ashwinasd @ek121268 @ABTasty
appback.com liked your Tweet
Check out "Protractor setup for Hybrid app"
on community.perfectomobile.com/posts/
Geran added you to list Apps
52 minutes
Maritza Velez followed you
8 hours
TechBeacon @TechBeaconCom
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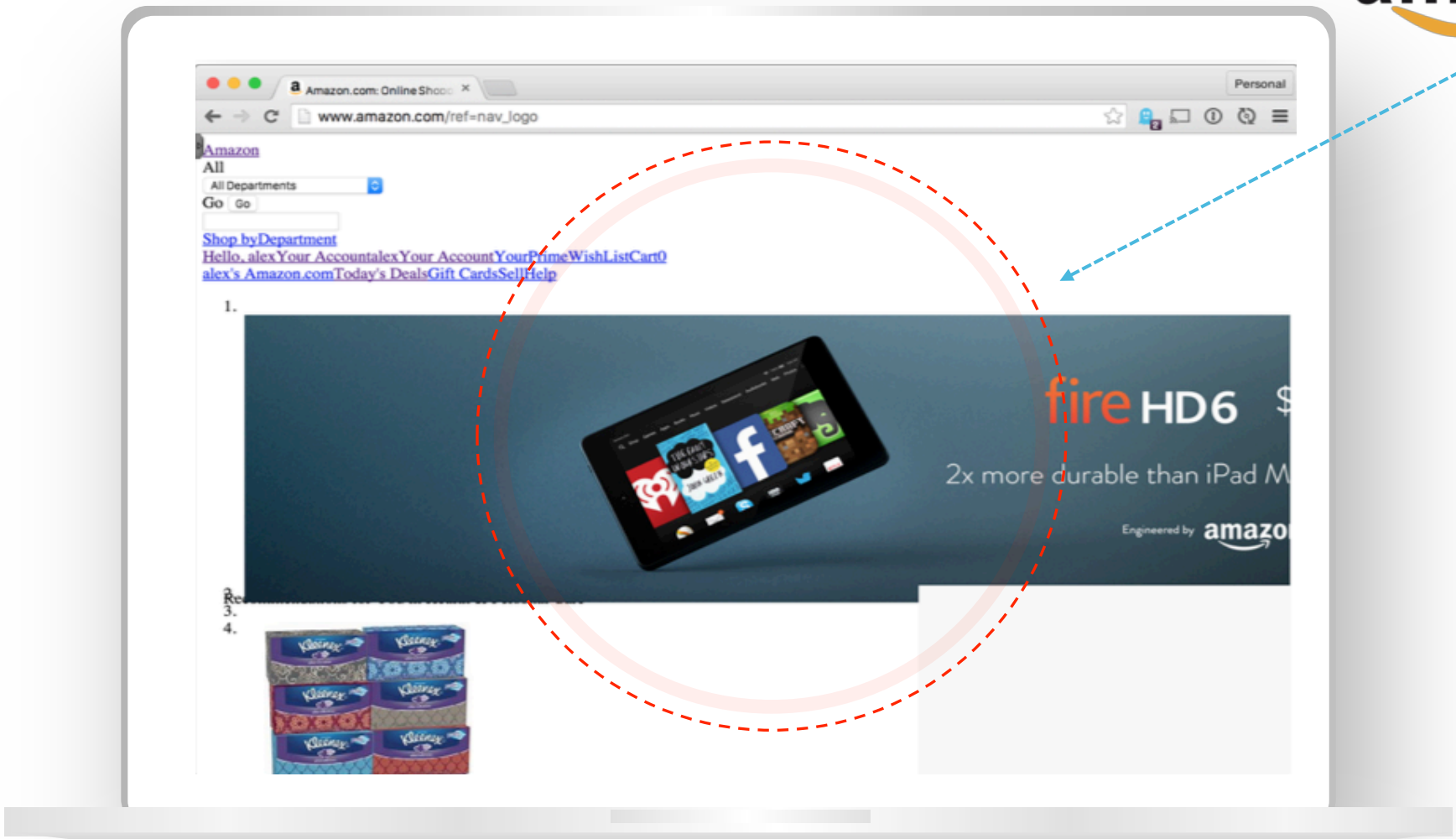
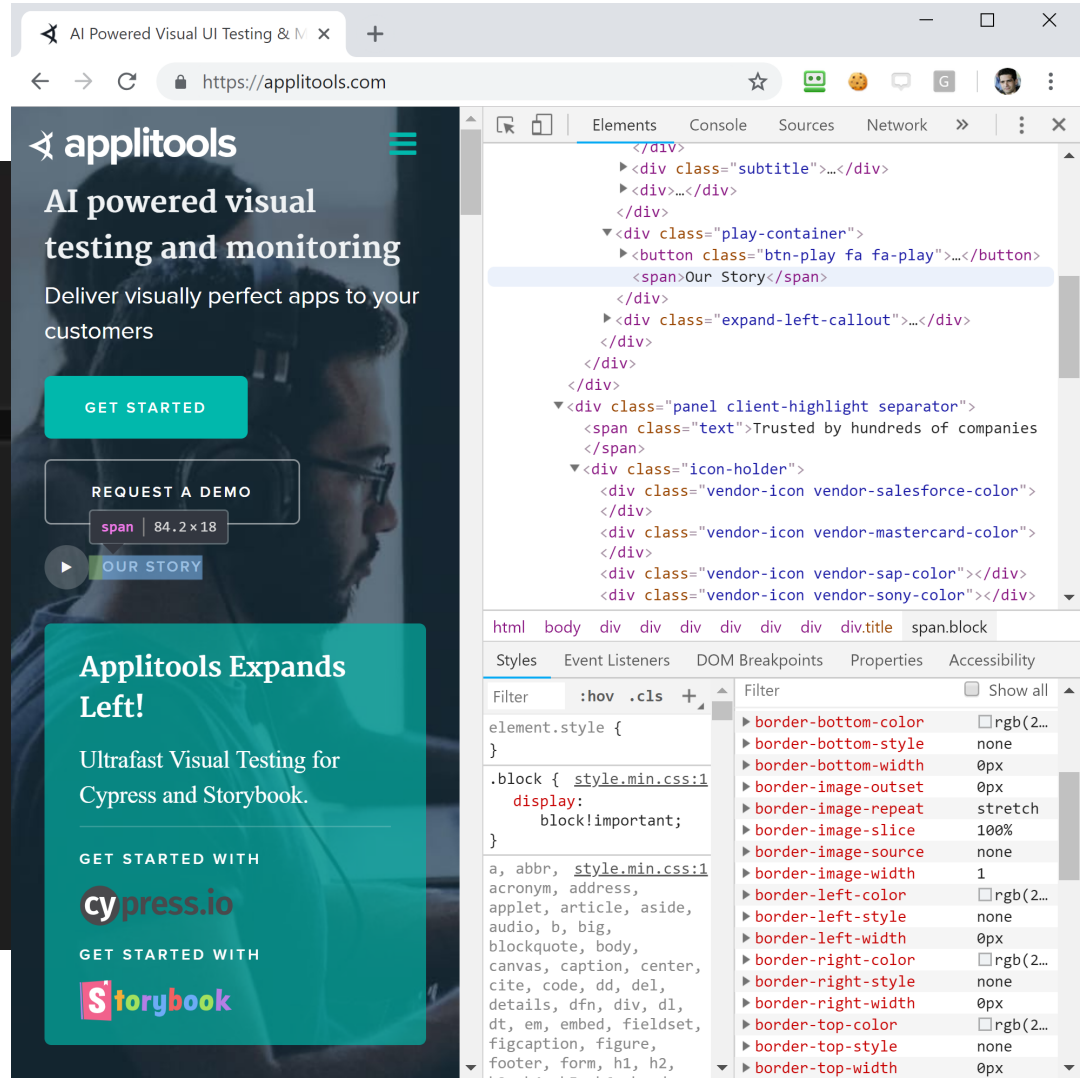

Amazon.com: Online Shop
Personal
www.amazon.com/ref=nav_logo
Amazon
All
All Departments
Go Go
Shop byDepartment
Hello, alexYour AccountalexYour AccountYourPrimeWishListCart0
alex's Amazon.comToday's DealsGift CardsSellHelp
fire HD6
2x more durable than iPad M
Engineered by amazo

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

Full page (functional) validation

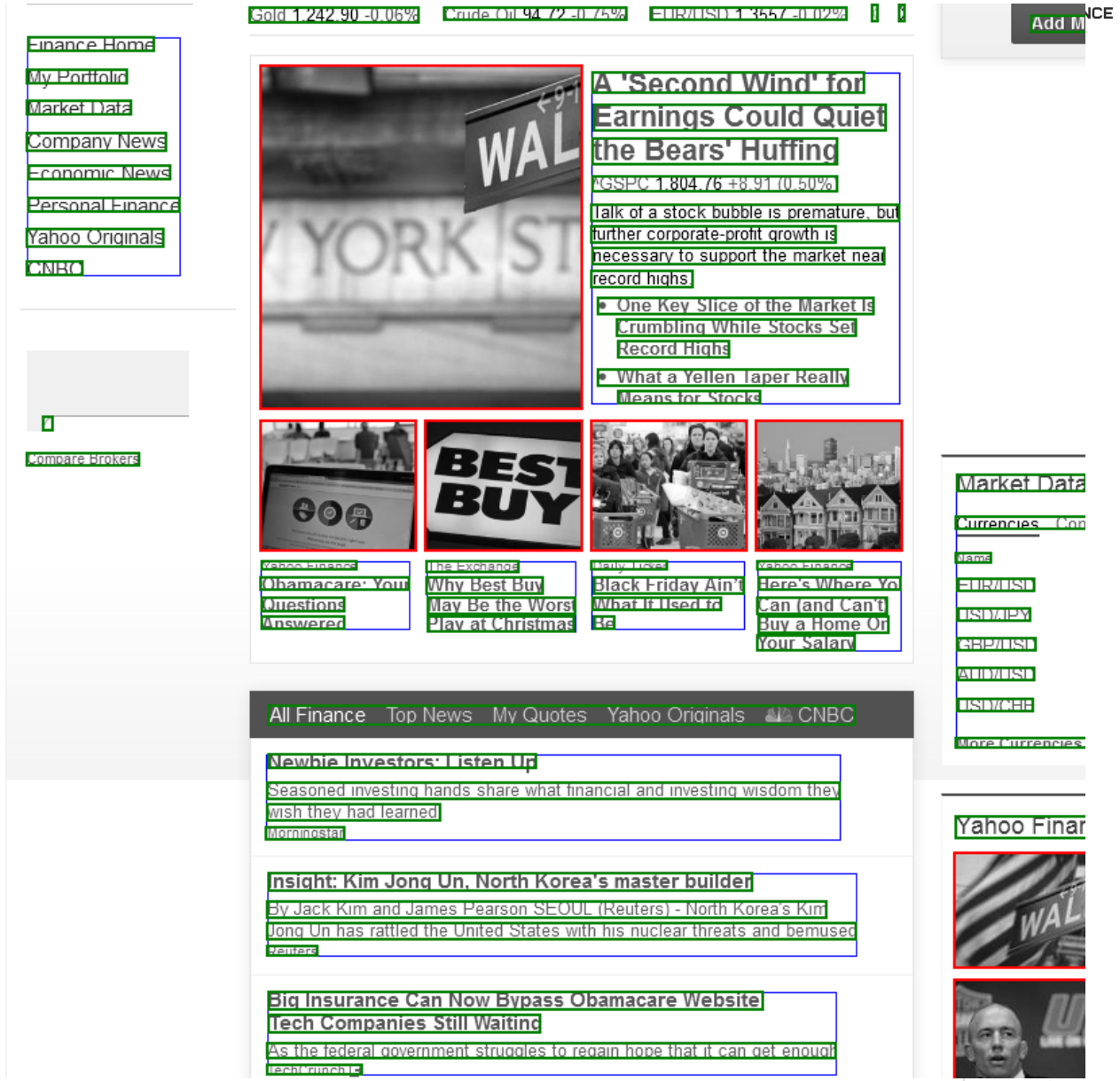
```
[Test]
0 references
public void TestResponsiveness()
{
    driver.Url = "https://github.com";

    var home = new HomePage(driver);

    var personalPage = home.GoToPersonalPage();

    var openSourcePage = personalPage.GoToOpenSourcePage();
}

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

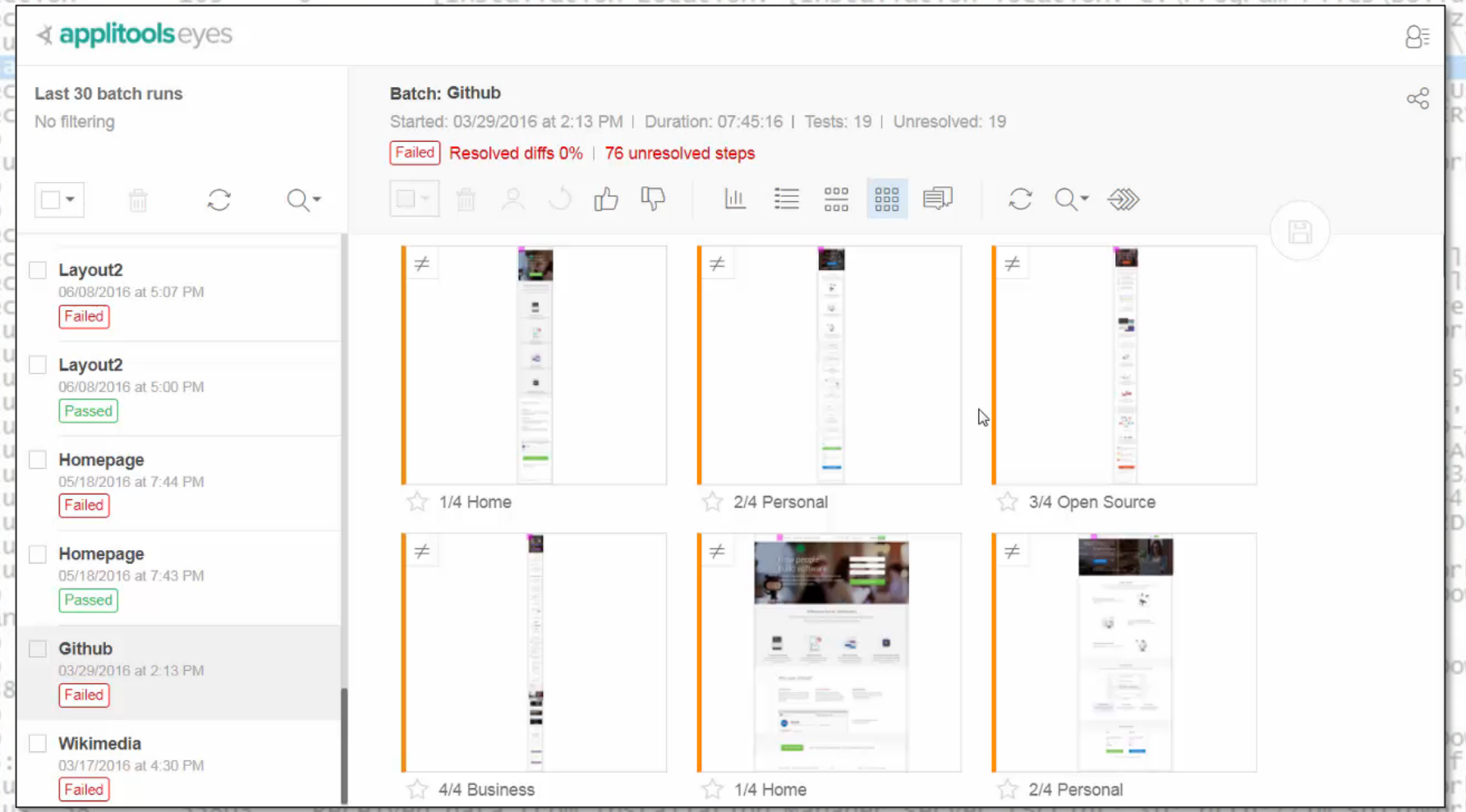


DEVOPS TALKS CONFERENCE

99.9999%
accuracy
...
and
improving!

Sections
Columns
Images
Text
Paragraphs
Patterns
Galleries
Tables
Trees



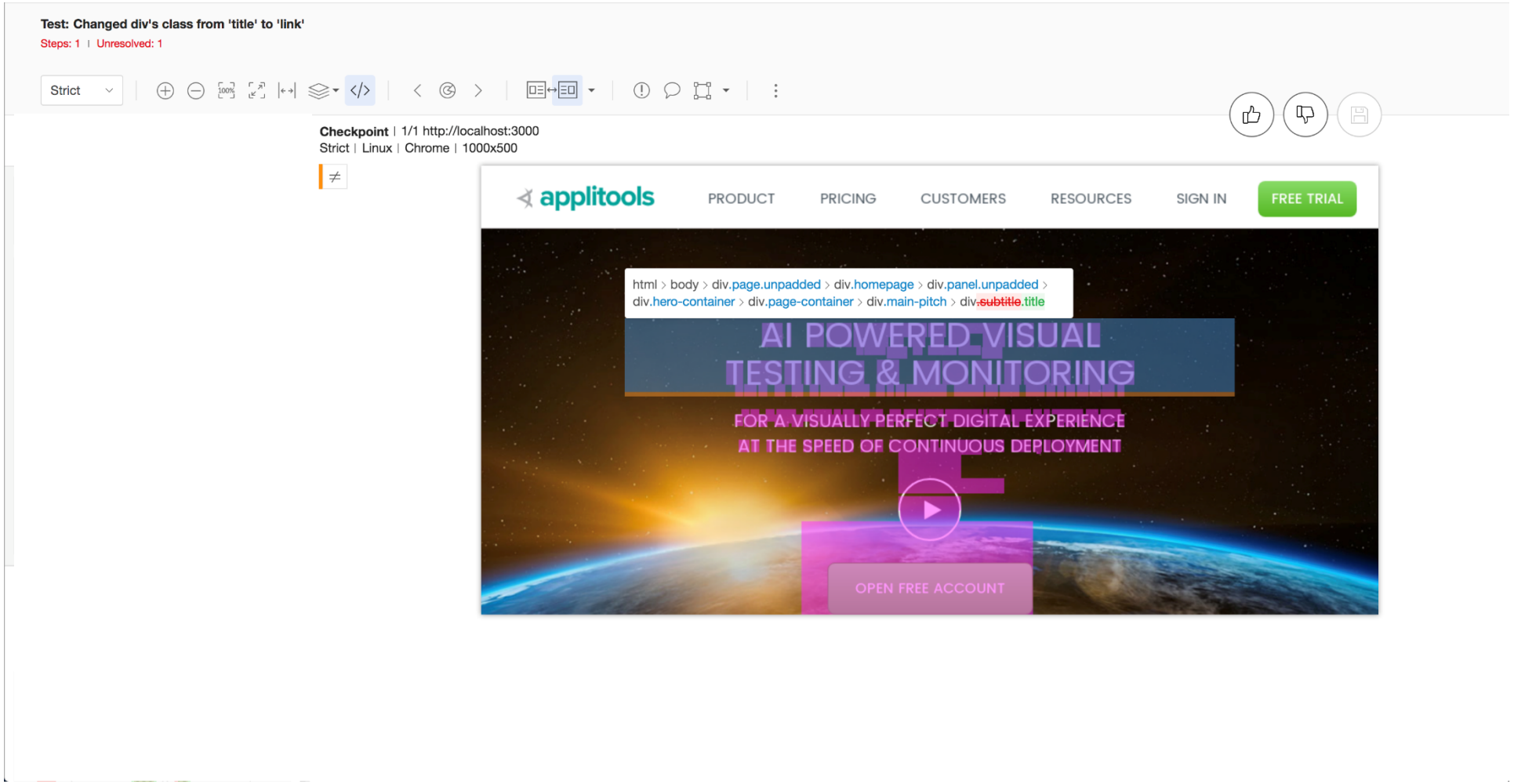

applitools eyes
Last 30 batch runs
No filtering
Layout2
06/08/2016 at 5:07 PM
Failed
Layout2
06/08/2016 at 5:00 PM
Passed
Homepage
05/18/2016 at 7:44 PM
Failed
Homepage
05/18/2016 at 7:43 PM
Passed
Github
03/29/2016 at 2:13 PM
Failed
Wikimedia
03/17/2016 at 4:30 PM
Failed
Batch: Github
Started: 03/29/2016 at 2:13 PM | Duration: 07:45:16 | Tests: 19 | Unresolved: 19
Failed
Resolved diffs 0%
76 unresolved steps
1/4 Home
2/4 Personal
3/4 Open Source
4/4 Business
1/4 Home
2/4 Personal

Low test coverage and slow feedback

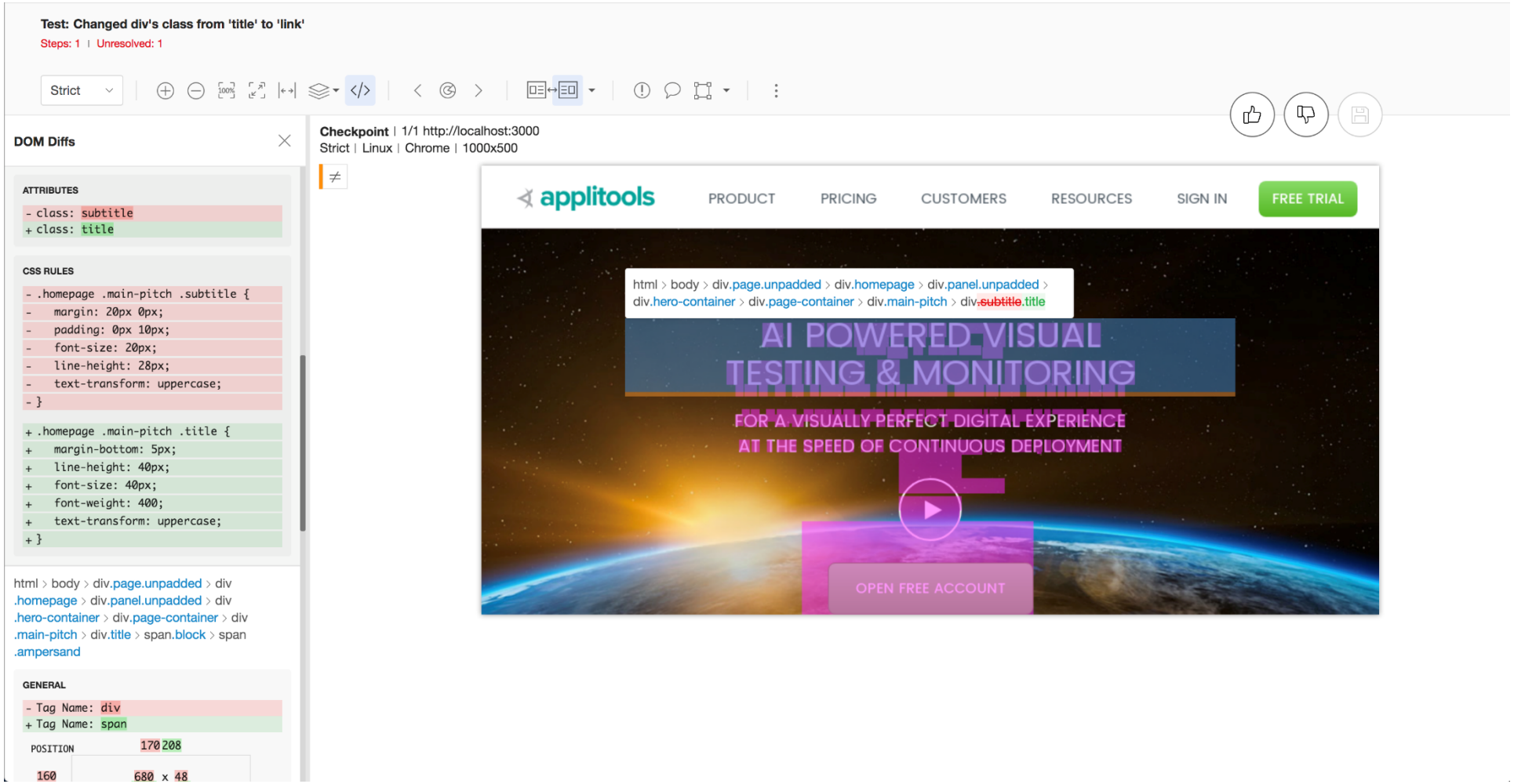
SOLVED!

- 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



Challenge #3 - Root cause analysis – SOLVED!



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

Navigate

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Navigate

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Click, click, click
checkScreenshot

Run each test ten times?

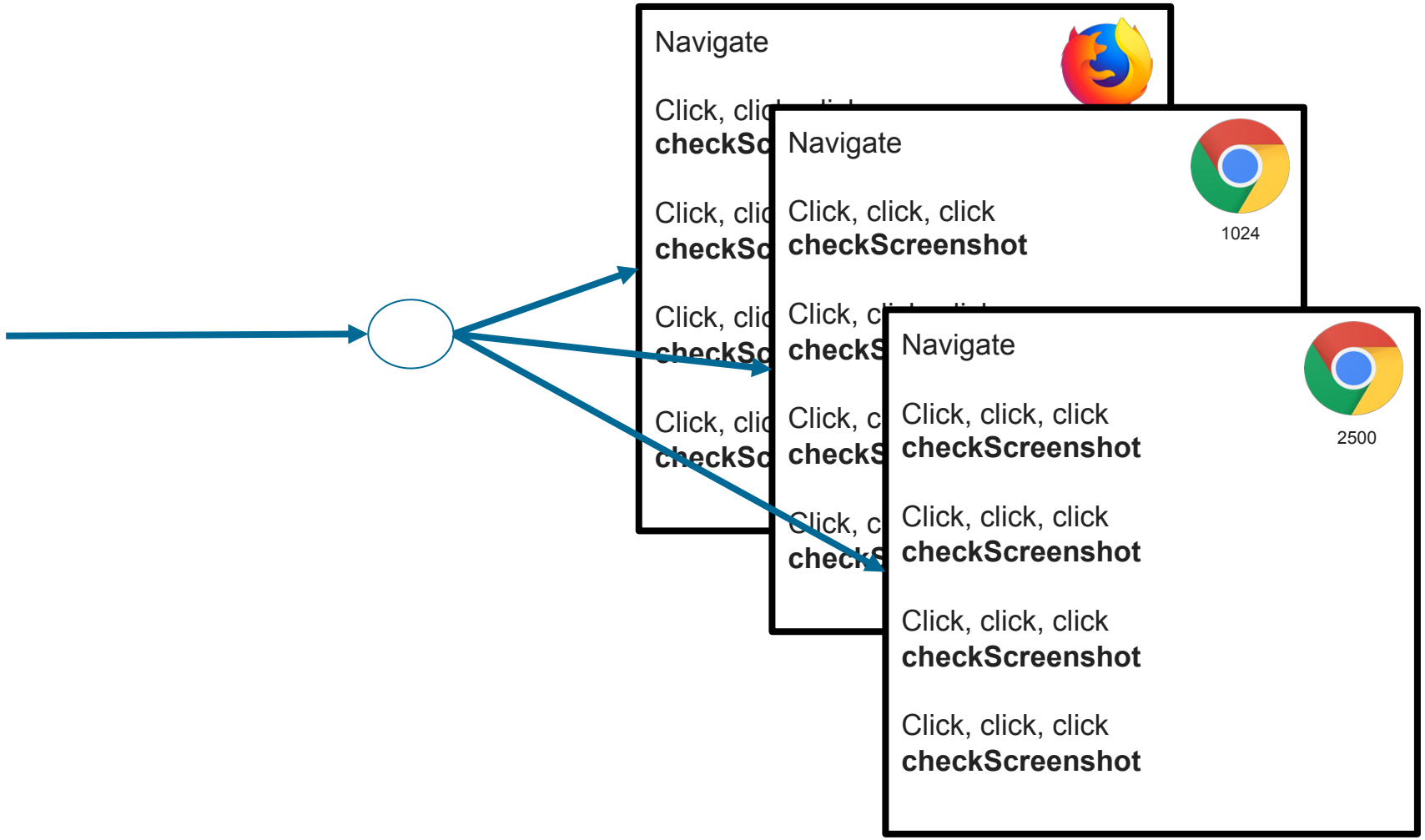
Run each test ten times?

(not even with Cypress…)

How do we solve this problem?

We parallelize

Solution: Parallelizing the tests



There’s a better solution

Parallelize the screenshots!

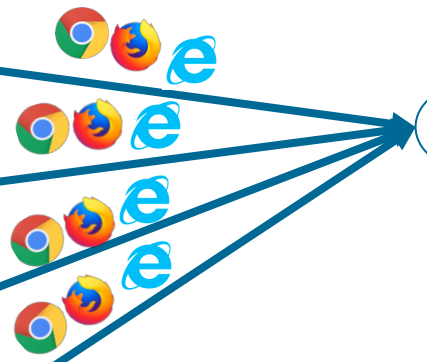
Navigate

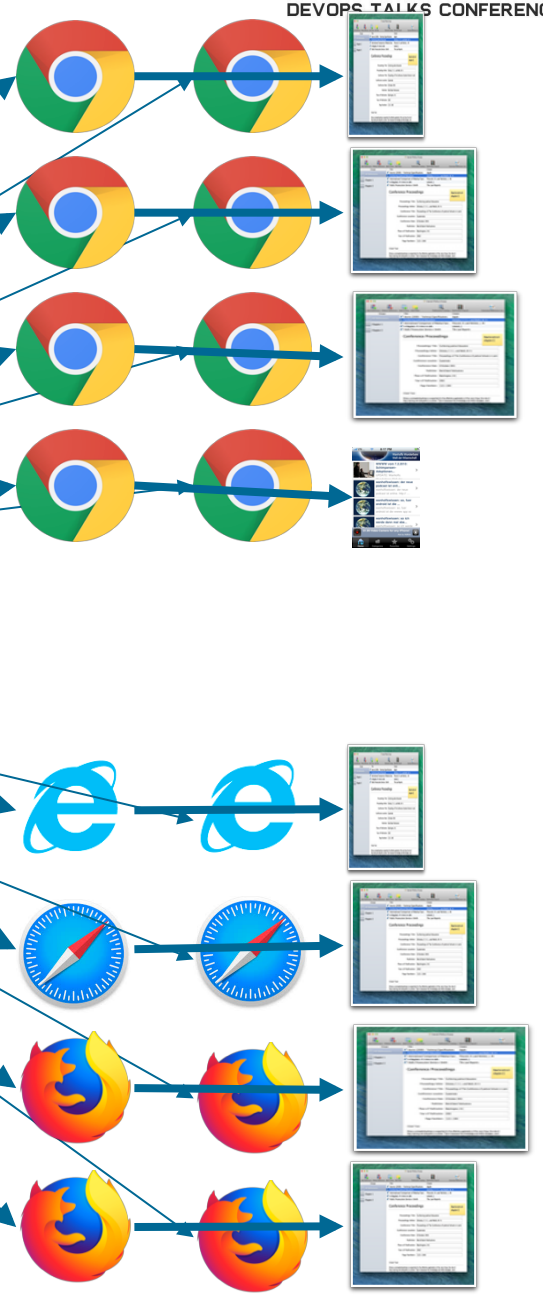
Click, click, click
checkScreenshot #1

Click, click, click
checkScreenshot #2

Click, click, click
checkScreenshot #3

Click, click, click
checkScreenshot #4





Screenshots!

How? DOM Snapshots!

Navigate

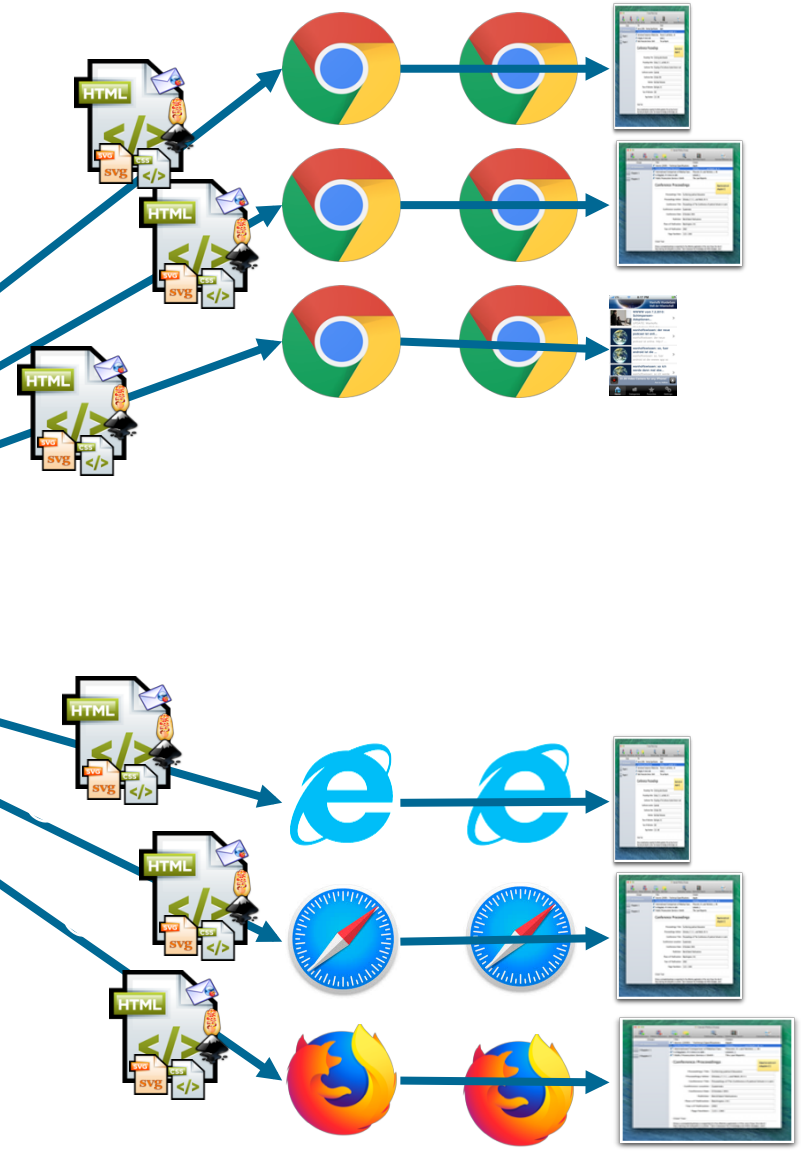
Click, click, click
checkScreenshot #1

Click, click, click
checkScreenshot #2

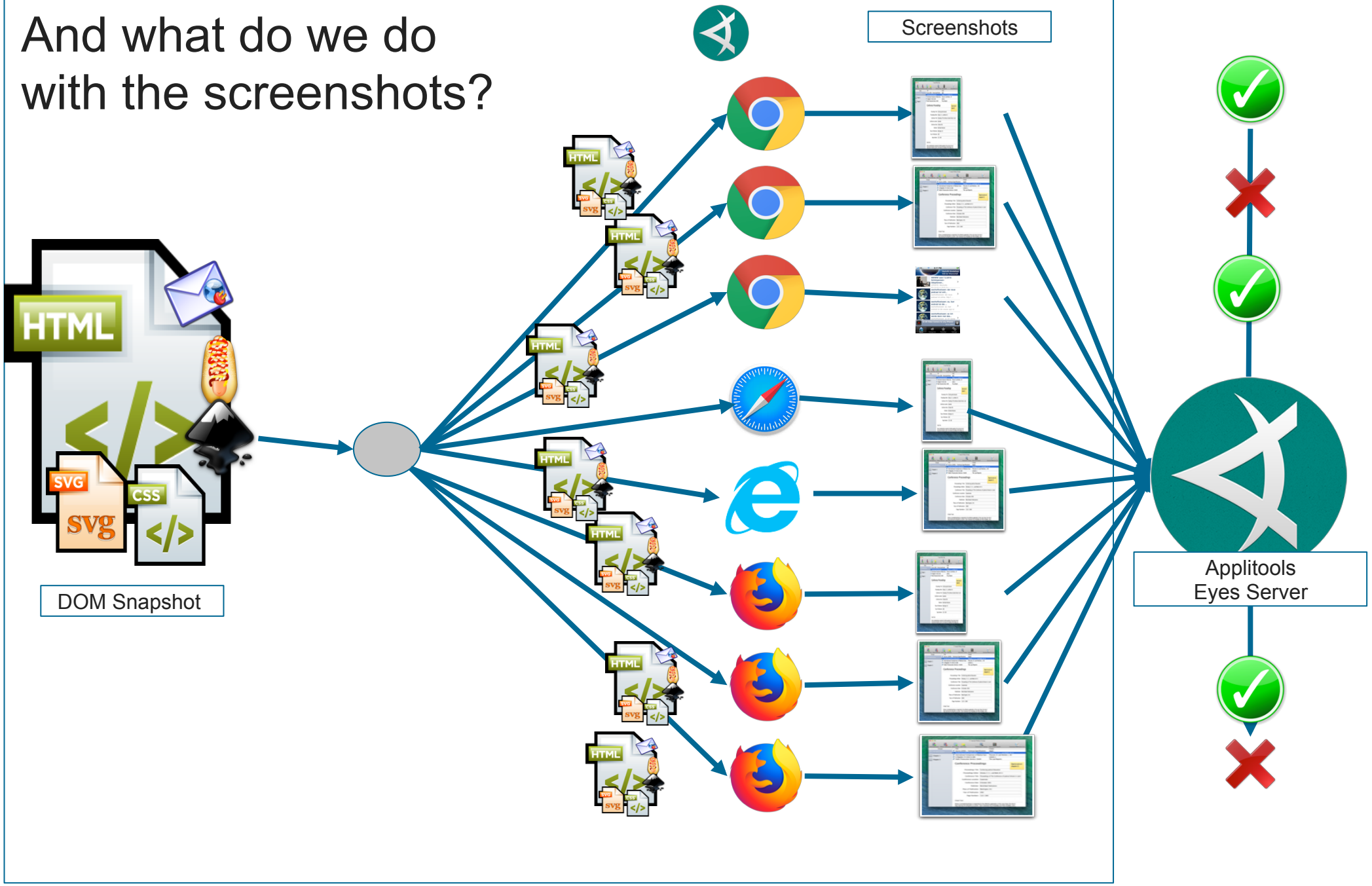
Click, click, click
checkScreenshot #3

Click, click, click
checkScreenshot #4

DOM Snapshot #1



And what do we do with the screenshots?



DOC
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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

OK, OK.
But how?

How do I write tests?

Show me some code!

One more thing...

Actually two ☺

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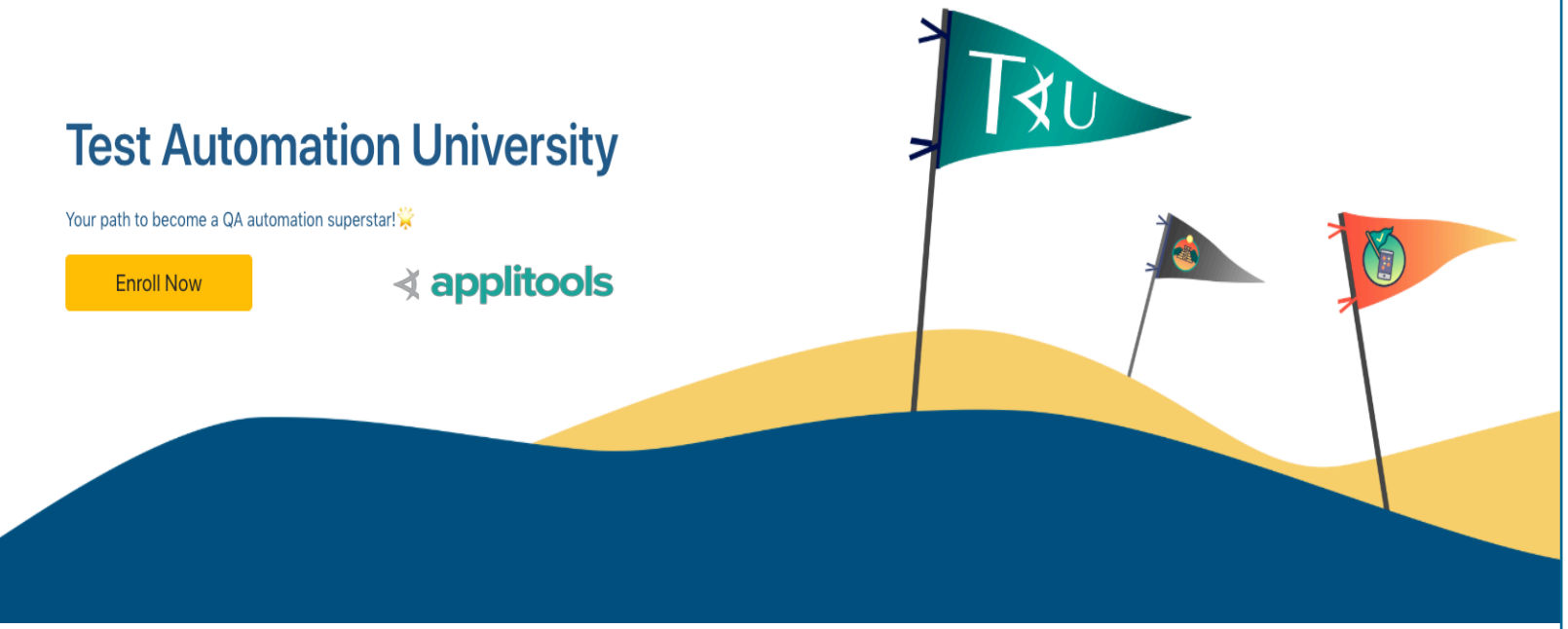
Applitools Test Automation University

Non profit initiative to help more engineers get into automation

Already trained over 11K engineers in 3 months



https://testautomationu.applitools.com/

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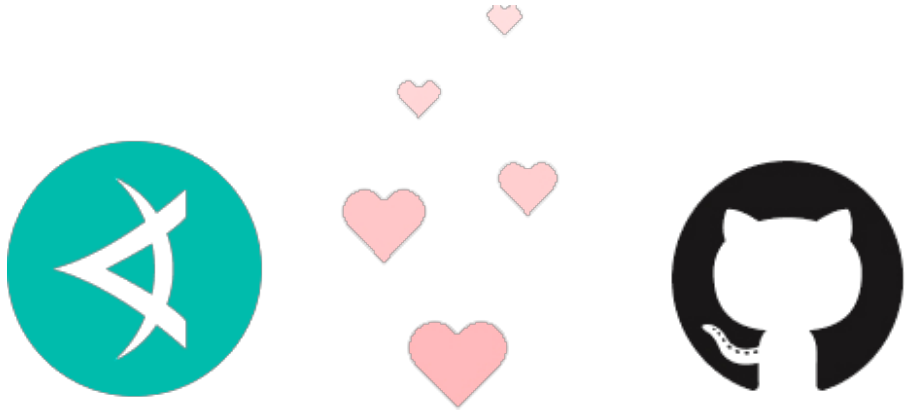
Open source projects get free access to Applitools*



Thank You

Stay in touch!

@MosheMilman