สยามชำนาญกิจ
SIAM CHAMNAN KIT

Mobile Automated Testing with Appium

Automated Testing

https://appium.io/docs/en/latest/

https://github.com/up1/course-appium-robotframework

Topics

Think about Test !!
Mobile testing strategies
Introduction to Appium
Working with **Android**, iOS and Flutter app
Write test cases
Tips and techniques

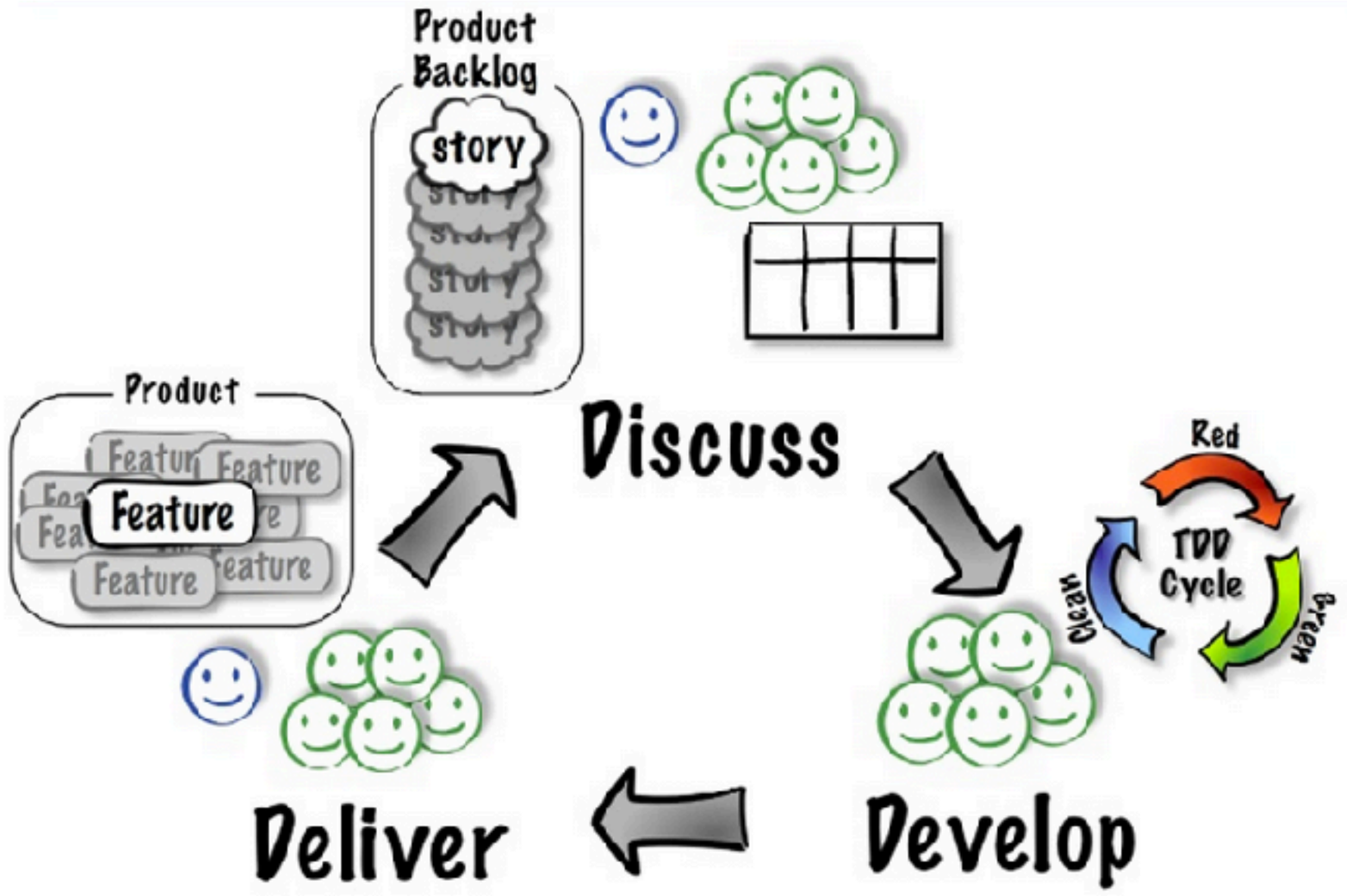
Test cases with Appium

Java
.NET C#
JavaScript
Python

Robotframework + AppiumLibrary

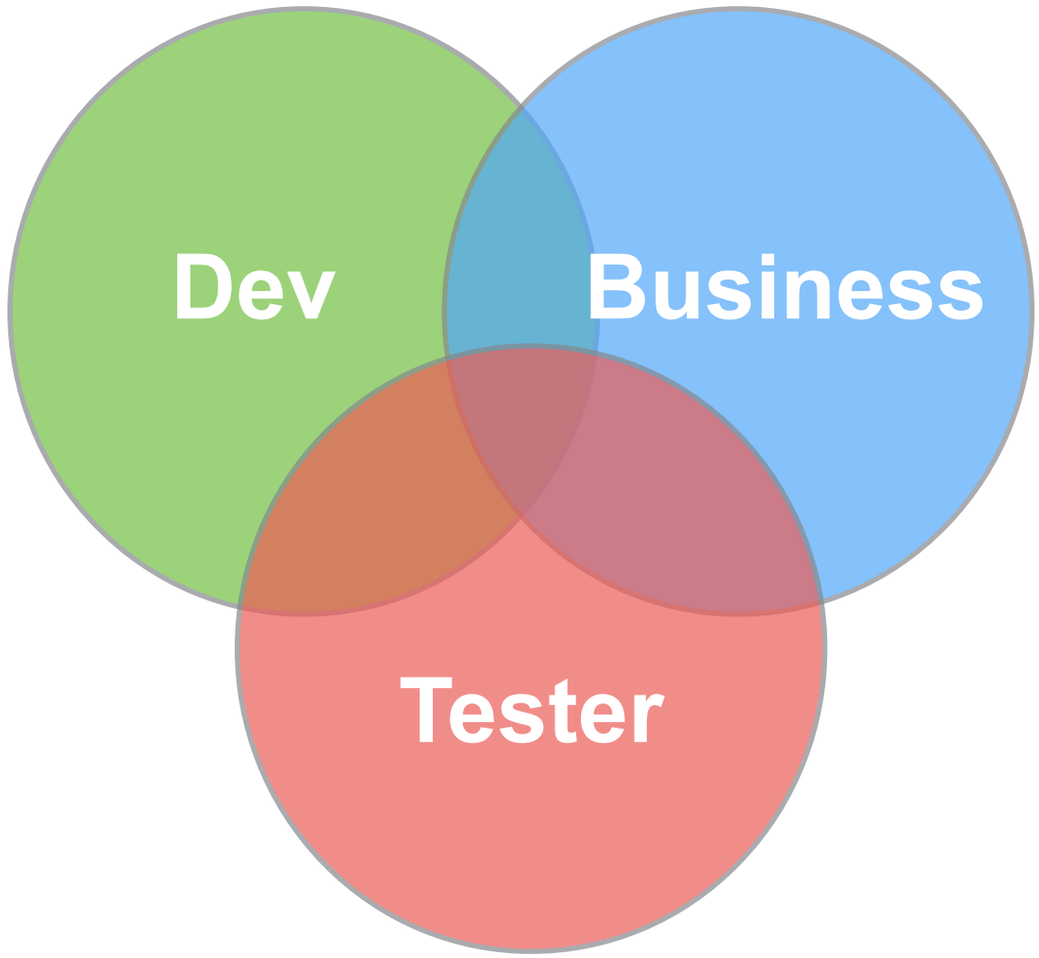
THINK before coding

Acceptance Test-Driven Development



(Model developed with Pekka Klärck, Bas Vodde, and Craig Larman.)

Acceptance Test-Driven Development



Acceptance Tests

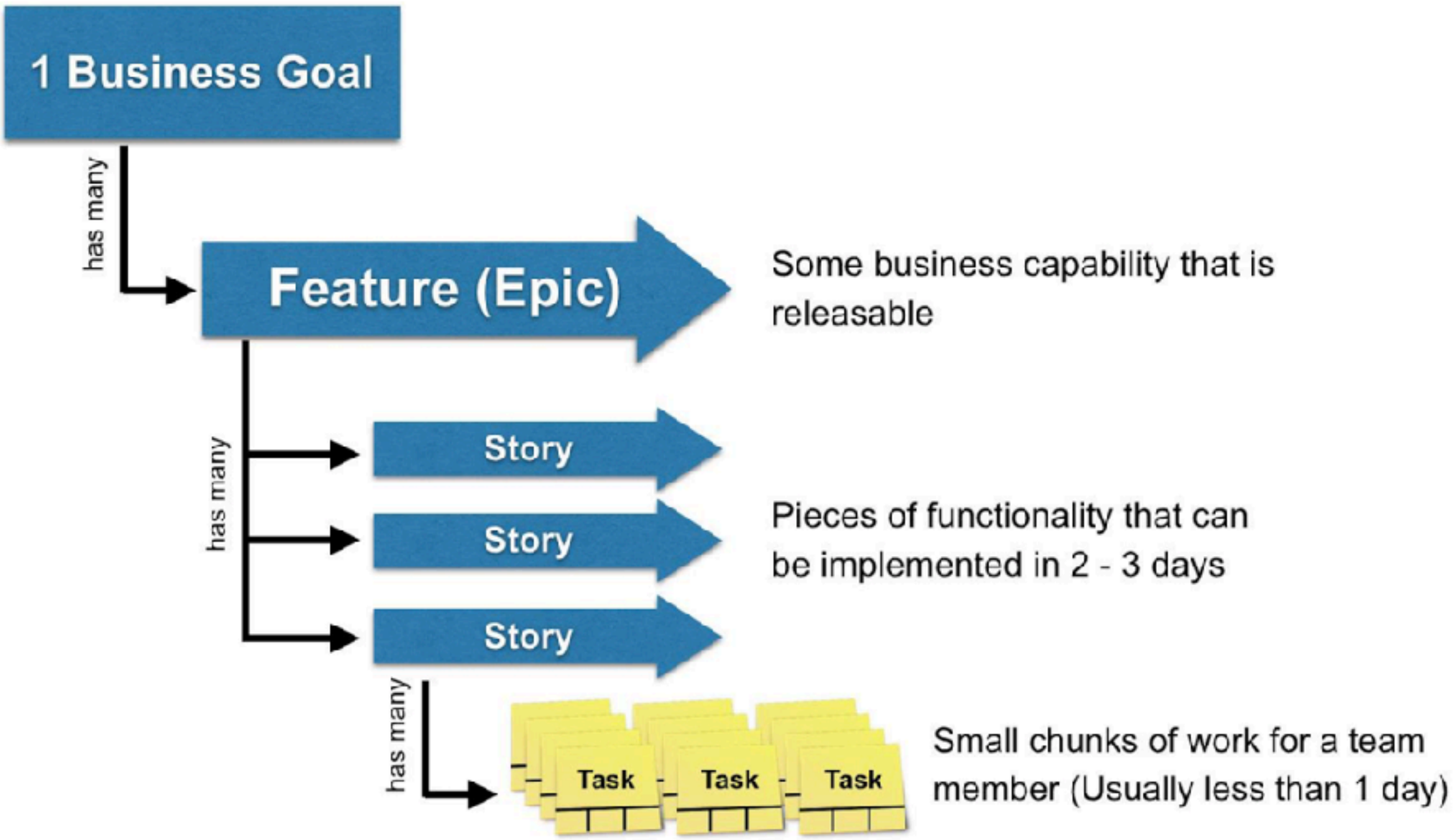
=

Business Criteria

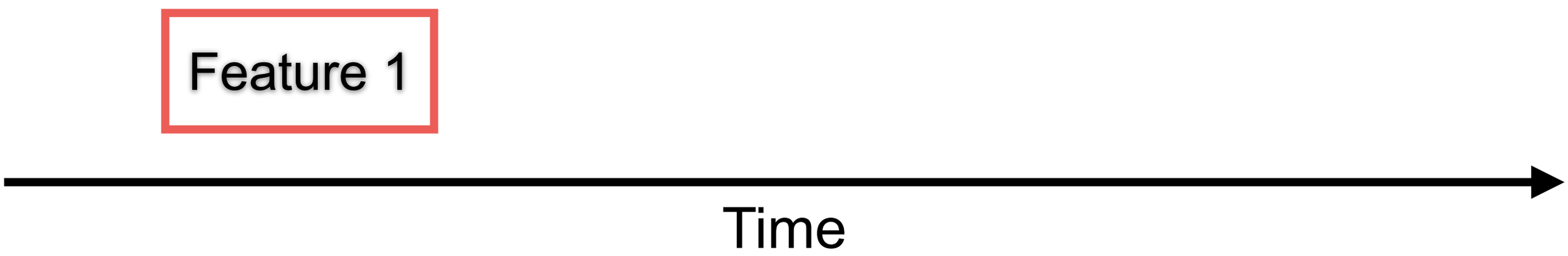
+

Examples (data)

Work break down

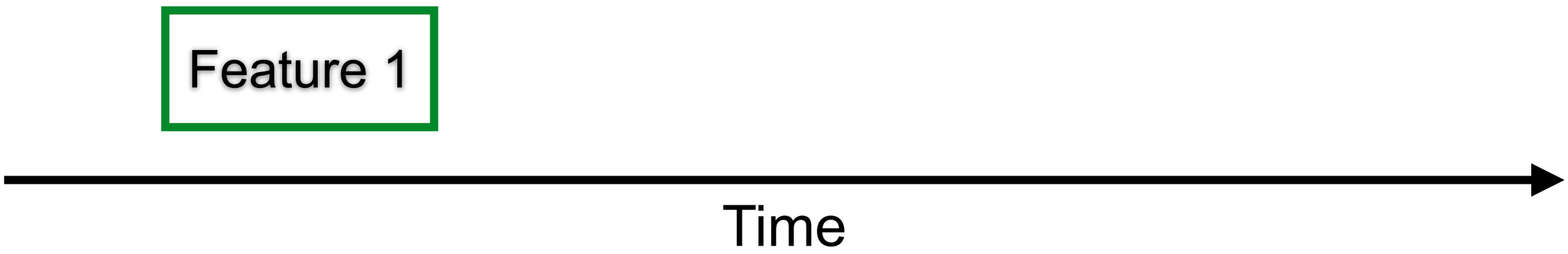


Iterative and incremental process



Iterative and incremental process

Done = coded and tested



Iterative and incremental process

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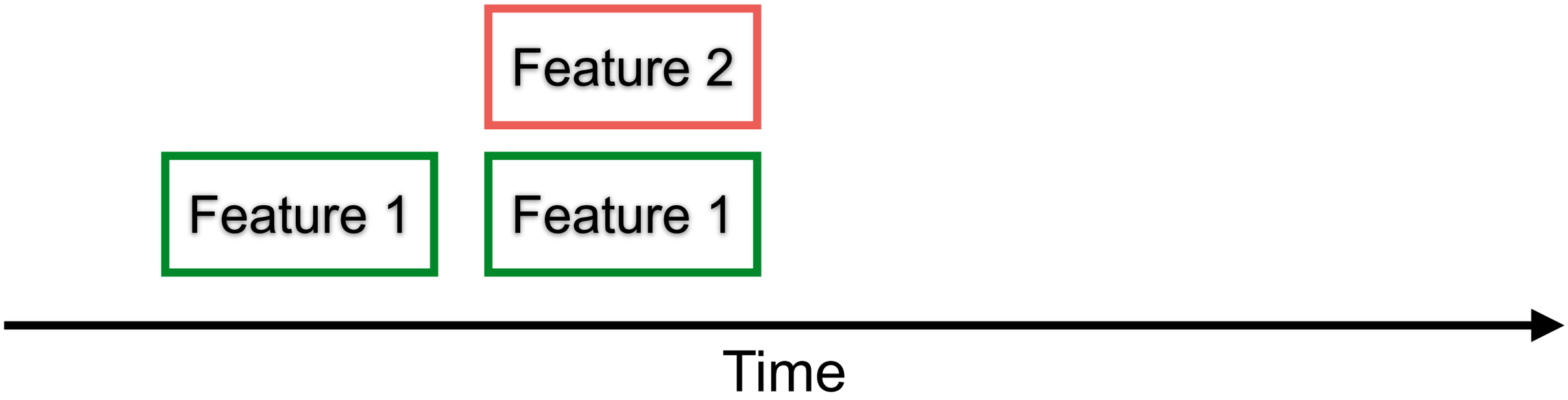
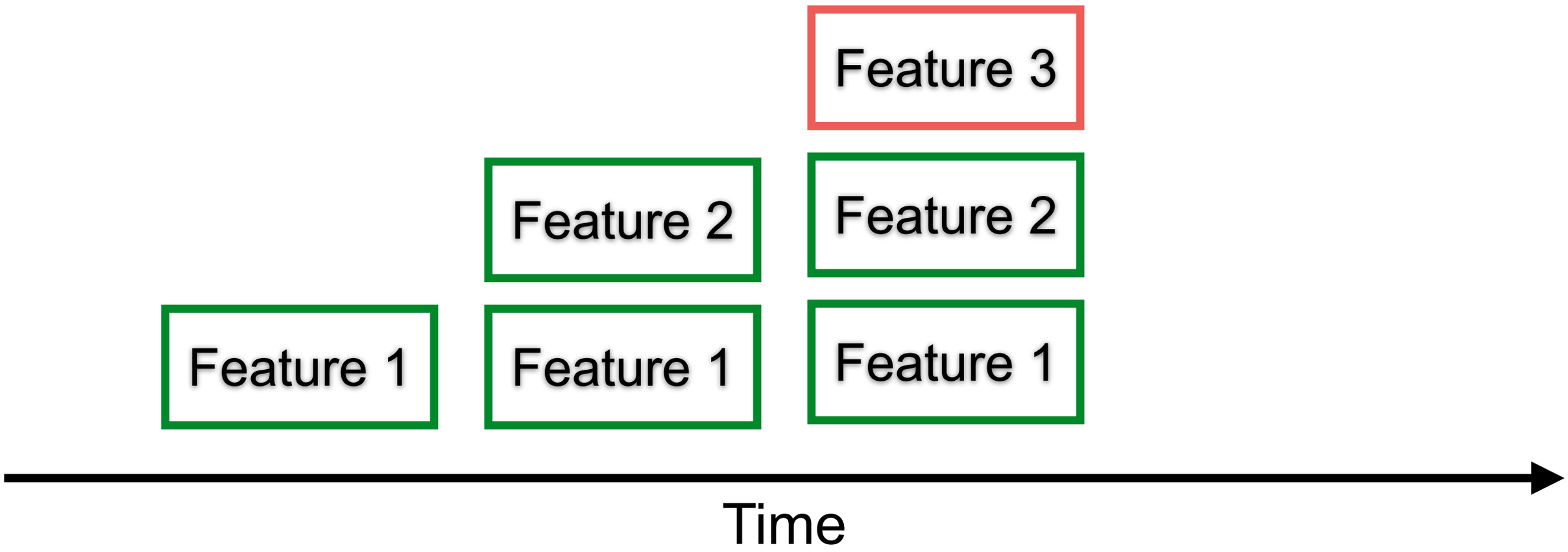


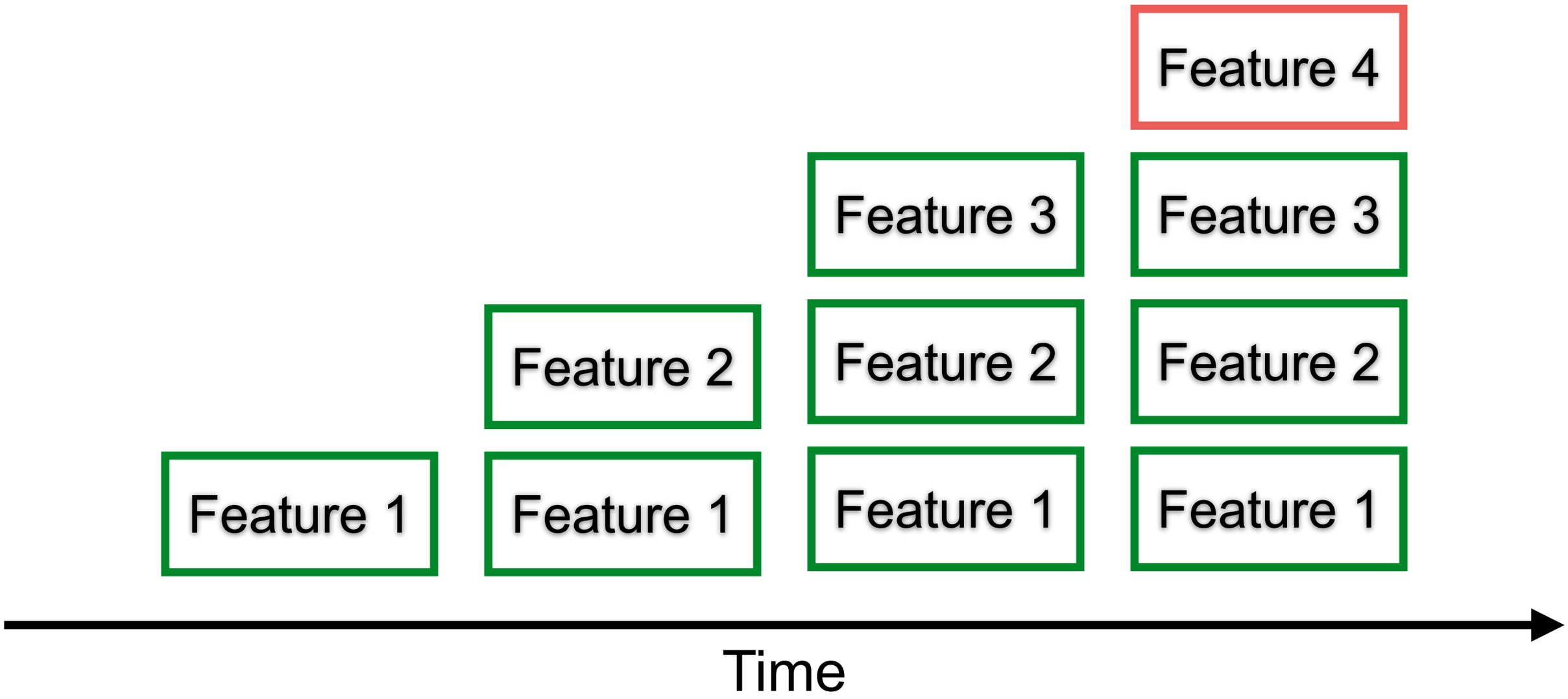
Iterative and incremental process

Done = coded and tested



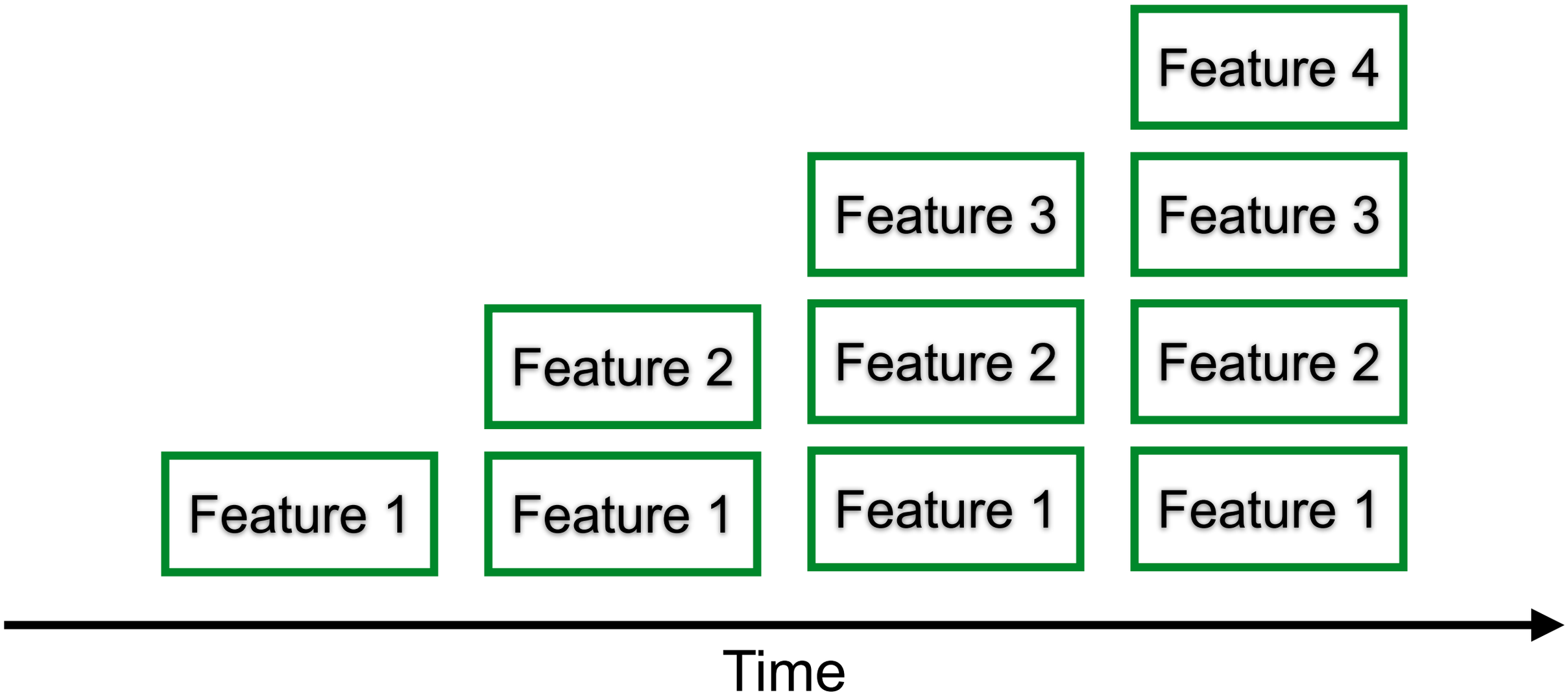
Iterative and incremental process

Done = coded and tested



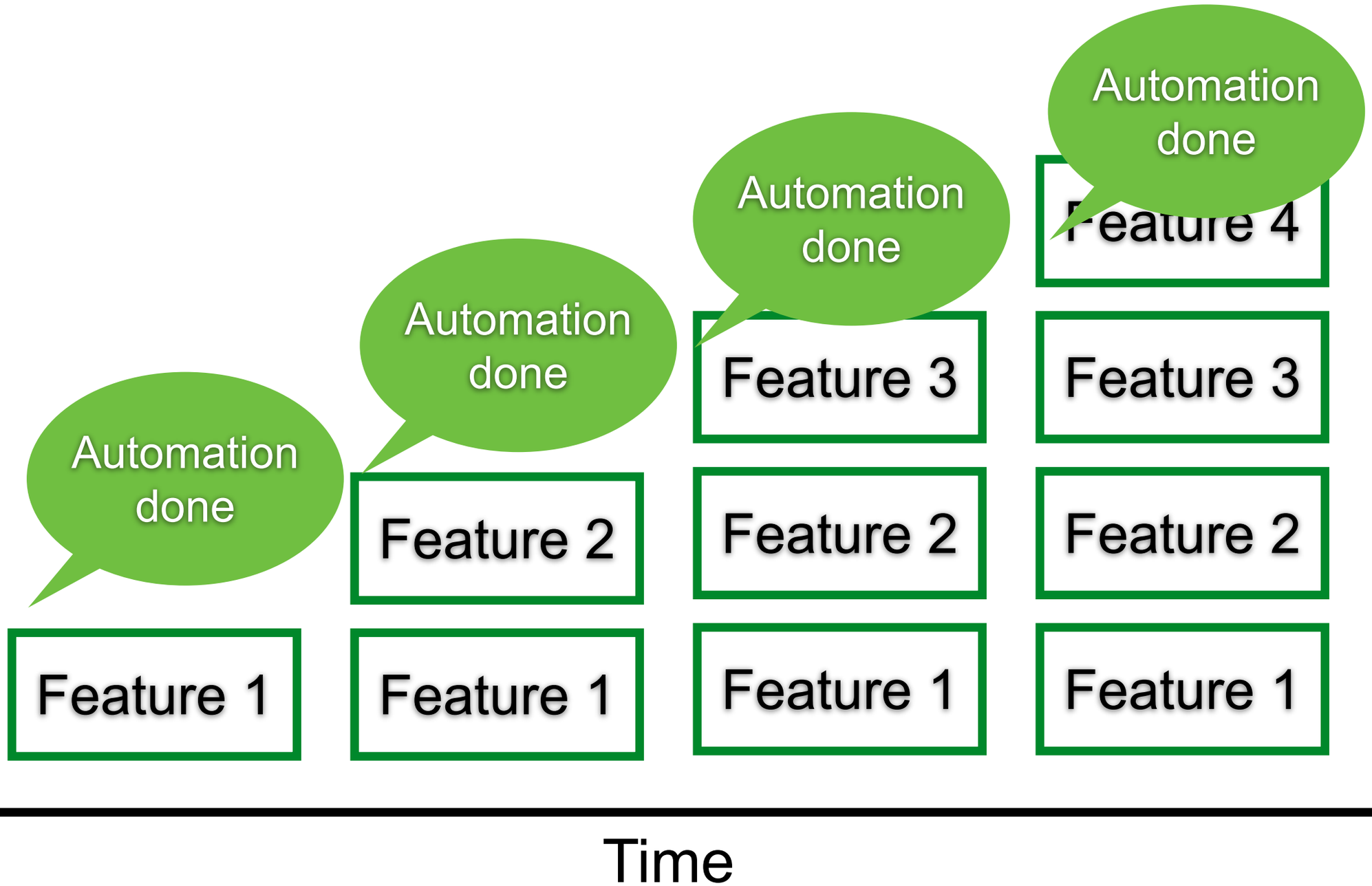
Iterative and incremental process

Done = coded and tested



Iterative and incremental process

Done = coded and tested



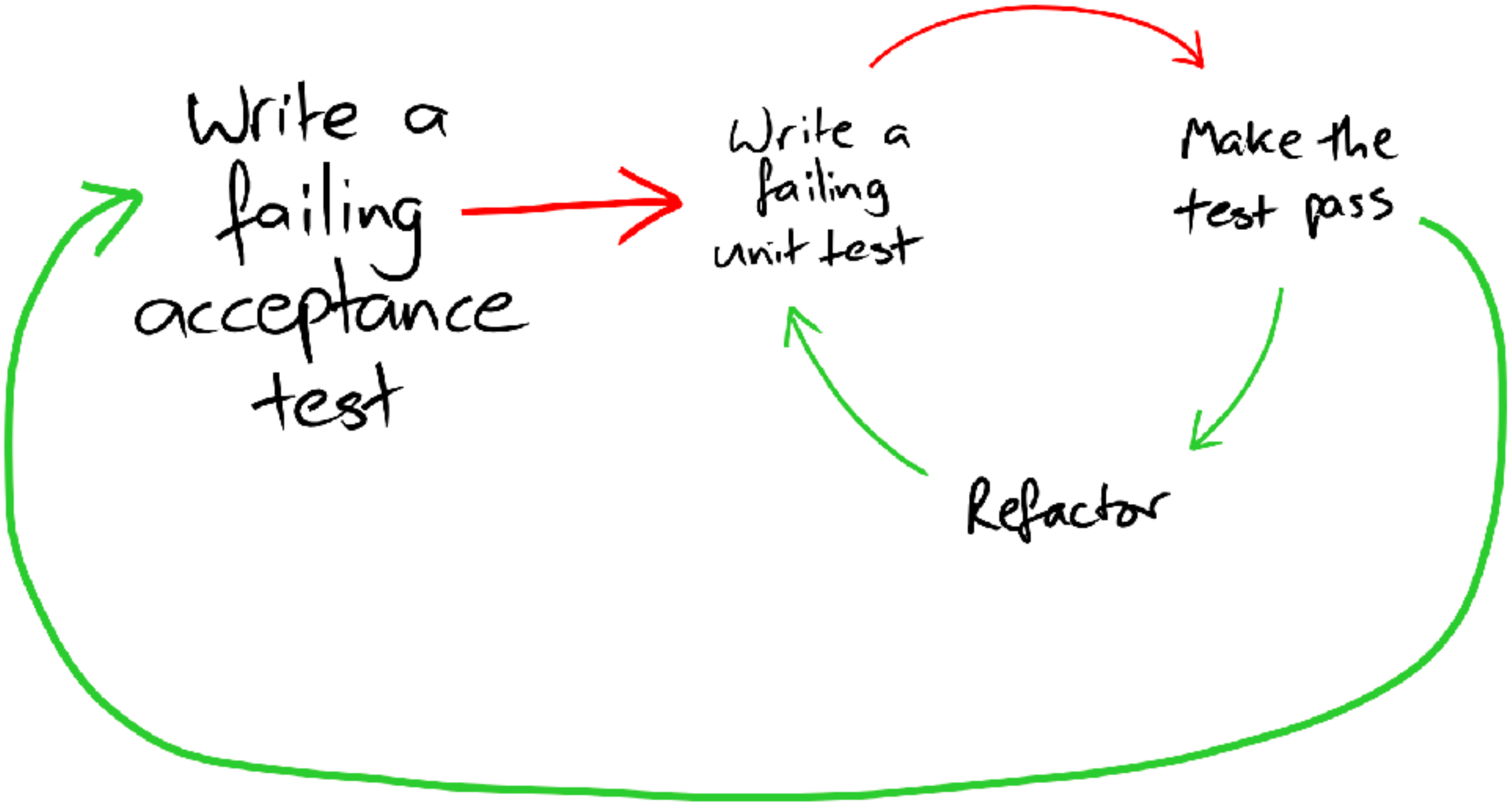
Automation feedback

Easier over time ?
Time spent on maintenance ?
Test find regression bugs ?

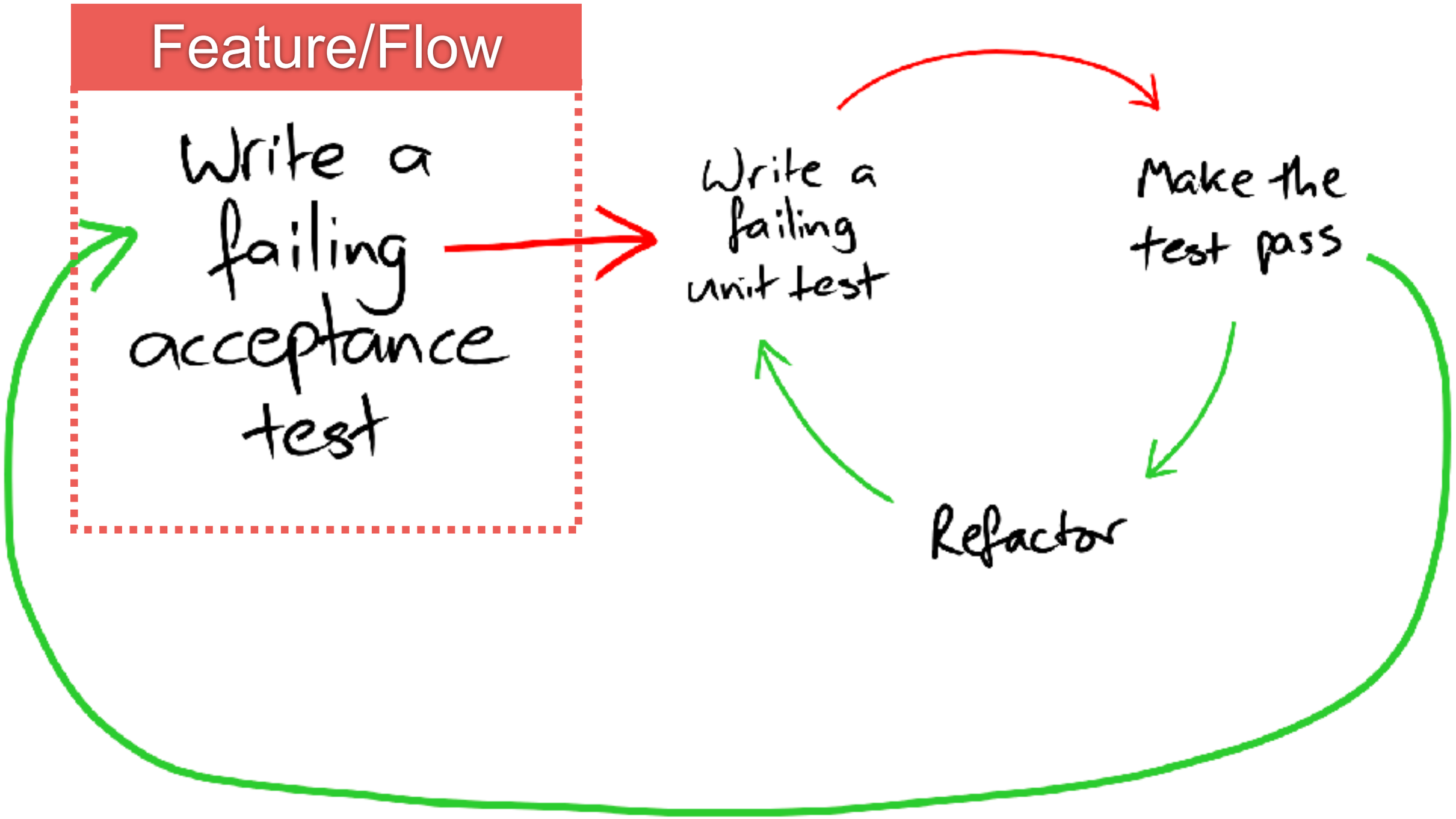
Start with simple

Use feedback to improve

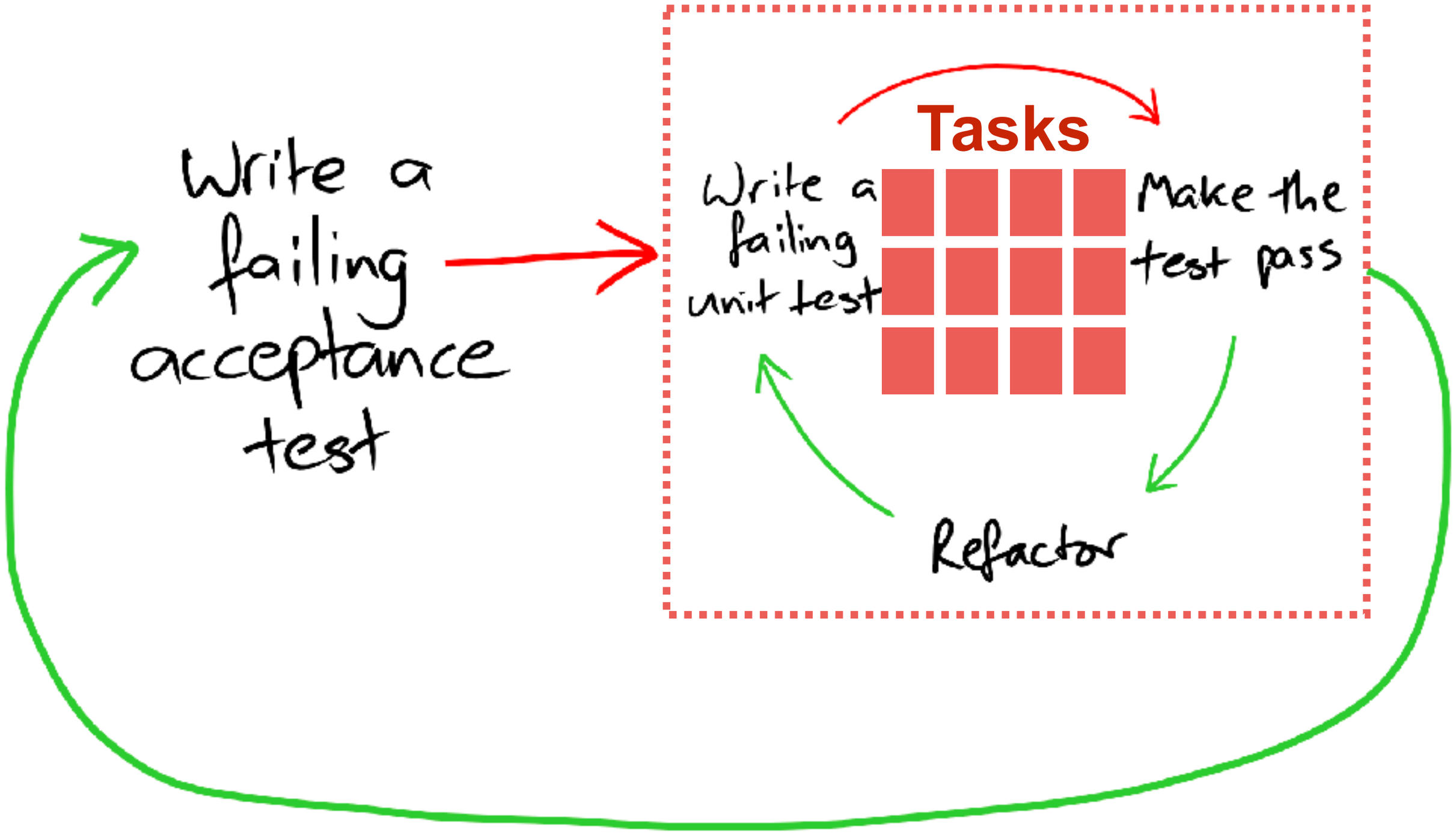
Outside-in develop/test



Outside-in develop/test

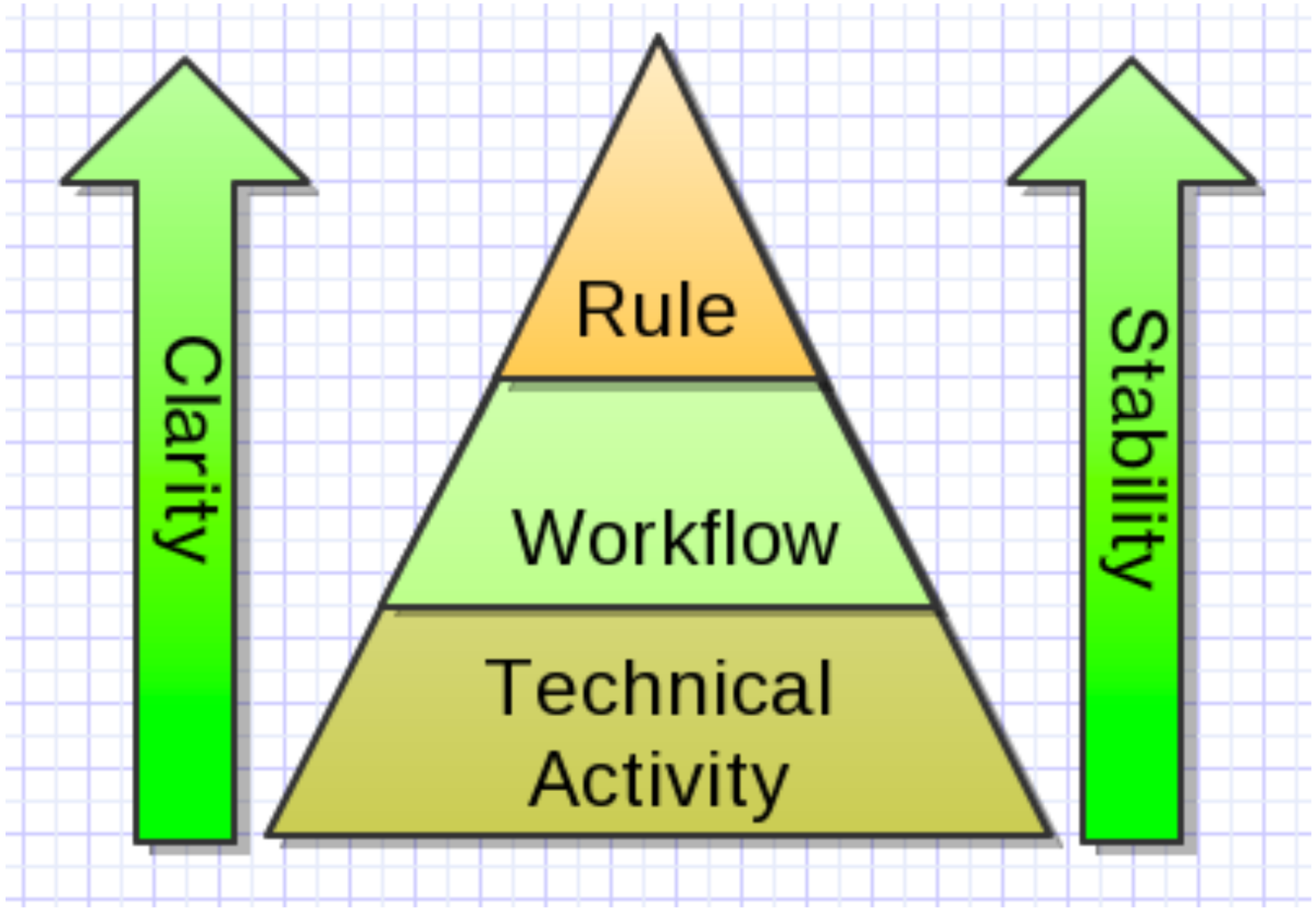


Outside-in develop/test



UI Test Automation

3 levels of UI test automation



3 levels of UI test automation

Business rule/functionality level

what is this test demonstrating or exercising

User interface workflow level

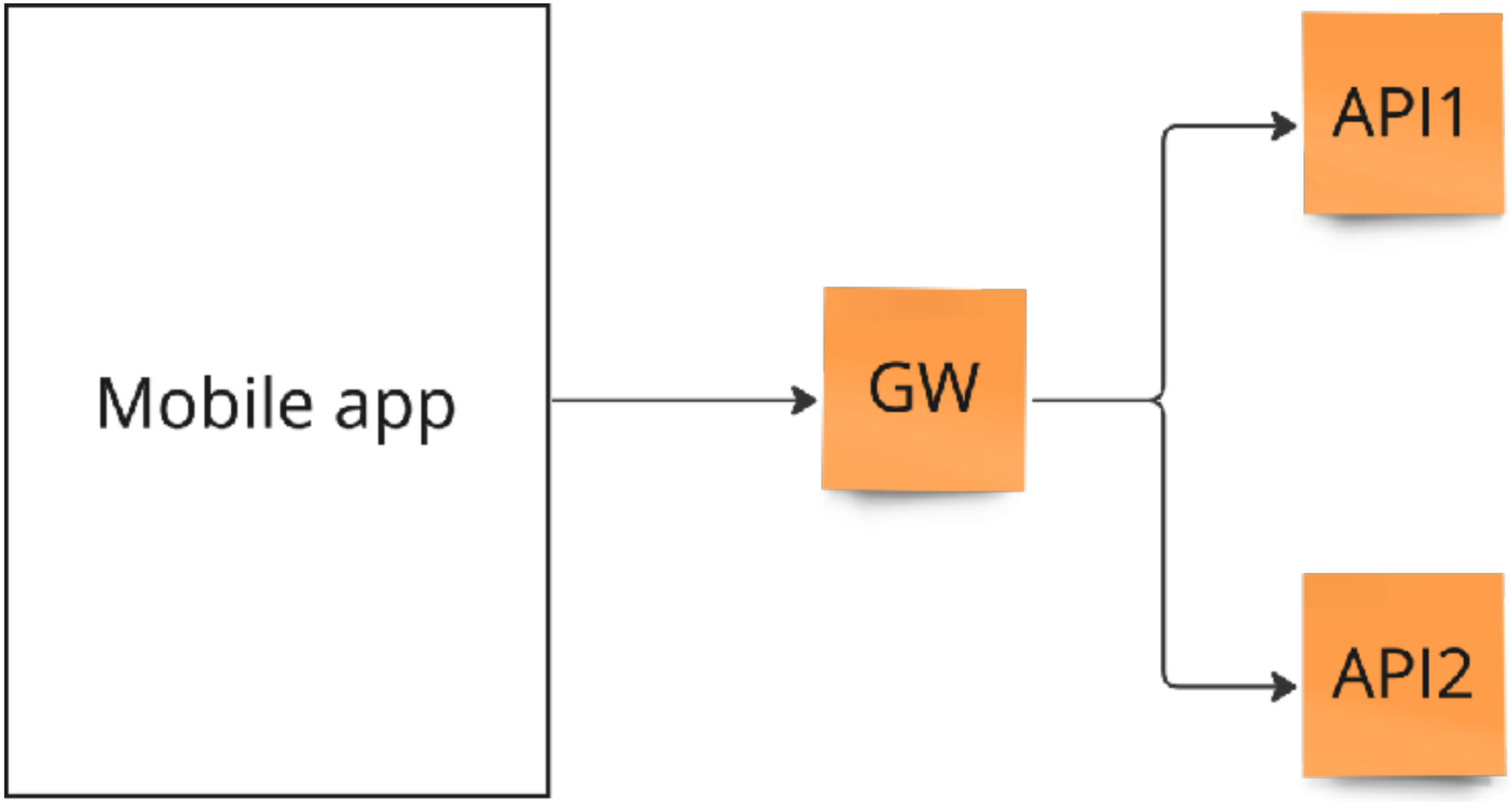
what does a user have to do to exercise the functionality through the UI

Technical activity level

what are the technical steps required to exercise the functionality

Architecture of Mobile App ?

Architecture of System

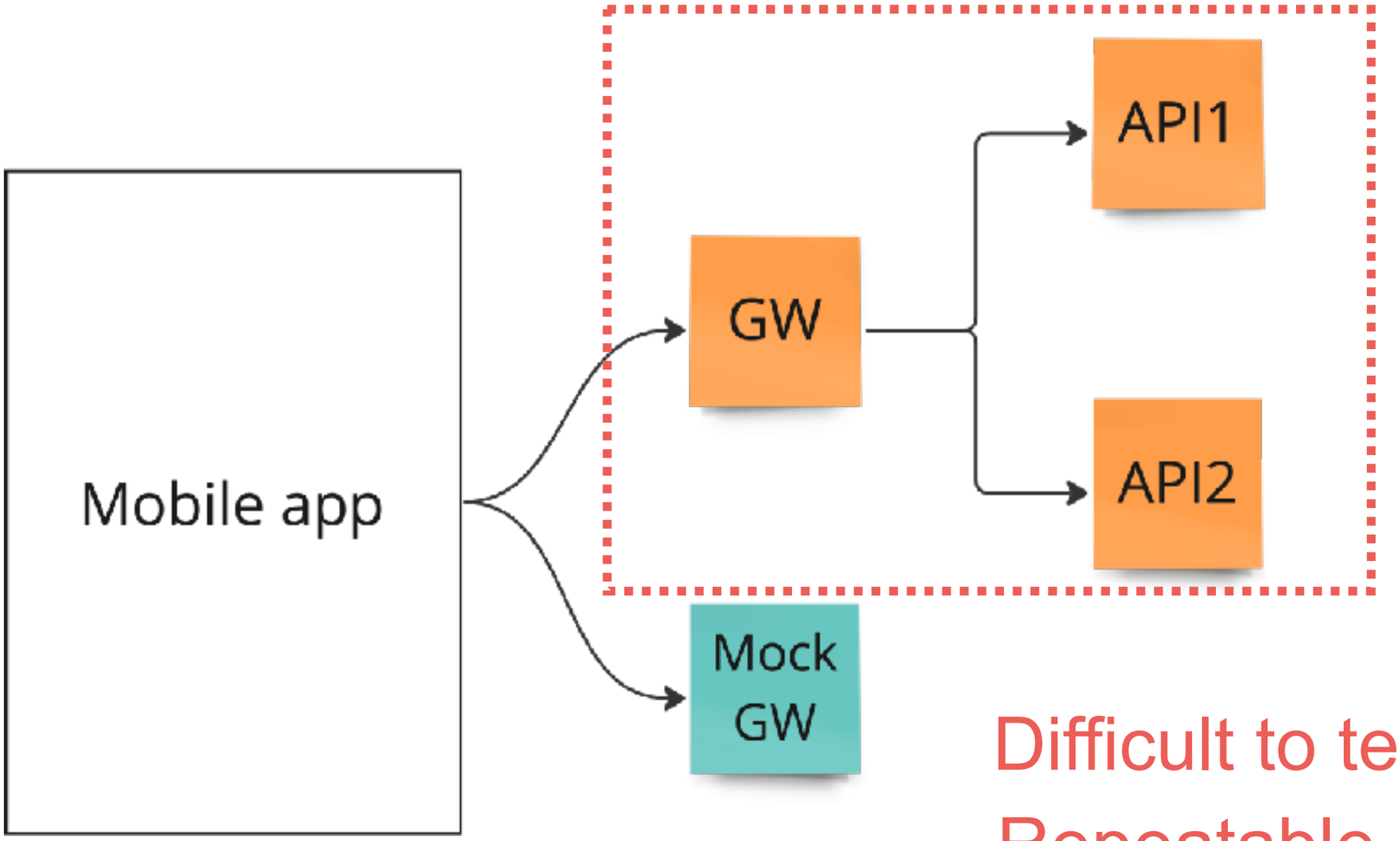


Test strategy ?

Good Tests ?

Fast
Isolate
Repeatable
Self-verify
Timely and Through
Understandable

Integration Testing

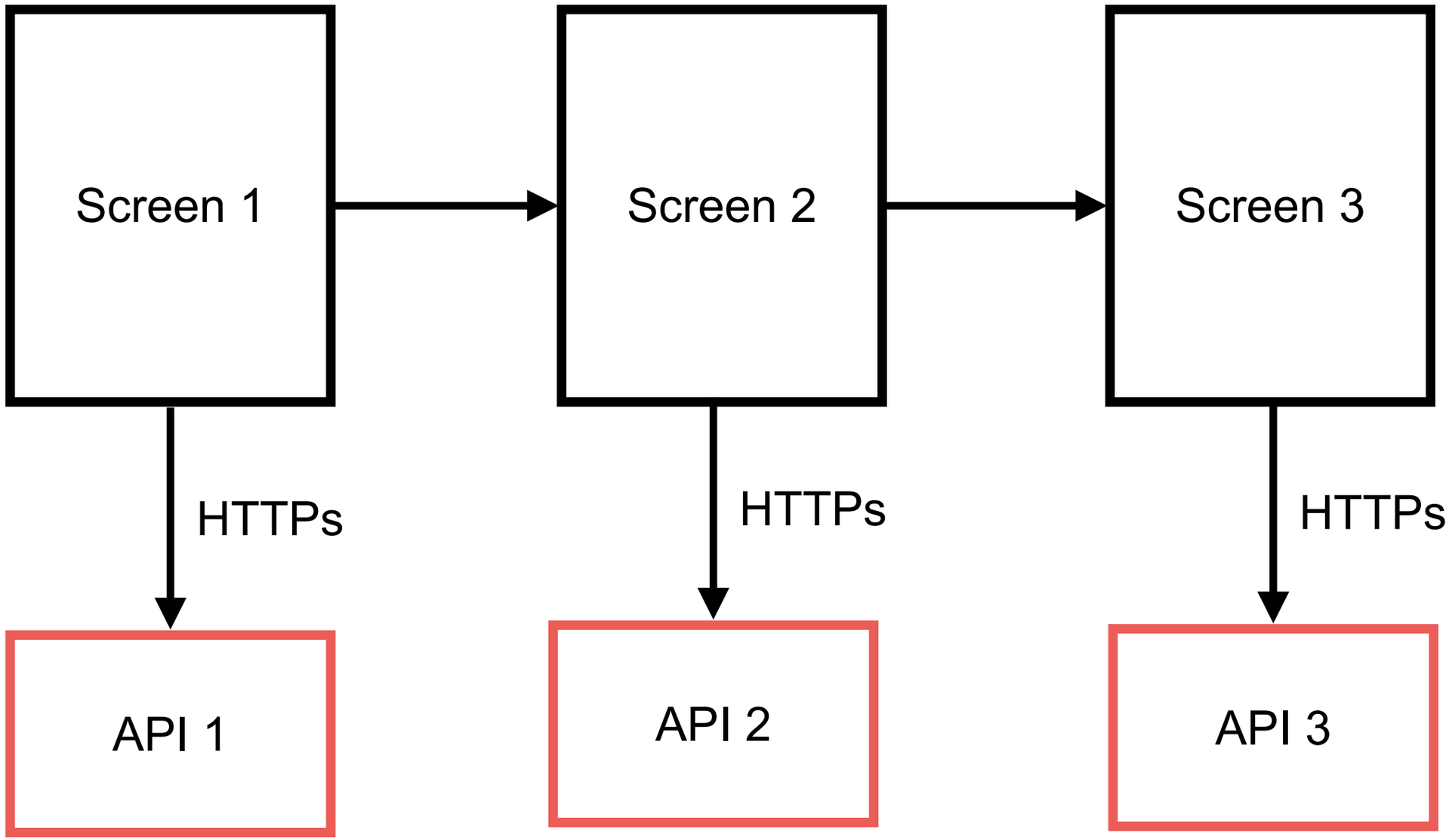


Difficult to test

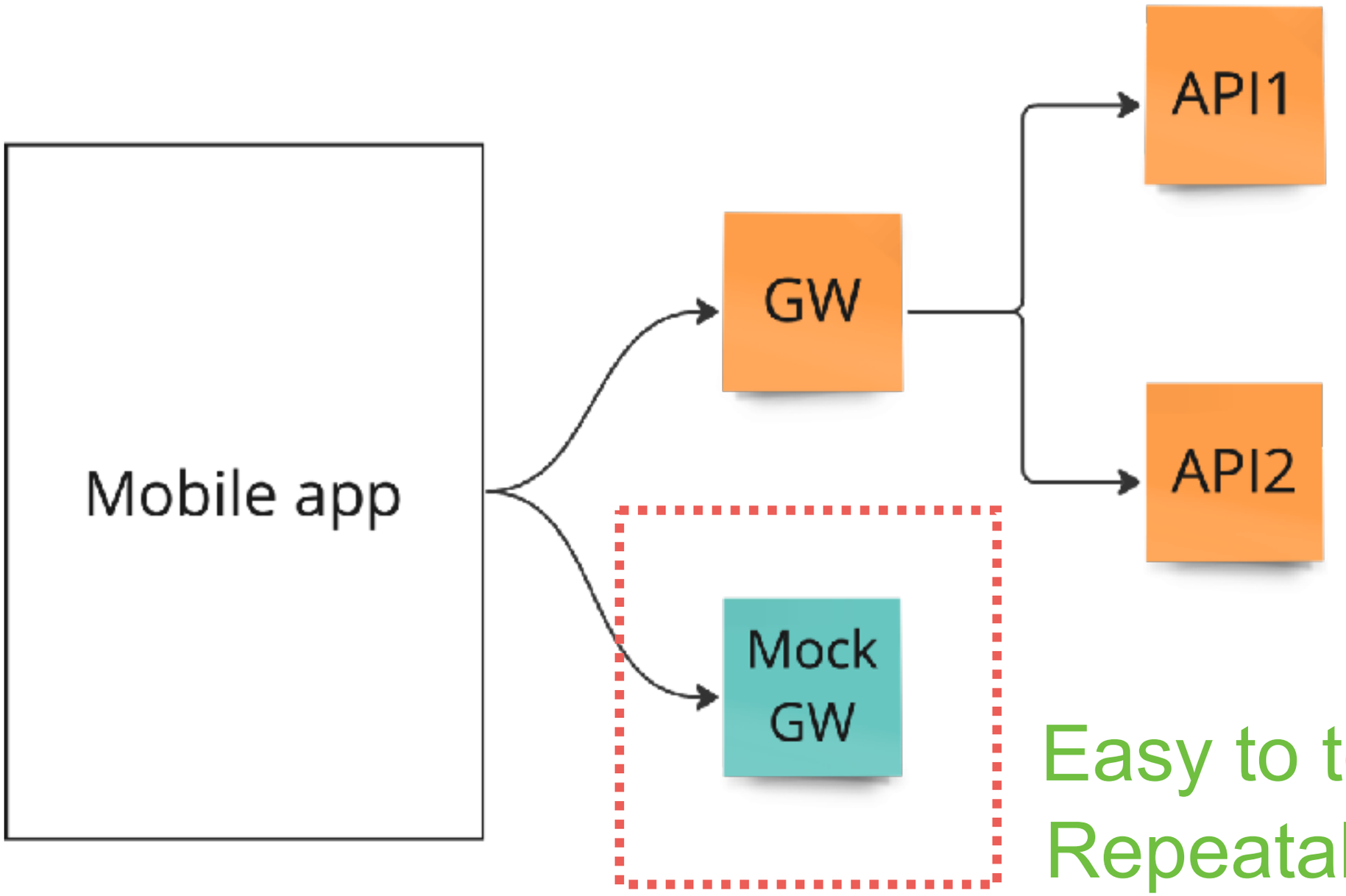
~~Repeatable~~

~~Reliable~~

Integration Testing



Component Testing



Easy to test
Repeatable
Reliable

Mock Server (HTTPs)

Stubby4Node

https://github.com/mrak/stubby4node

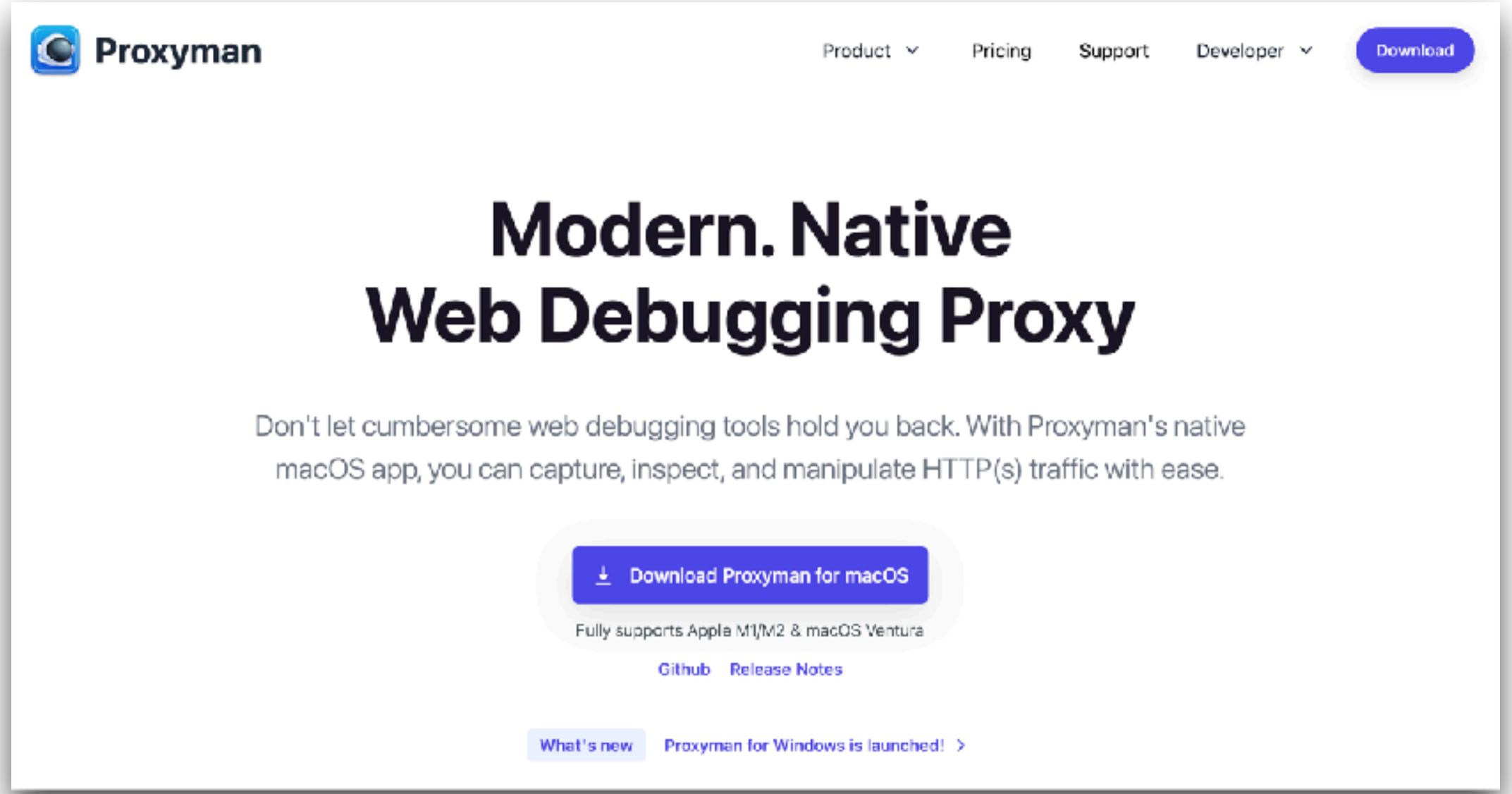
MountBank

https://www.mbtest.org/

WireMock

https://wiremock.org/

Capture traffic from Mobile app



https://proxyman.io/

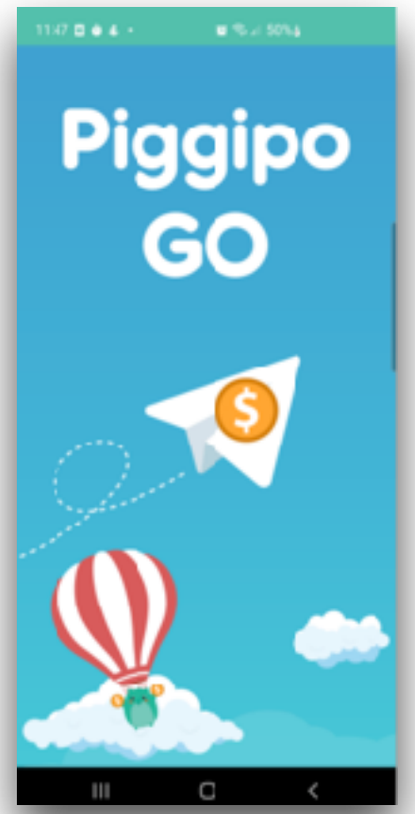
Encryption Data !!

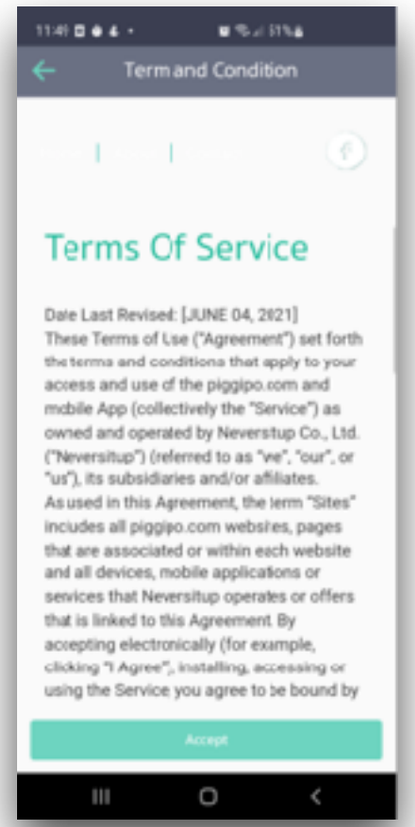
Manage App’s States

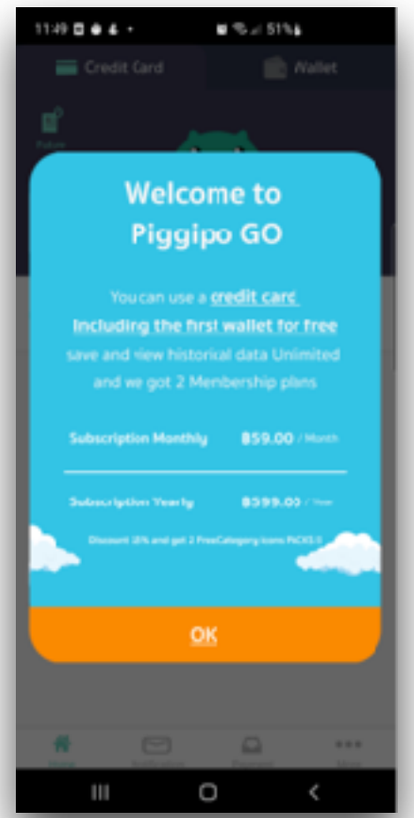
Manage App's States

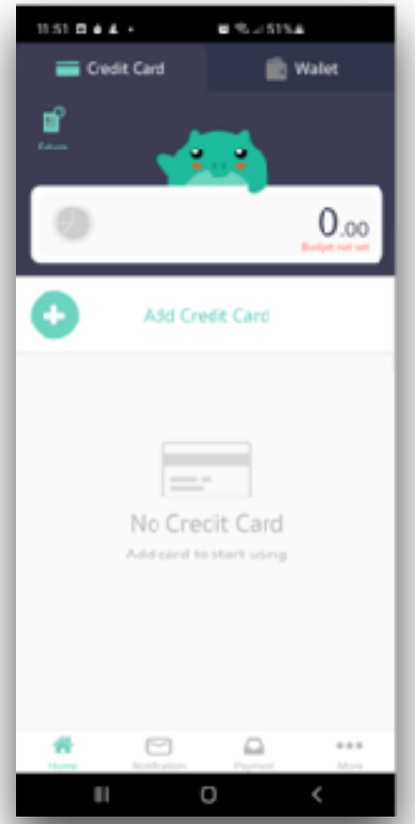
Easy for test
Reduce test steps

Manage App’s States

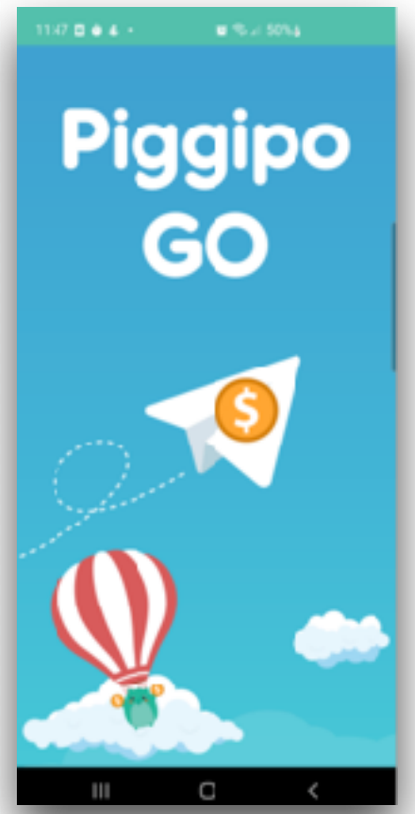


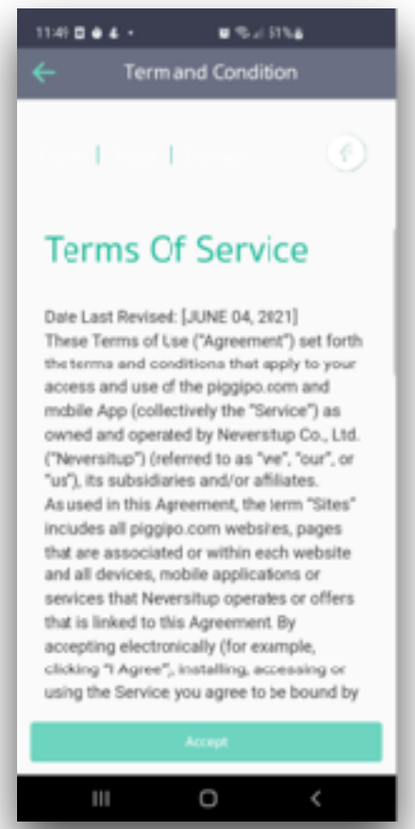


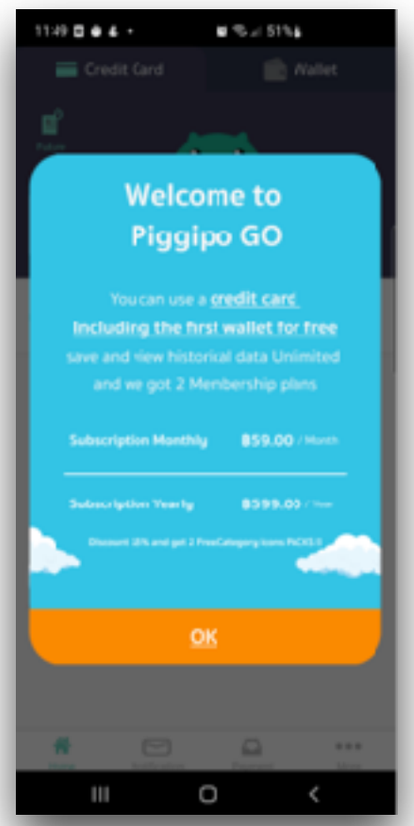


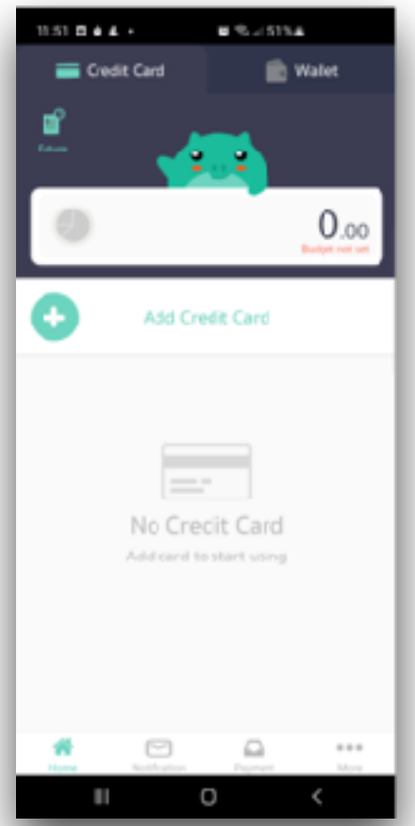


Manage App’s States





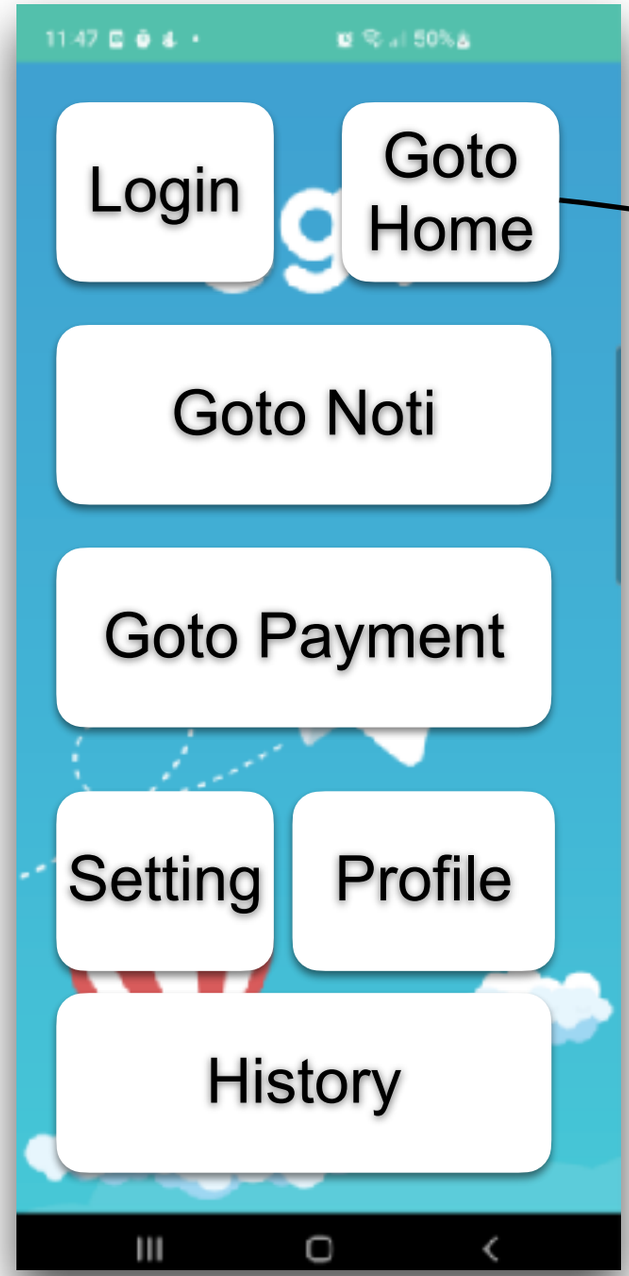


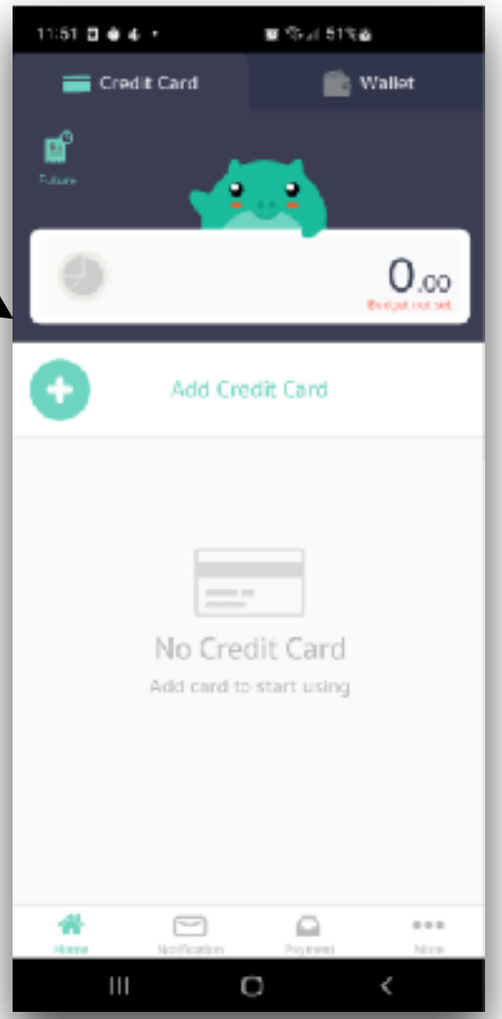


Manage App's States

Use only in test build of the app
Screen with on-click link to all area of app
Link can even populate data

Manage App's States





State vs. Assertions

State vs. Assertions

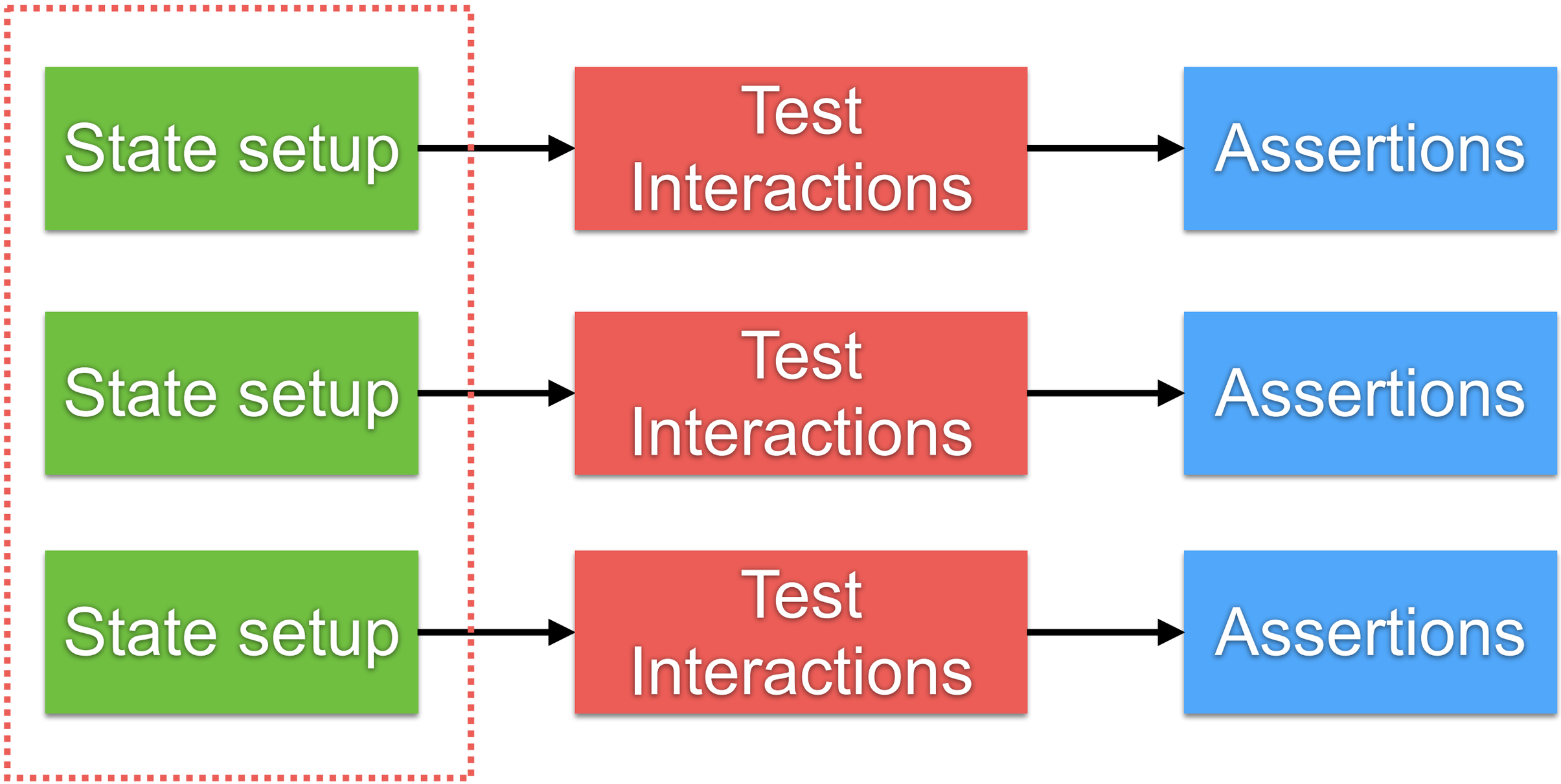
Create account and login

Add item to cart

Check cart quantity

State vs. Assertions

Not too much time !!



Make it Work

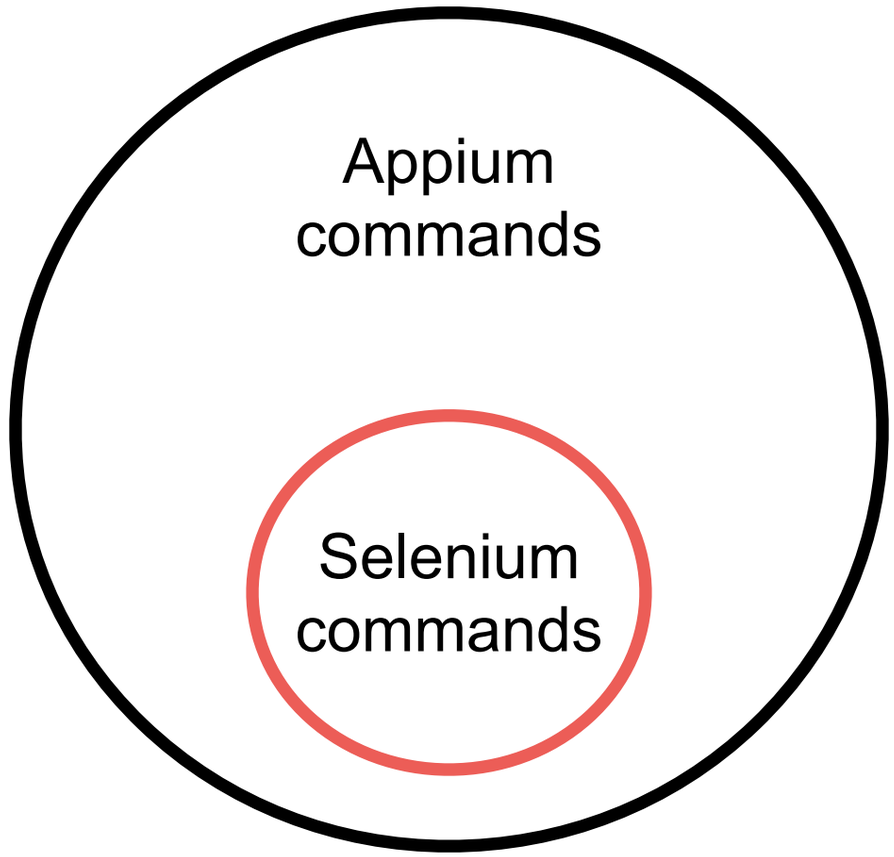
Make it Right

Test-First
Test-Last
Test-Later

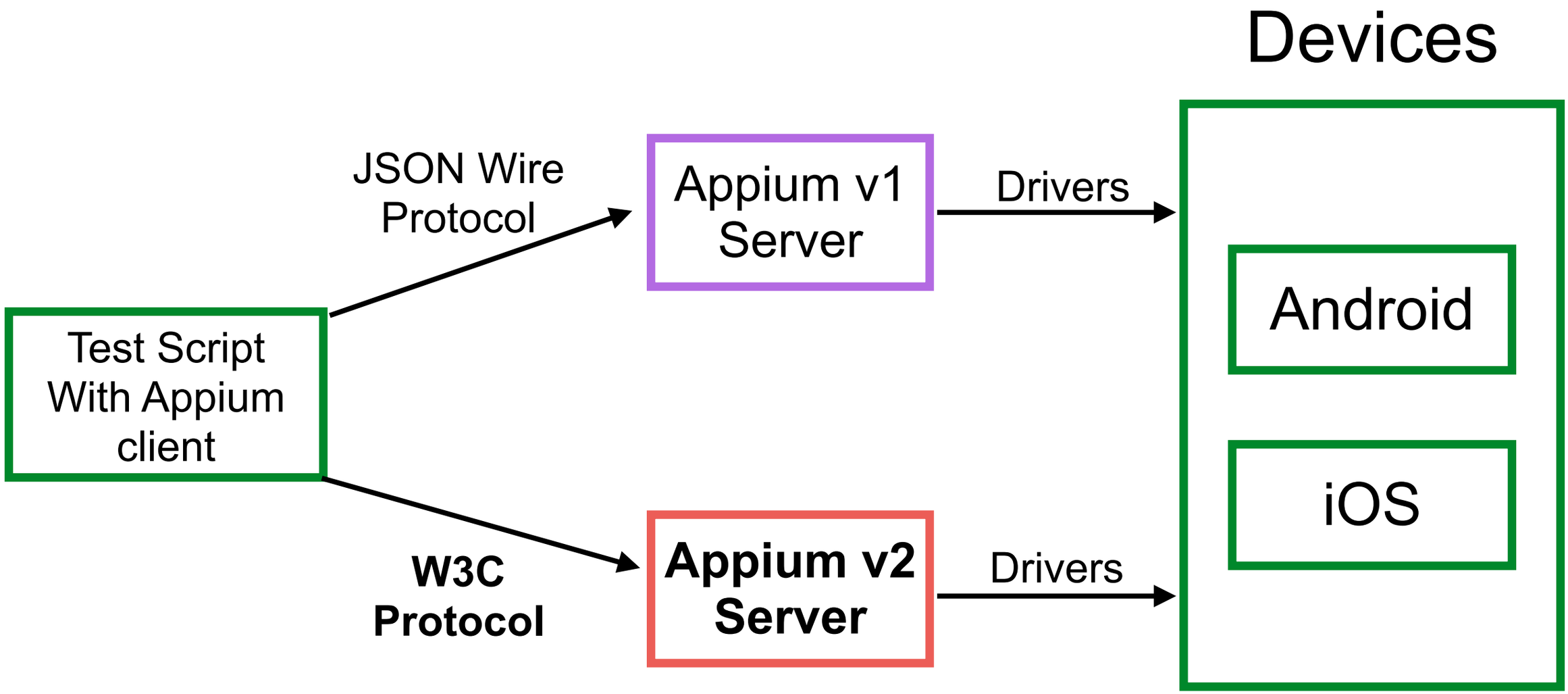
Let’ start with Appium

Appium

Automation tool for mobile app
Selenium for mobile
High compatibility with selenium



Architecture



Appium Tools

Appium Server via npm

Appium Server GUI/Desktop (deprecated)

Appium Inspector

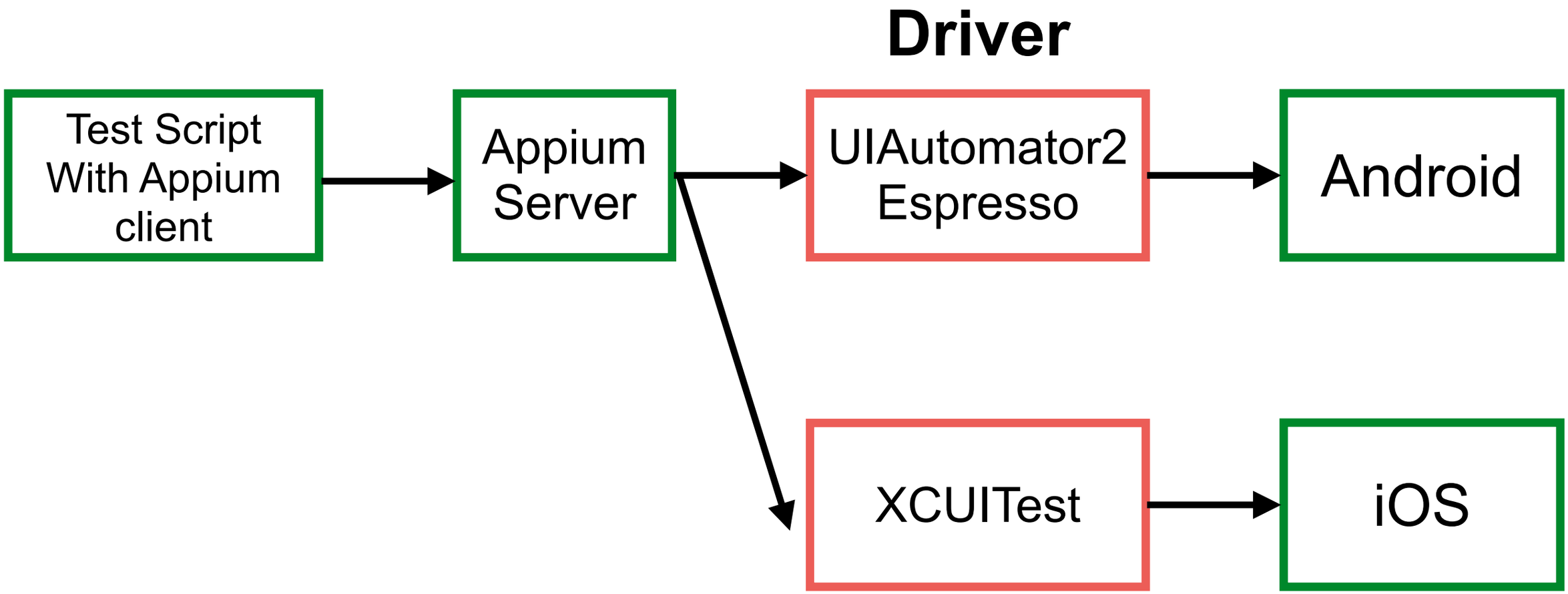
http://appium.io/docs/en/about-appium/getting-started/?lang=en#installing-appium

Appium Clients

Ruby
Python
Java
C#
Robotframework + Appium Library

http://appium.io/docs/en/about-appium/appium-clients/index.html

Appium Drivers and Plug-in



Appium Drivers

$appium driver install <installation key>

Driver	Installation Key	Platform(s)	Mode(s)
Chromium	`chromium`	macOS, Windows, Linux	Web
Espresso	`espresso`	Android	Native
Gecko	`gecko`	macOS, Windows, Linux, Android	Web
Mac2	`mac2`	macOS	Native
Safari	`safari`	macOS, iOS	Web
UiAutomator2	`uiautomator2`	Android	Native, Hybrid, Web
Windows	`windows`	Windows	Native
XCUITest	`xcuitest`	iOS	Native, Hybrid, Web

https://appium.io/docs/en/latest/ecosystem/drivers/

Appium Plugins

Extend or modify Appium’s behavior

Official Plugins

These plugins are are currently maintained by the Appium team:

Plugin	Installation Key	Description
Execute Driver	`execute-driver`	Run entire batches of commands in a single call to the Appium server
Images	`images`	Image matching and comparison features
Relaxed Caps	`relaxed-caps`	Relax Appium's requirement for vendor prefixes on capabilities
Universal XML	`universal-xml`	Instead of the standard XML format for iOS and Android, use an XML definition that is the same across both platforms

https://appium.io/docs/en/latest/ecosystem/plugins/

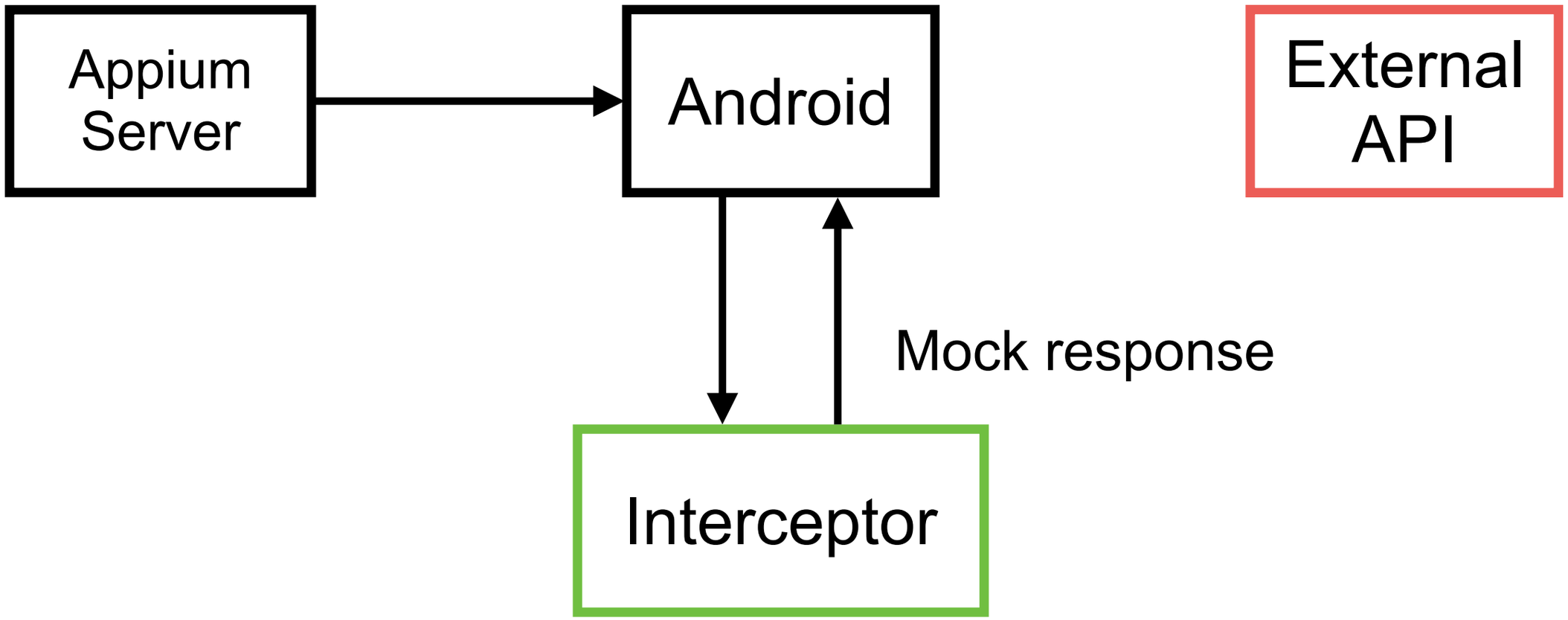
Appium Interceptor Plugins

Intercept API response and mocking
Supported Android

https://github.com/AppiumTestDistribution/appium-interceptor-plugin

Appium Interceptor Plugins

$appium plugin install --source=npm appium-interceptor



https://github.com/AppiumTestDistribution/appium-interceptor-plugin

Drivers in workshop

Android

UIAutomator2

iOS

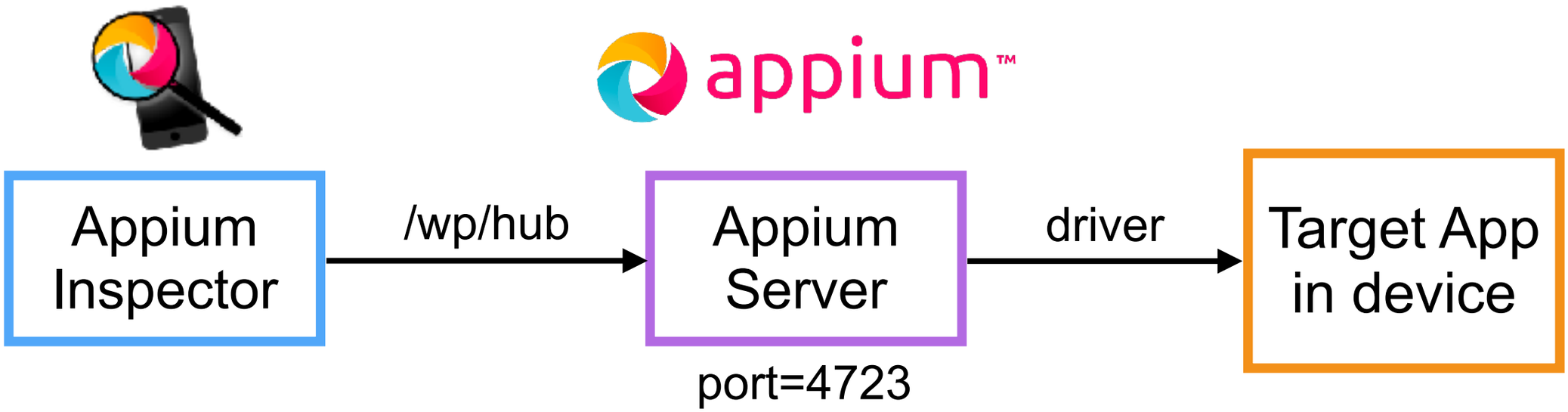
XCUITest

Flutter

Flutter

Let’s start with Appium

Let’s start with Appium



Appium doctor (android, iOS)

https://github.com/up1/course-appium-robotframework/wiki/Workshop-with-appium

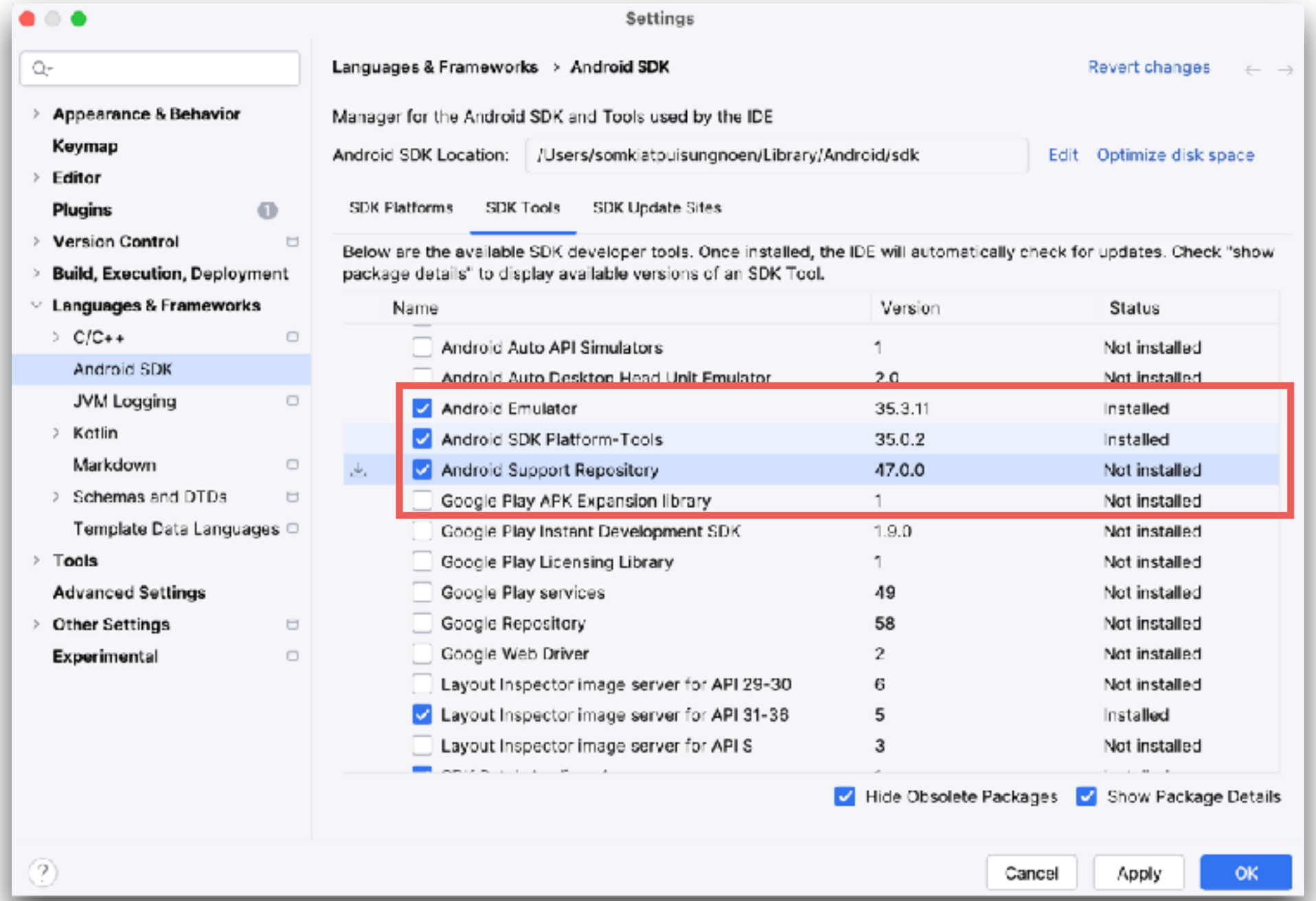
Steps to run

Appium doctor
Start server
Provide target apps (api, ipa/app)
Appium Inspector

Check environments

Android	iOS
APPIUM_HOME	APPIUM_HOME
ANDROID_HOME	Xcode
JAVA_HOME	Xcode command line tools
adb, emulator, apkanalyzer	ios-deploy, applesimutils
NodeJS	NodeJS

Install tools in Android Studio



List of android’s devices

$adb devices

List of iOS's devices

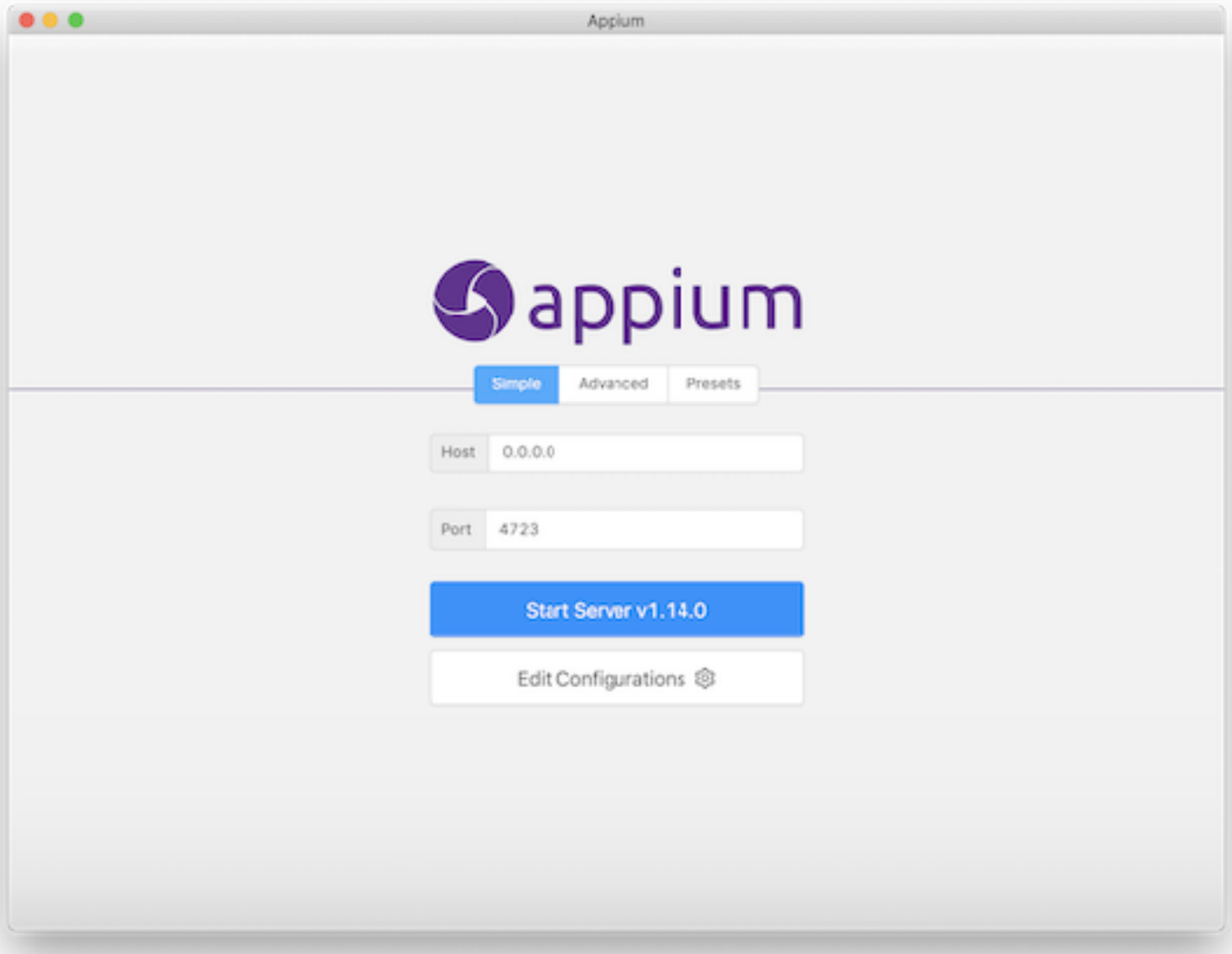
$xcrun xctrace list devices

```
== Simulators ==
Apple TV Simulator (15.2) (9666637B-AD71-47CD-932D-DE7BA9096F46)
Apple TV 4K (2nd generation) Simulator (15.2) (2B6A15B3-4A03-41B5-B6C6-D7727DCA94D8)
Apple TV 4K (at 1080p) (2nd generation) Simulator (15.2) (EC5B5310-9DE7-4CB2-8AE2-172FC885DB8C)
iPad (9th generation) Simulator (15.2) (03B84395-1A2B-4759-B01A-171CD4F8F796)
iPad Air (4th generation) Simulator (15.2) (6389A3CA-7805-452D-9110-5B3796A9D9BB)
iPad Pro (11-inch) (3rd generation) Simulator (15.2) (40E522A5-14CE-453C-A54C-29D096F19236)
iPad Pro (12.9-inch) (5th generation) Simulator (15.2) (1E6E63EF-FA56-4E31-8082-13B0C664AD33)
iPad Pro (9.7-inch) Simulator (15.2) (9C7181D9-73D6-48BF-8972-80A73ADB2EA9)
iPad mini (6th generation) Simulator (15.2) (01F8F0AB-1AF5-4FBE-9587-B7713F7BBC6F)
iPhone 11 Simulator (15.2) (1E75E325-57EC-4D6D-85BF-9958B0A9B158)
iPhone 11 Pro Simulator (15.2) (7D50F81C-3521-447F-A79C-8613C6C58FEF)
iPhone 11 Pro Max Simulator (15.2) (FB336CEE-A241-43D1-8704-B0632EA9FD28)
iPhone 12 Simulator (15.2) (5325CF3D-9576-462A-A110-49A5D76665FE)
```

Appium Server

Appium Server Desktop

DEPRECATED !!!



https://github.com/appium/appium-desktop

Appium Server (CLI)

Install via npm (required Node.js)

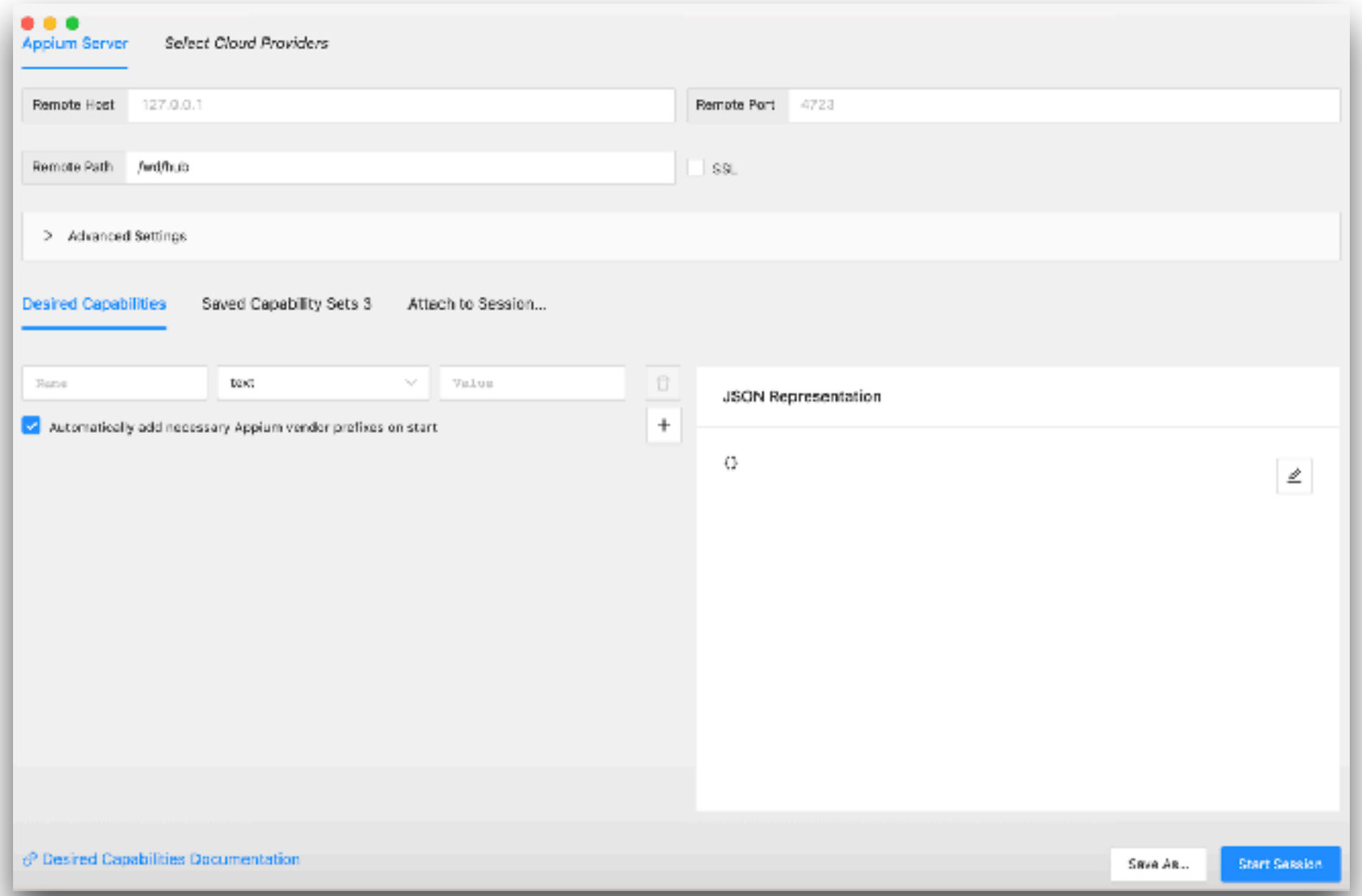
```
$npm install -g appium
$appium
```

https://github.com/appium/appium
https://appium.io/docs/en/latest/cli/args/

Appium Inspector

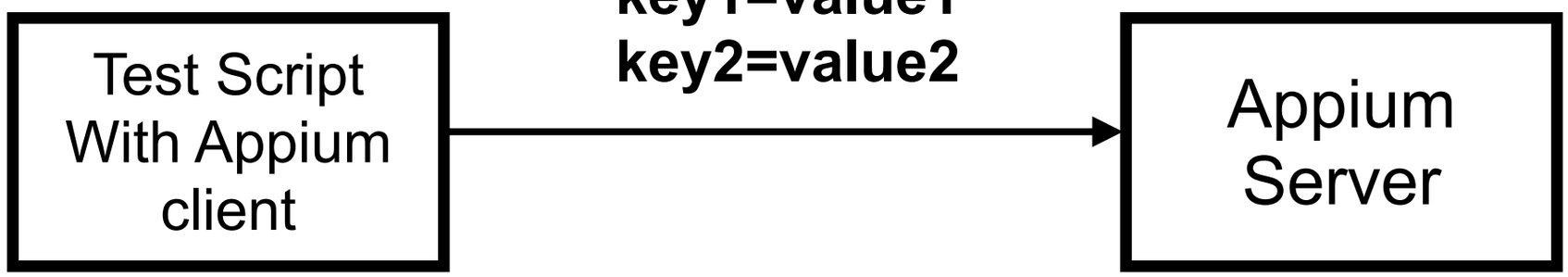
Appium Inspector

GUI inspector for mobile apps



https://github.com/appium/appium-inspector

Create a session with capabilities



http://appium.io/docs/en/writing-running-appium/caps/index.html

Required capabilities

Name	Description
platformName	Platform to automate (iOS, Android)
platformVersion	Version of platform
deviceName	Type of device to automate
app	Path to your app

https://appium.io/docs/en/2.1/guides/caps/

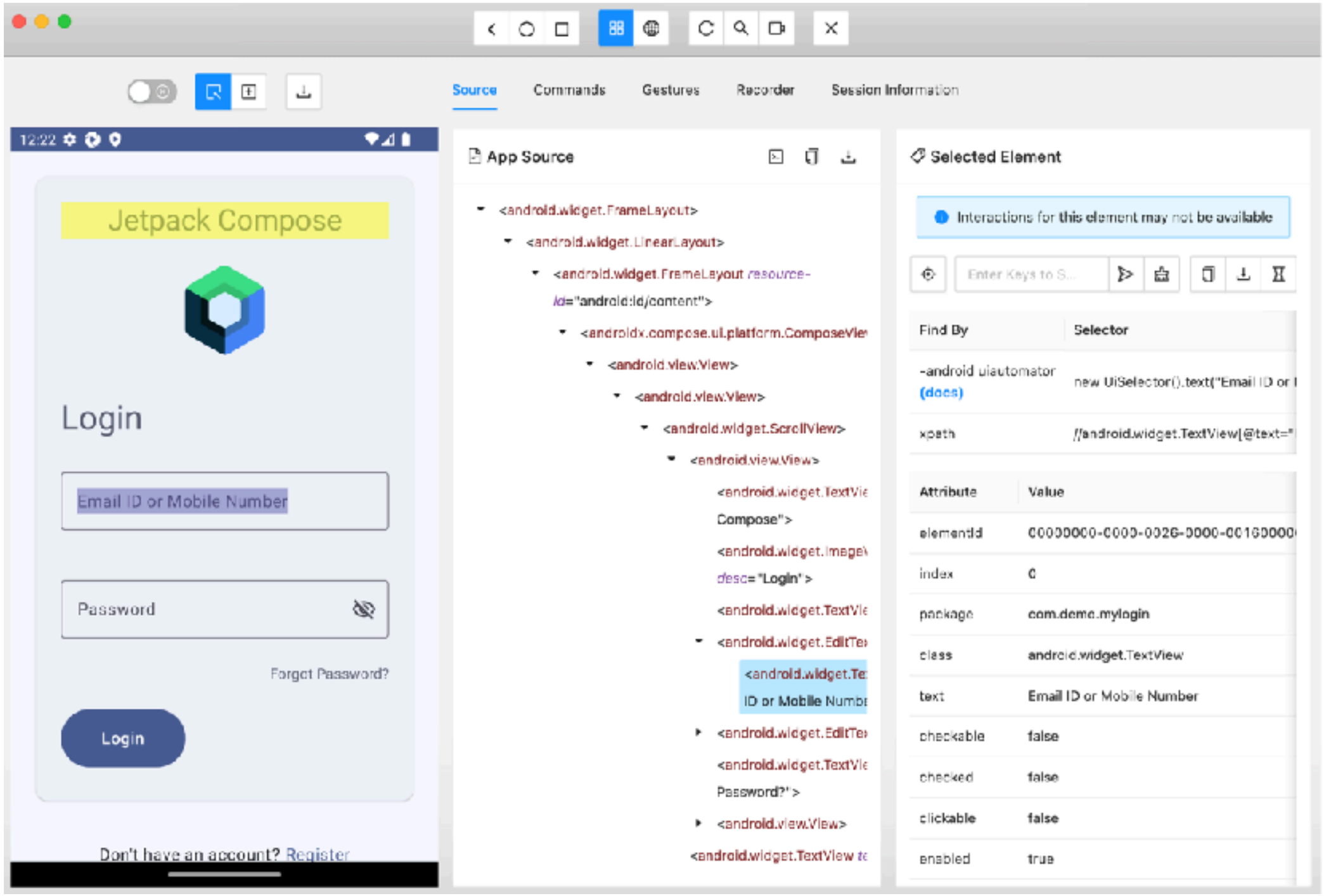
Session capabilities for android

```
{
  "platformName": "Android",
  "automationName": "UiAutomator2",
  "app": "Path to APK file",
  'deviceName": "ID/Name of target device"
}
```

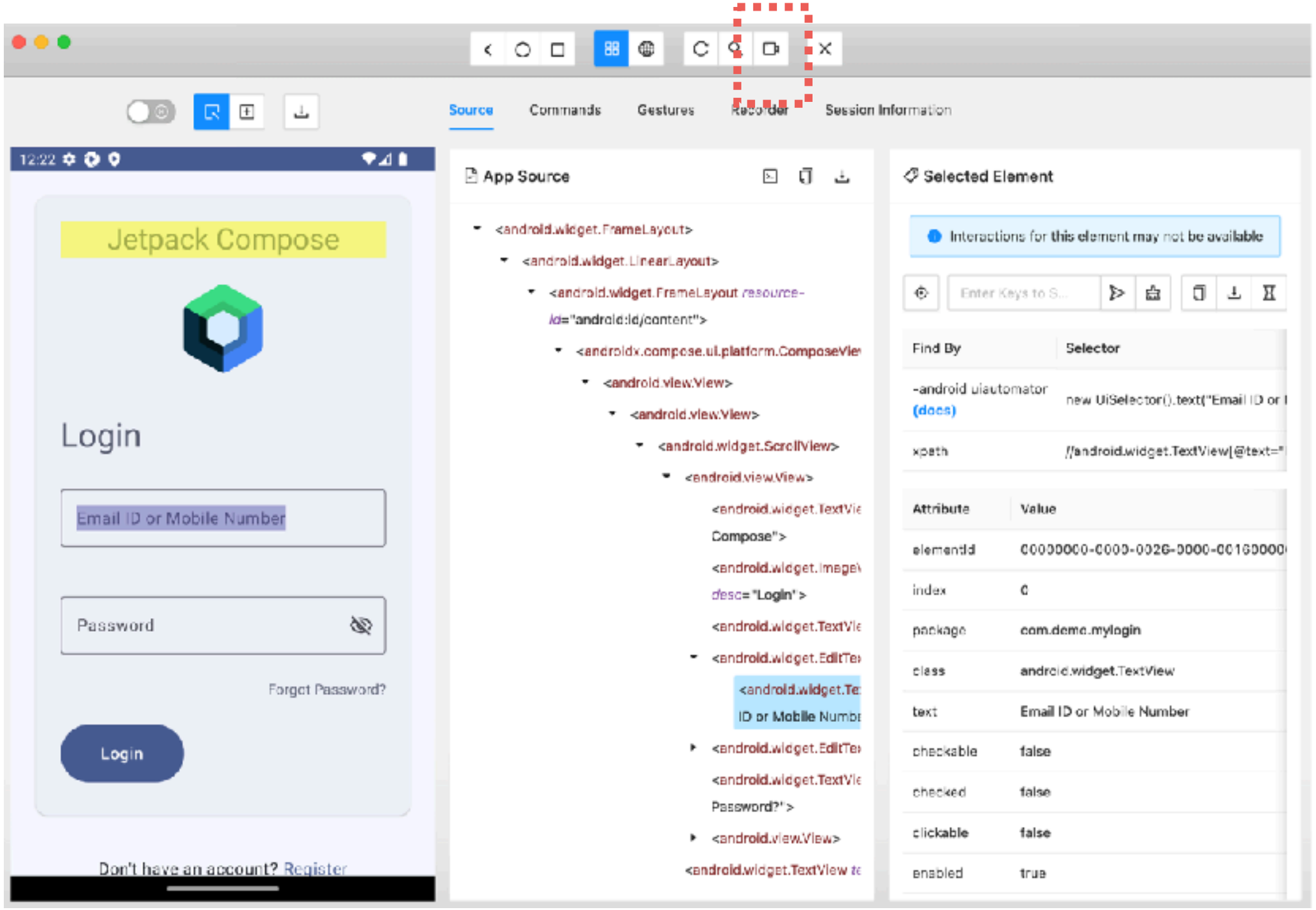
?

https://appium.io/docs/en/drivers/android-uiautomator2/

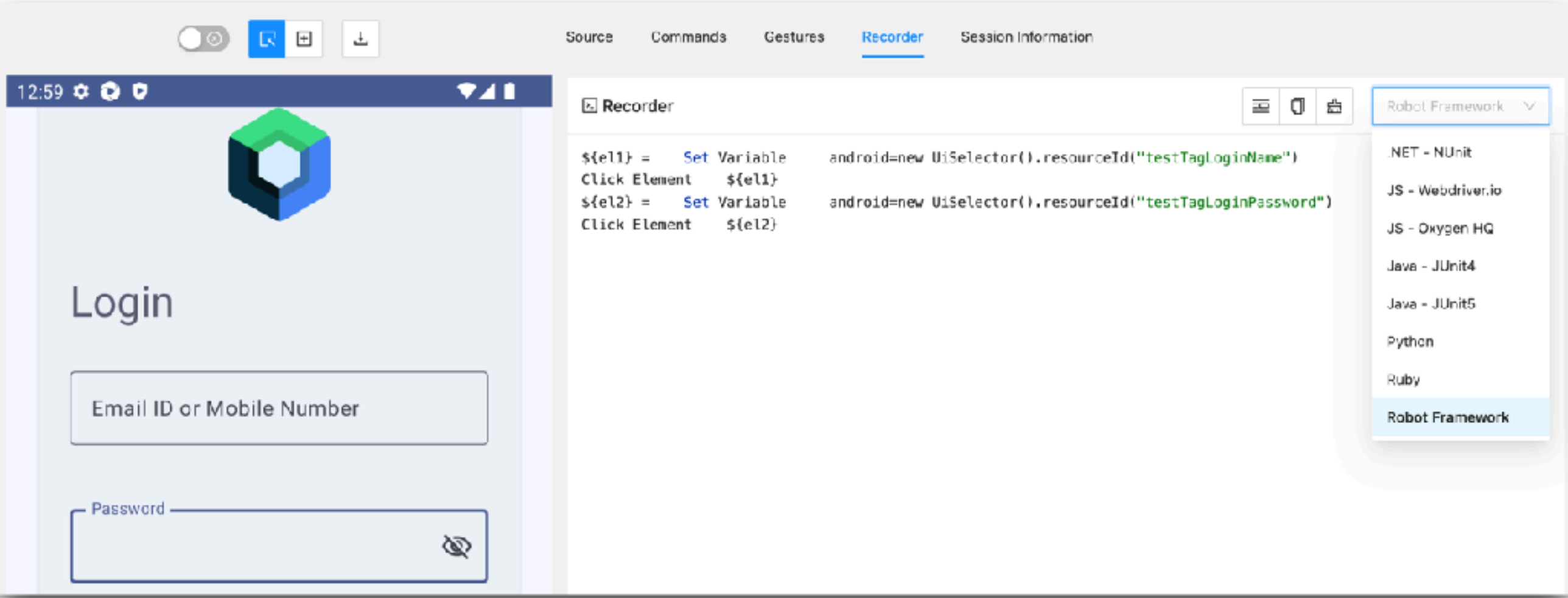
Appium Inspector



Recording



Generate Test Script



Session capabilities for iOS

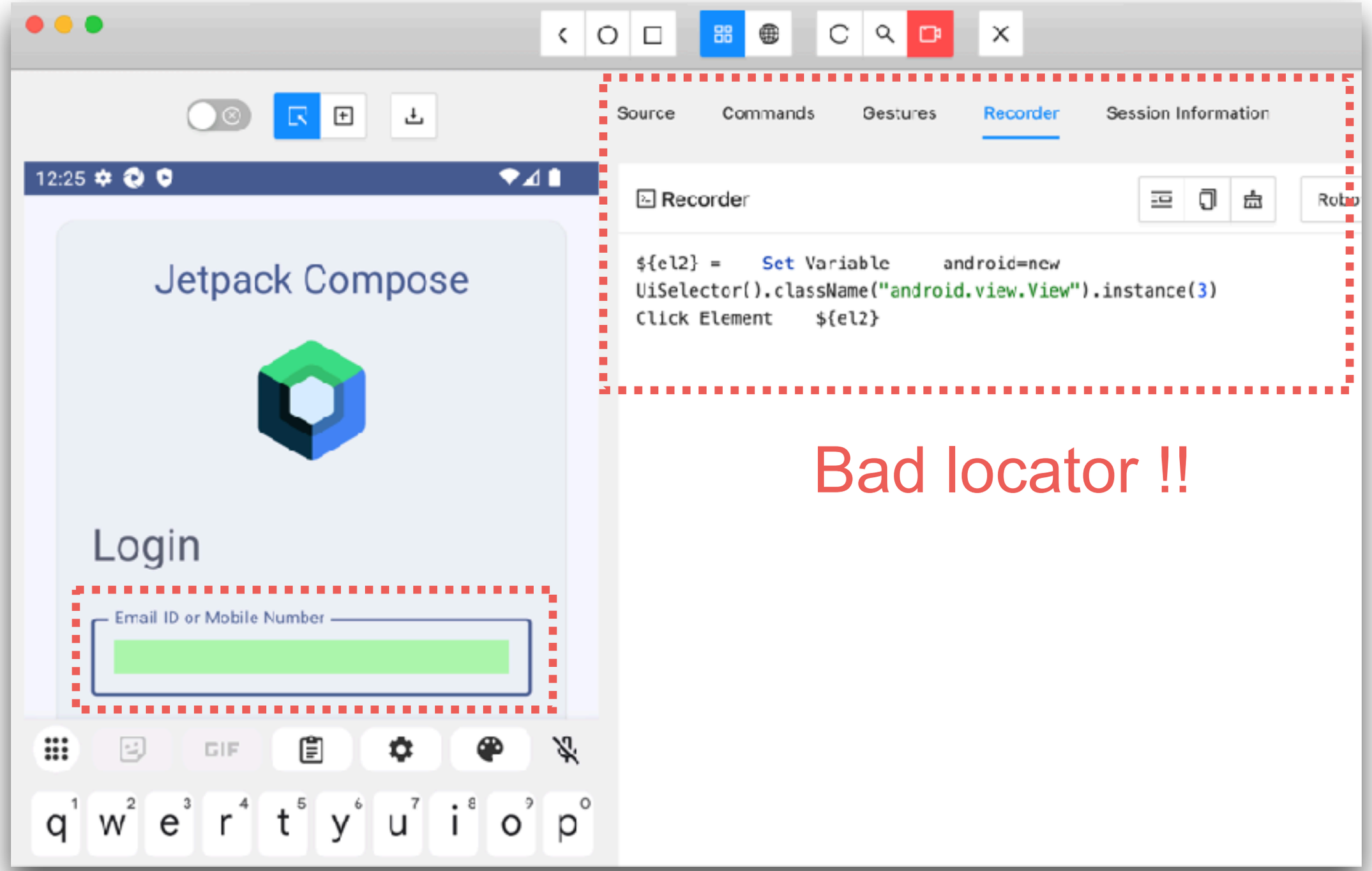
```
{
  "platformName": "Android",
  "automationName": "XCUITest",
  "app": "Path to IPA file",
  "platformVersion": "14.5"
  "deviceName": "ID/Name of target device"
}
```

https://appium.io/docs/en/drivers/ios-xcuitest/index.html

Finding and Using Elements

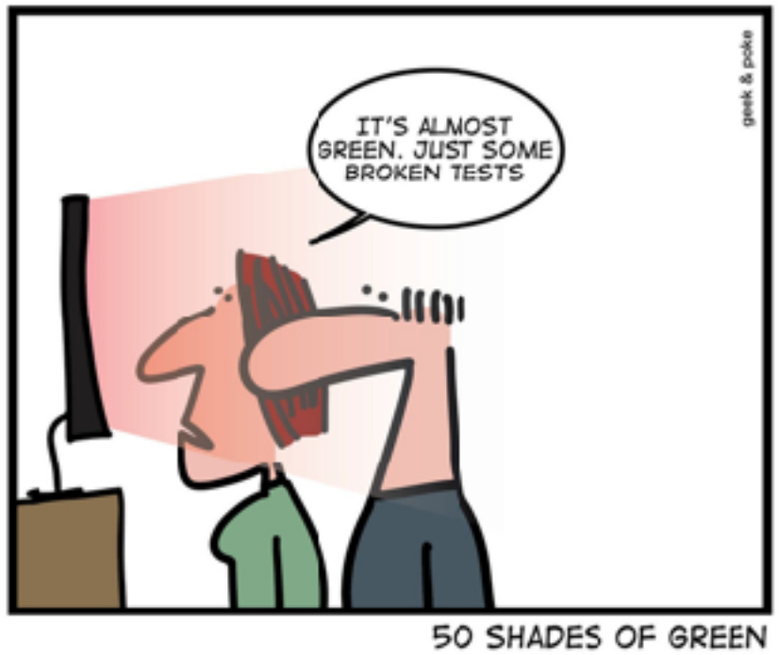
Isolated from UI !!

Recording and Inspect element



Good Locators

Unique
Descriptive
Resilient
Shorter in length (maintainability)



Locator Strategies for Android

Strategy	Description
ID	resource-id
Accessibility ID	Content description
Class name	UiSelector()
Android UIAutomator	Name of element
XPath	Pattern of element in XML (not recommended) Absolute path vs Relative path ?

https://github.com/appium/appium-uiautomator2-driver/blob/master/README.md#element-location

Improve locator in Android app

Jetpack Compose with **testTag**

Enable interoperability

```
modifier = modifier.semantics {
    testTagsAsResourceId = true
}
```

Set testTag in each element

```
EmailTextField(
    modifier = Modifier
        .testTag("testTagLoginName")
```

https://developer.android.com/develop/ui/compose/testing/interoperability

Improve locator in Android app

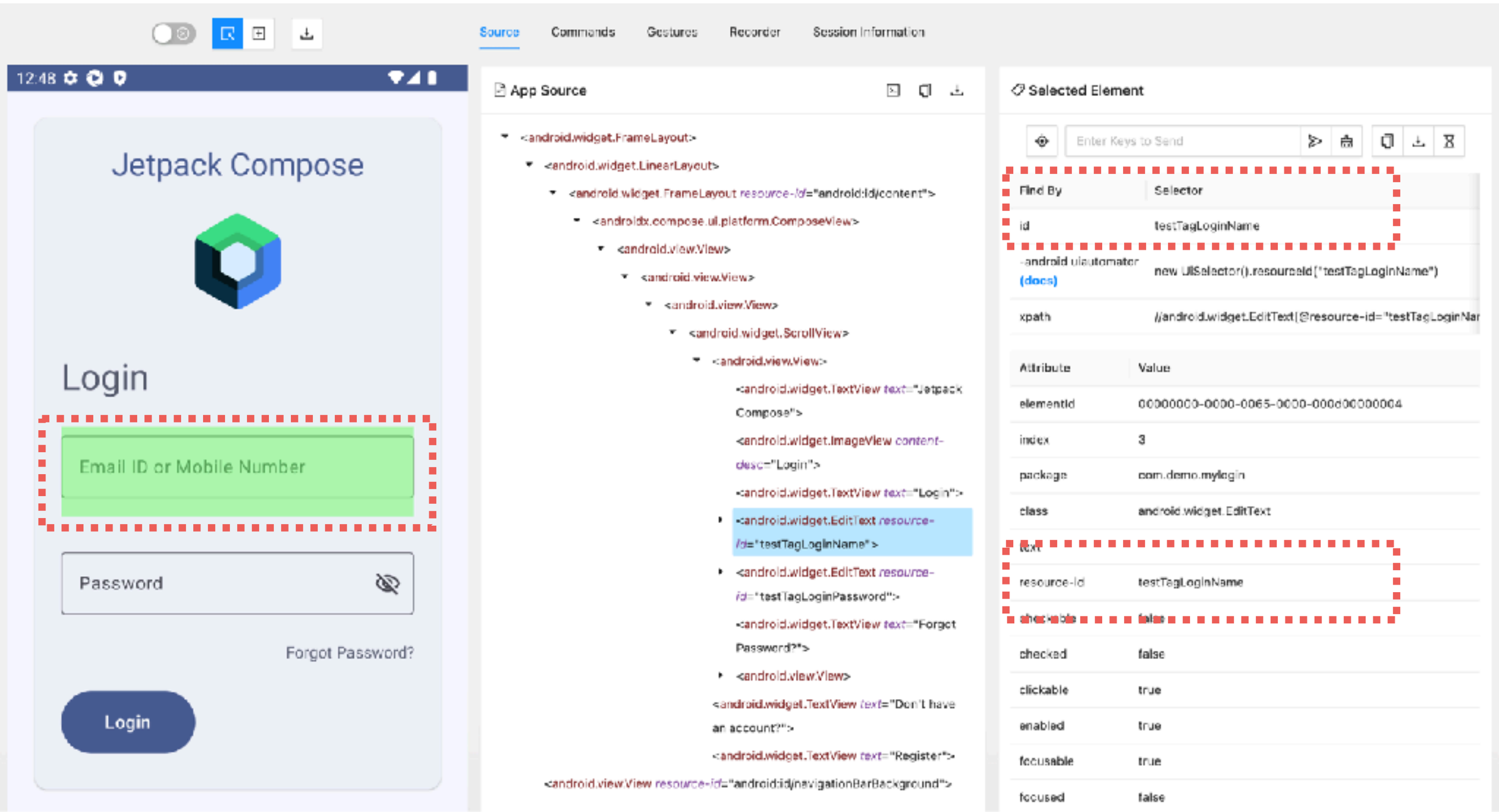
Jetpack Compose with **contentDescription**

```
EmailTextField(
    modifier = Modifier
        .fillMaxWidth()
        .padding(top = AppTheme.dimens.paddingLarge)
        .testTag(“testTagLoginName")

        .semantics {
            contentDescription = "login_name"
        }
```

https://developer.android.com/develop/ui/compose/testing/interoperability

Appium Inspector



XPath

CML Path Language
Query language used to identify tag in XML
Appium builds XML representation of app

XPath is powerful but very dangerous

Benefits of XPath

Find any element that exists
Find elements by using complex criteria

Cons of XPath

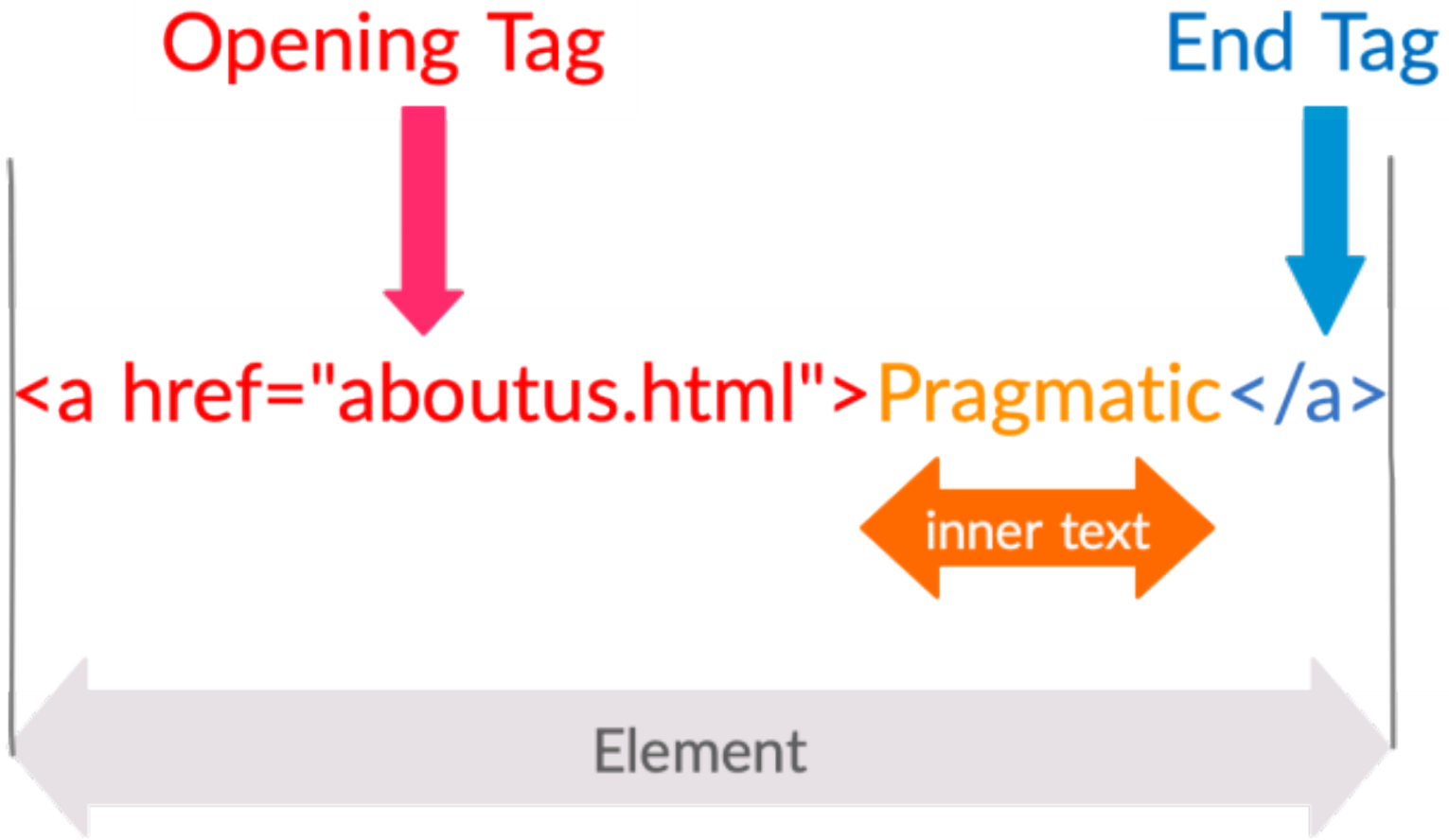
XPath selectors can be brittle

Slow

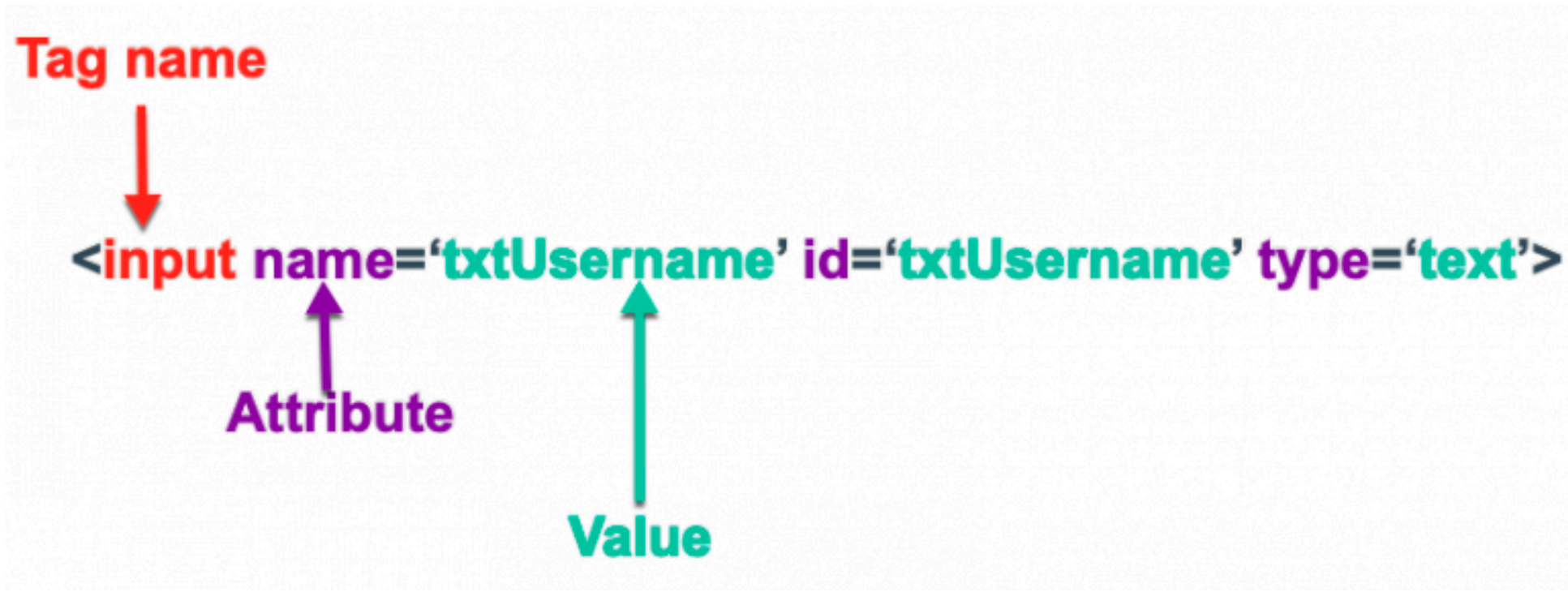
Broken test !!

Avoid brittle selectors by rely on unique tag attribute

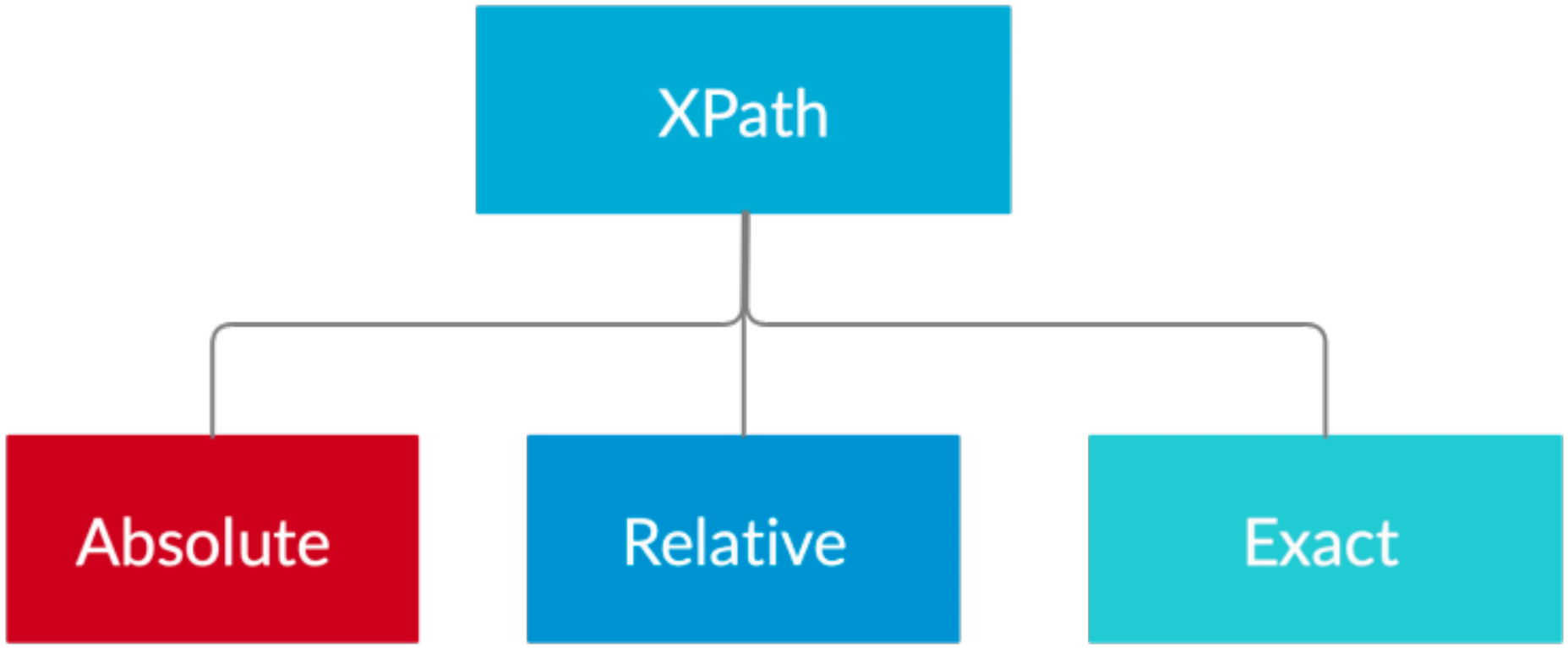
XPath



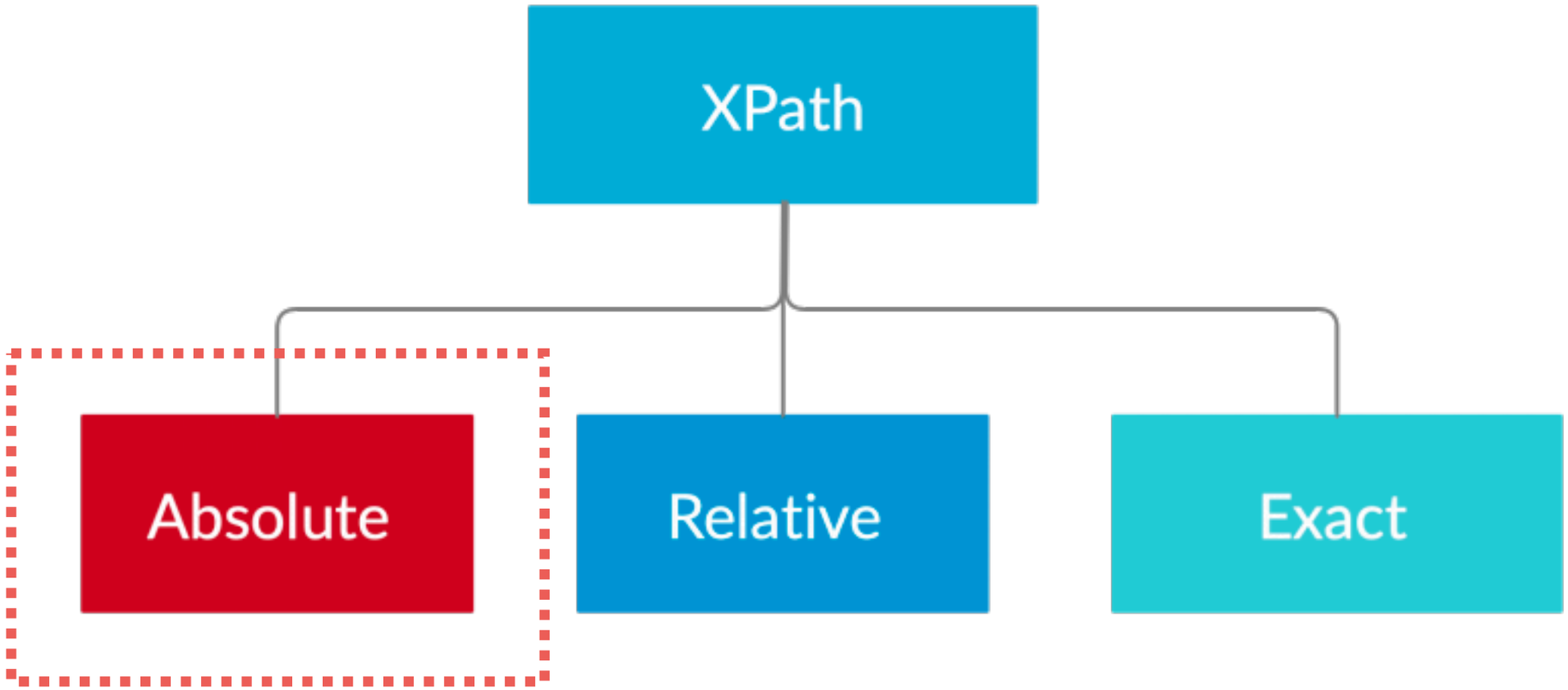
XPath



Types XPath

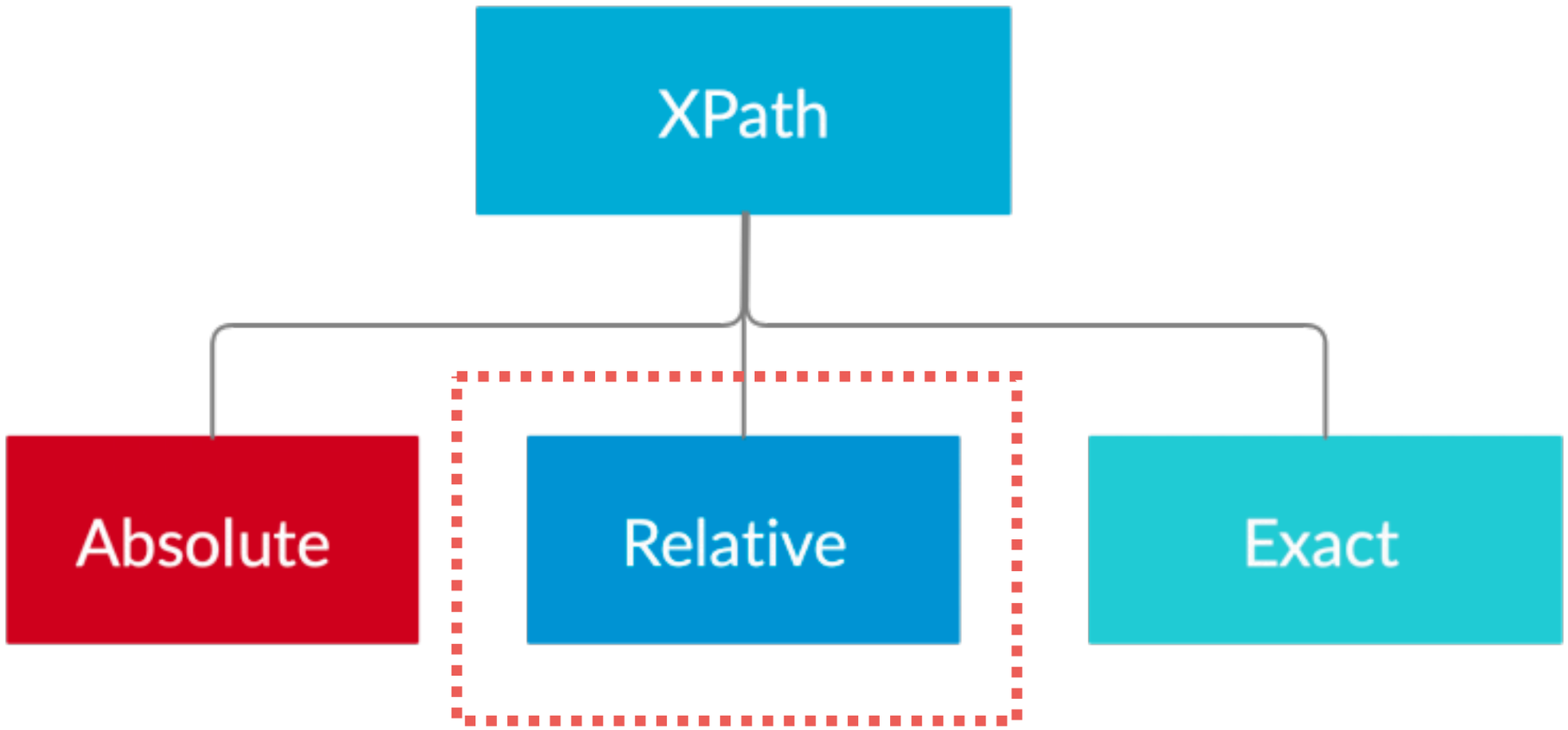


Don’t use !!



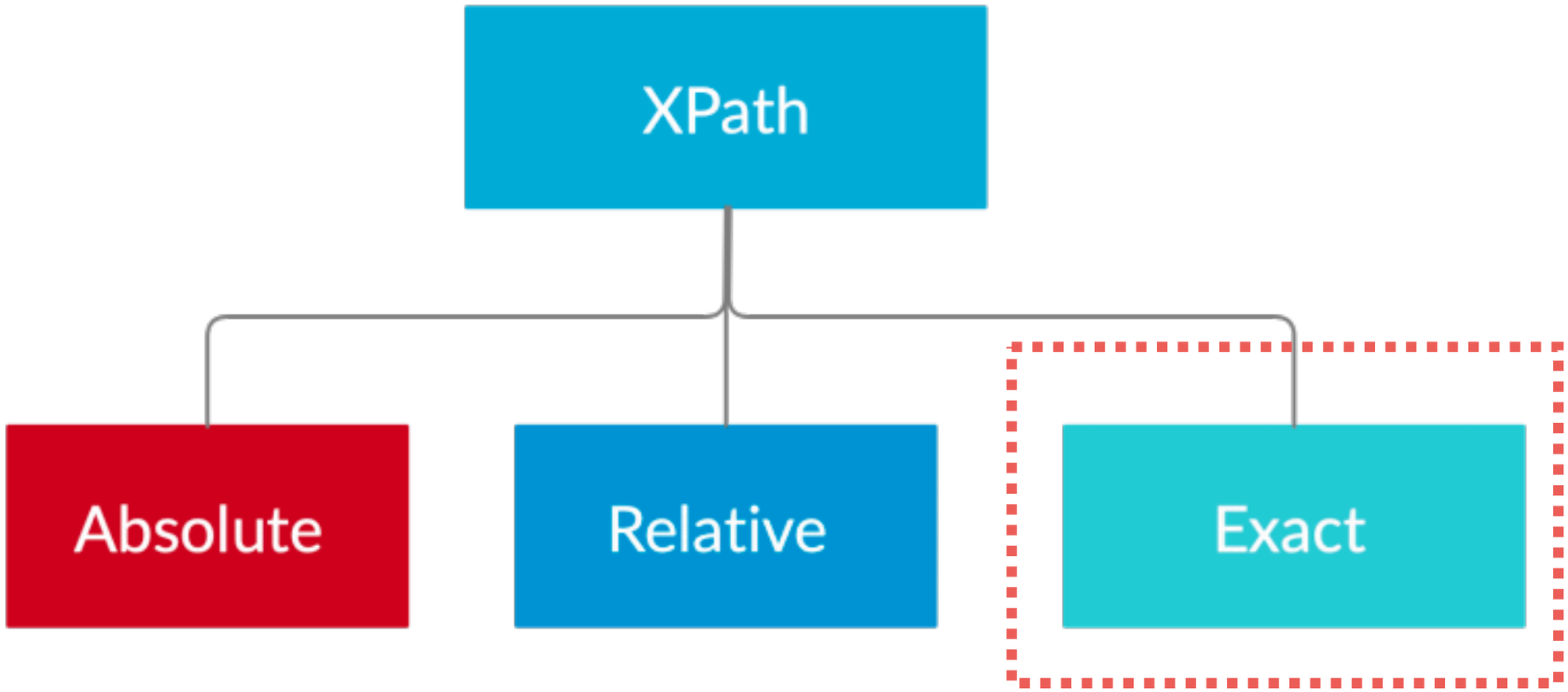
/html/body/div[1]/div/div[2]/form/div[2]/input

Relative




```
//div[@id='divUsername']/input
//form/div[@id='divUsername']/input
//form/*/input
```

Exact




```
//div[@class='datevalue currmonth']//span[./text()='2']
```

Absolute faster than Relative
But shortest is better

Element Interactions

Element Interactions

Command	Description
click()	Tab an element
sendKeys()	Enter keystrokes into an input field
clear()	Clear an input field
getText()	Retrieve the text displayed from a field or label

https://github.com/appium/appium-uiautomator2-driver/blob/master/README.md#mobile-gesture-commands

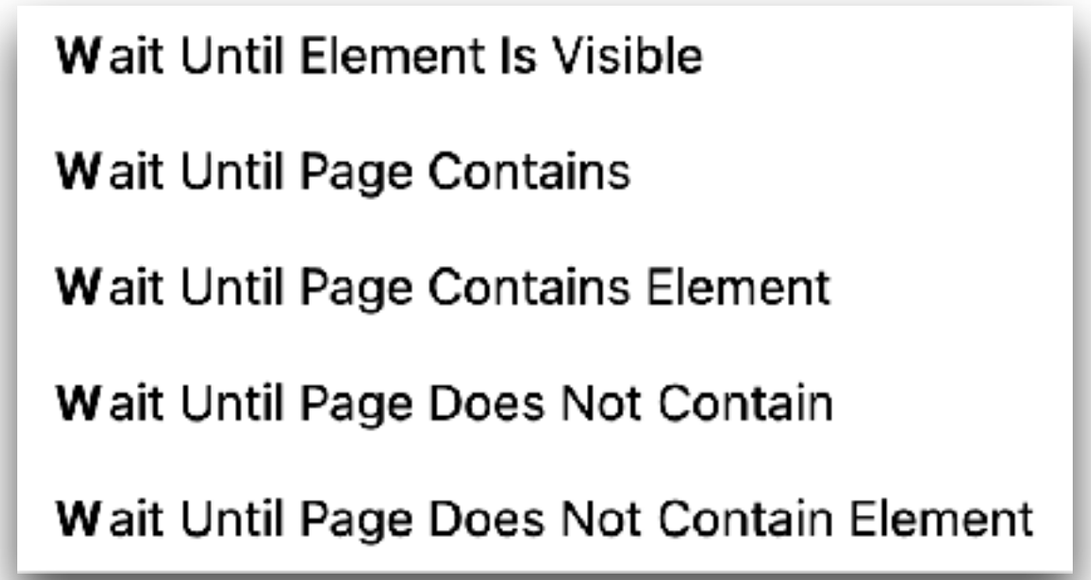
Waiting for Elements

Waiting …

Static waits (sleep) !!

Explicit waits

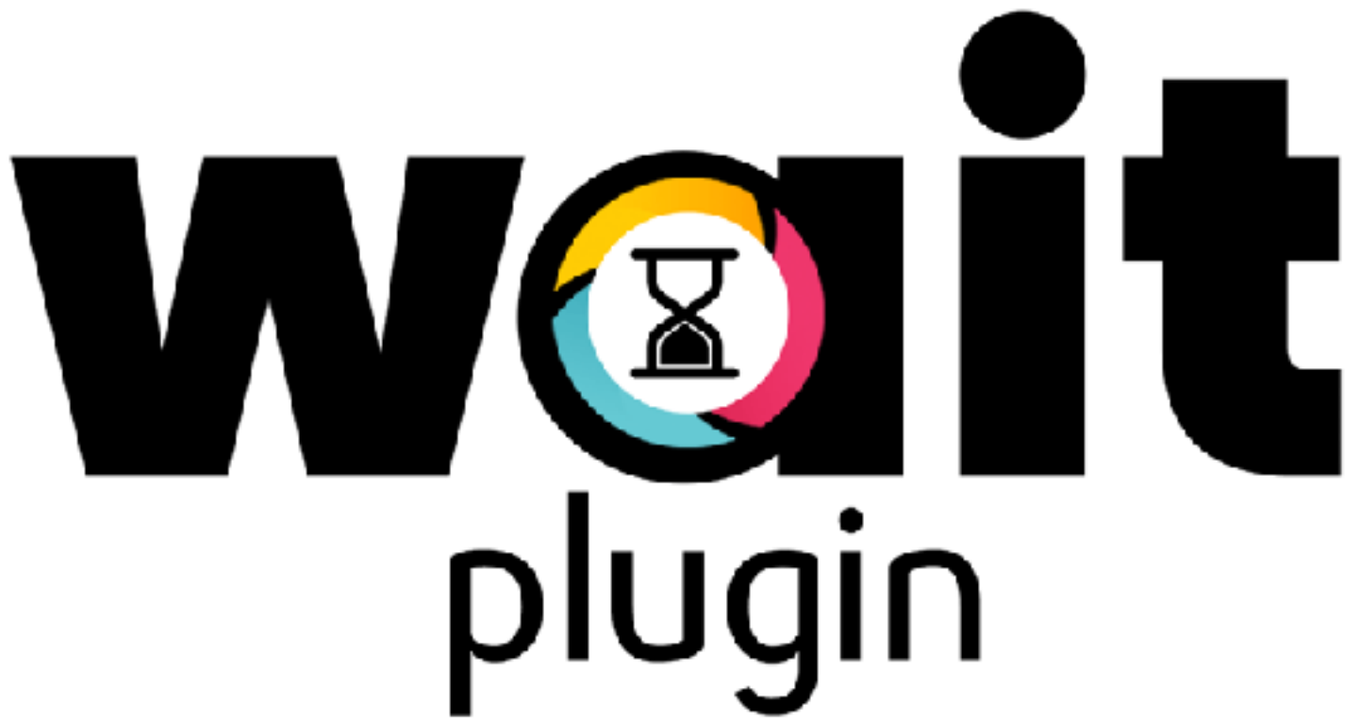
Wait until the element is found before proceeding the next step



Working with Appium's plugin

$appium plugin install --source=npm appium-wait-plugin

$appium --use-plugins=element-wait



https://github.com/AppiumTestDistribution/appium-wait-plugin

Learn to read Appium logs

```
[HTTP] {}
[AndroidUiautomator2Driver@0c13 (97cf7a81)] Driver proxy active, passing request on via HTTP proxy
[debug] [AndroidUiautomator2Driver@0c13 (97cf7a81)] Matched '/session/97cf7a81-37ce-4ac4-bd05-4d029612237e
/source' to command name 'getPageSource'
[debug] [AndroidUiautomator2Driver@0c13 (97cf7a81)] Proxying [GET /session/97cf7a81-37ce-4ac4-bd05-4d02961
2237e/source] to [GET http://127.0.0.1:8200/session/fe20a07f-45ed-4502-91f5-05df40569d7e/source] with no b
ody
[debug] [AndroidUiautomator2Driver@0c13 (97cf7a81)] Got response with status 200: {"sessionId":"fe20a07f-4
5ed-4502-91f5-05df40569d7e","value":"<?xml version='1.0' encoding='UTF-8' standalone='yes' ?>\r\n<hierarch
y index=\"0\" class=\"hierarchy\" rotation=\"0\" width=\"1080\" height=\"1857\">\r\n  <android.widget.Fram
eLayout index=\"0\" package=\"com.amazonaws.devicefarm.android.referenceapp\" class=\"android.widget.Frame
Layout\" text=\"\" checkable=\"false\" checked=\"false\" clickable=\"false\" enabled=\"true\" focusable=\"
false\" focused=\"false\" long-clickable=\"false\" password=\"false\" scrollable=\"false\" selected=\"fals
e\" bounds=\"[0,0][1080,1857]\" displayed=\"true\">\r\n    <android.widget.LinearLayout index=\"0\" packag
e=\"com.amazonaws.devicefarm.android.referenceapp\" class=\"android.widget.LinearLayout\" text=\"\" checka
ble=\"false\" checked=\"false\" clickable=\"false\" enabled=\"true\" focusable=\"false\" focused=\"false\"
 long-clickable=\"false\" password=\"false\" scrollable=\"false\" selected=\"false\" bounds=\"[0,0][1080,1
857]\" displayed=\"true\">\r\n      <androi...
[AndroidUiautomator2Driver@0c13 (97cf7a81)] Replacing sessionId fe20a07f-45ed-4502-91f5-05df40569d7e with
97cf7a81-37ce-4ac4-bd05-4d029612237e
[HTTP] <-- GET /session/97cf7a81-37ce-4ac4-bd05-4d029612237e/source 200 51 ms - 26619
[HTTP]
[HTTP] --> POST /session/97cf7a81-37ce-4ac4-bd05-4d029612237e/element
```

Write Test cases

Robot Framework

https://robotframework.org/

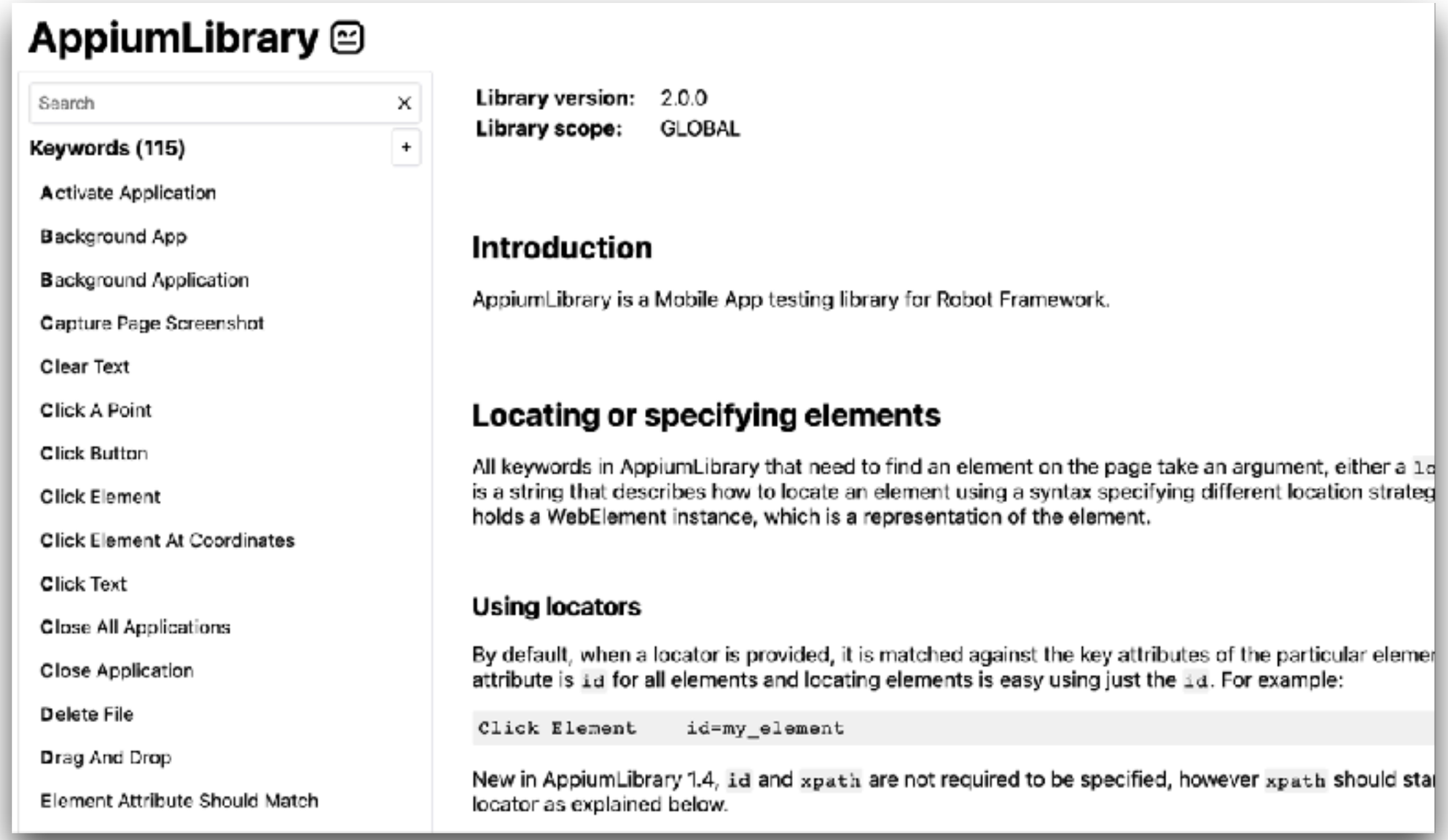
https://github.com/serhatbolsu/robotframework-appiumlibrary

Install Appium Library

$pip install -U robotframework
$pip install -U robotframework-appiumlibrary

https://robotframework.org/

Appium Library keywords



https://serhatbolsu.github.io/robotframework-appiumlibrary/AppiumLibrary.html

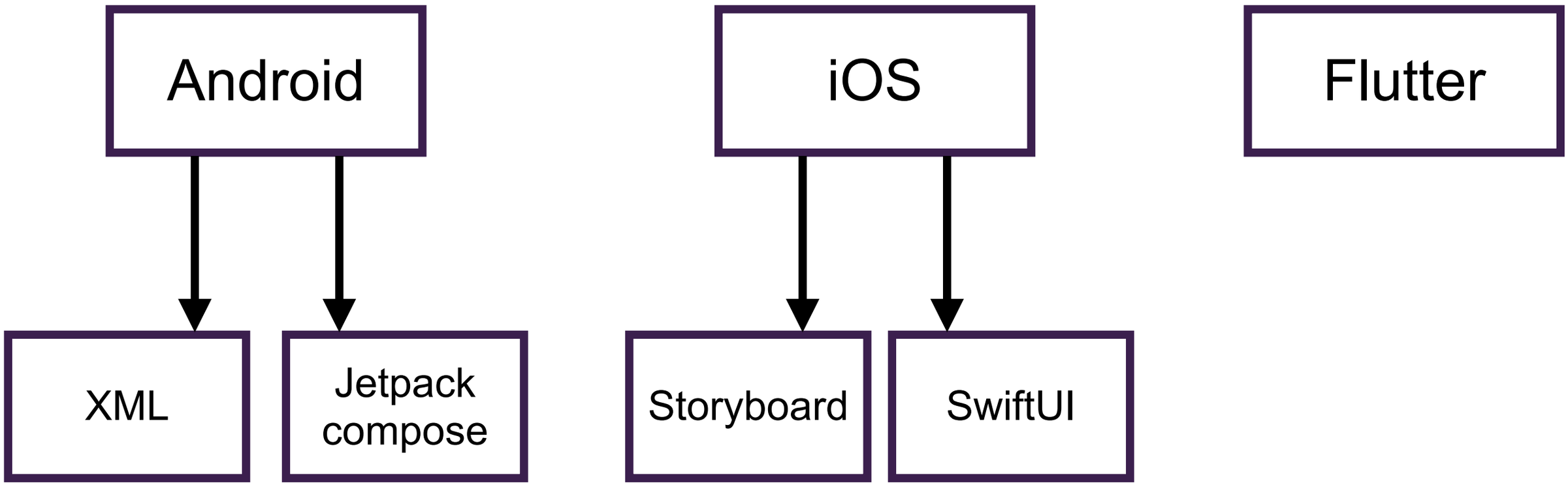
Locator Elements

Strategy	Example	Description
identifier	Click Element / identifier=my_element	Matches by @id attribute
id	Click Element / id=my_element	Matches by @resource-id attribute
accessibility_id	Click Element / accessibility_id=button3	Accessibility options utilize.
xpath	Click Element / xpath=//UIATableView/UIATableCell/UIAButton	Matches with arbitrary XPath
class	Click Element / class=UIAPickerWheel	Matches by class
android	Click Element / android=UiSelector().description('Apps')	Matches by Android UI Automator
ios	Click Element / ios=.buttons().withName('Apps')	Matches by iOS UI Automation
nsp	Click Element / nsp=name=="login"	Matches by iOSNsPredicate
chain	Click Element / chain=XCUIElementTypeWindow[1]/*	Matches by iOS Class Chain
css	Click Element / css=.green_button	Matches by css in webview
name	Click Element / name=my_element	Matches by @name attribute

https://serhatbolsu.github.io/robotframework-appiumlibrary/AppiumLibrary.html

Write your tests

Target App with UI Test



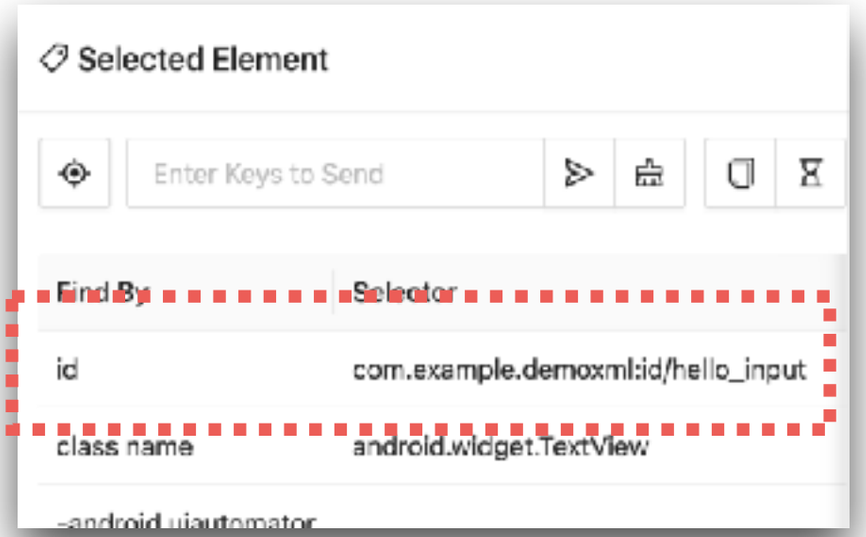
Android + Jetpack Compose

MainActivity.kt

```kotlin
@OptIn(ExperimentalComposeUiApi::class)
fun Modifier.setTagAndId(tag: String): Modifier {
    return this
        .semantics { this.testTagsAsResourceId = true }
        .testTag(tag)
}

@Composable
fun Greeting(name: String, modifier: Modifier = Modifier) {
    Box(
        modifier = Modifier.fillMaxSize(),
        contentAlignment = Alignment.Center
    ) {
        Text(
            text = "XXXXXXHello $name!",
            modifier =
     Modifier.setTagAndId("com.example.demoxml:id/hello_input")
        )
    }
}
```

Appium Inspector

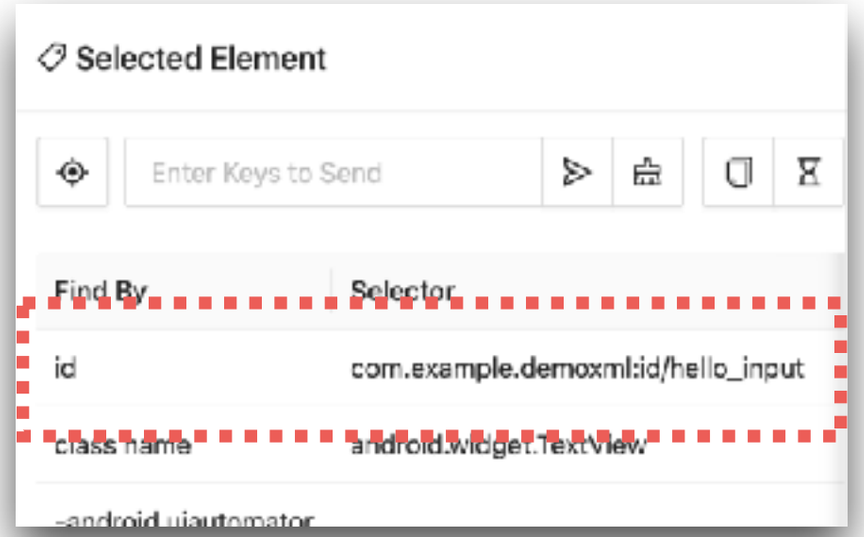


Android + XML Layout

activity_main.xml

```
<TextView
    android:id=“@+id/hello_input"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Hello World from xml"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toTopOf="parent" />
```

Appium Inspector



appPackage=com.example.demoxml

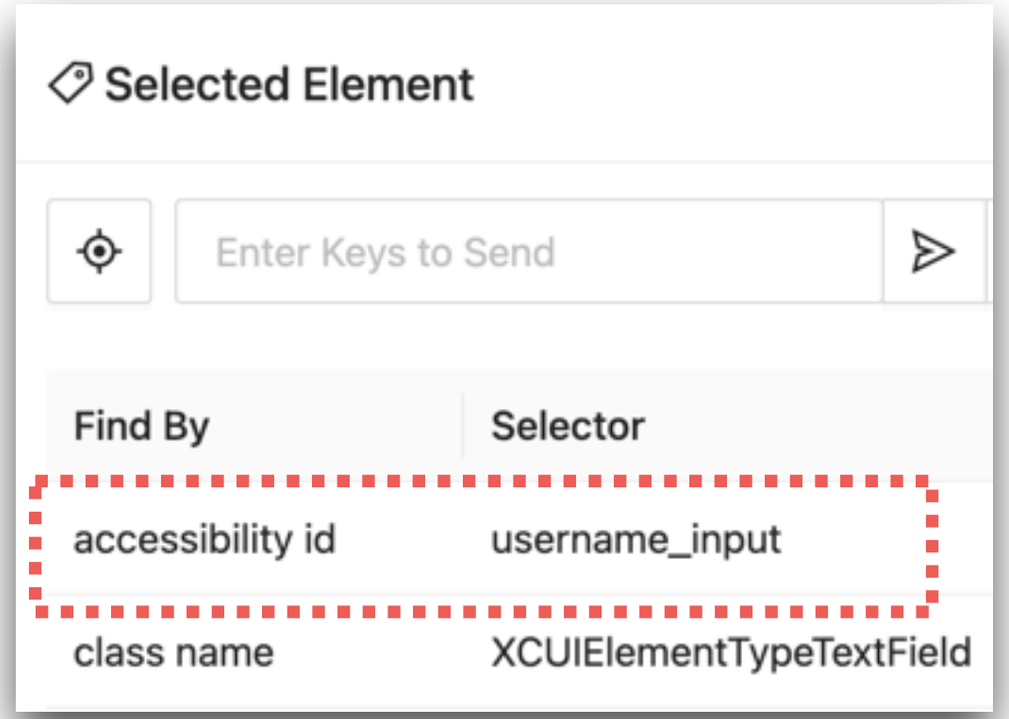
iOS + SwiftUI

LoginView.swift

```
TextField("Username", text: $username)
    .textFieldStyle(RoundedBorderTextFieldStyle())
    .padding()

    .accessibilityIdentifier("username_input")
SecureField("Password", text: $password)
    .textFieldStyle(RoundedBorderTextFieldStyle())
    .padding()
    .accessibilityIdentifier("password_input")
```

Appium Inspector

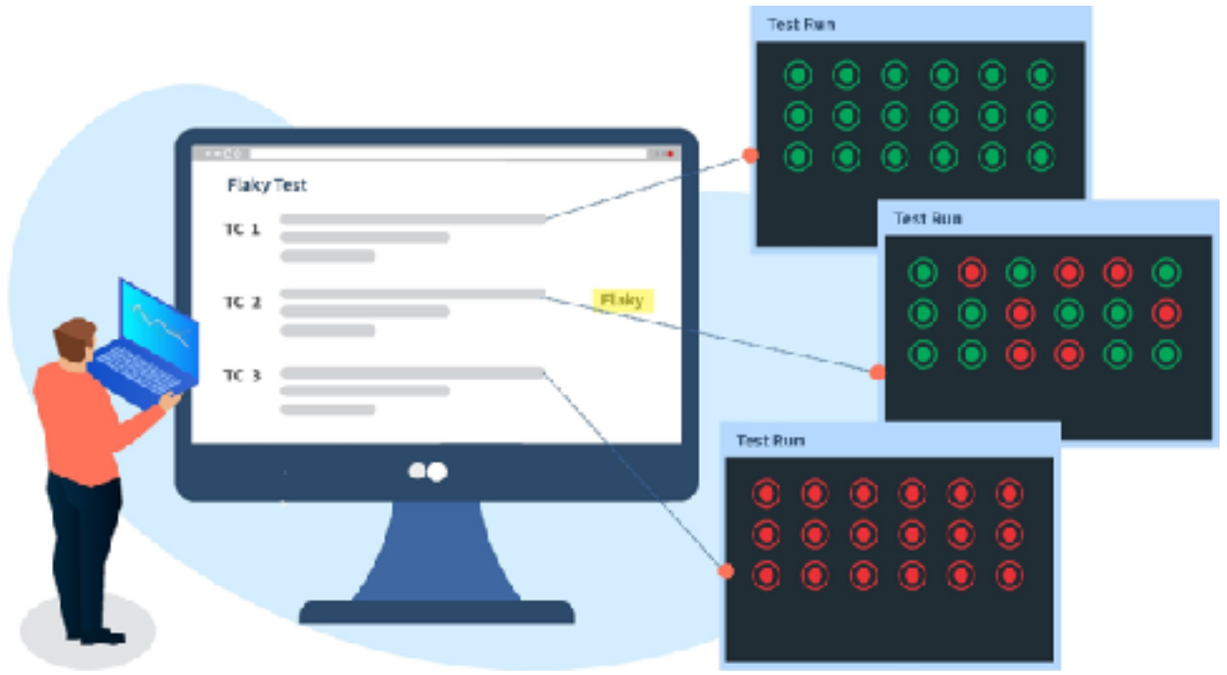


Flaky test
in UI automation

https://www.browserstack.com/test-observability/features/test-reporting/what-is-flaky-test

Flaky test

Inconsistency test results
Non-repeatable
Pass or failure **unpredictable**
System not change !!



Causes of Flaky test

Concurrency issues	Insufficient assertions	Flaw logic
Unstable environment	External dependencies	Non-deterministic behavior

How to detect Flaky test ?

Re-run only failed tests
Run tests in parallel way
Run test in different environments
Analyze test results and logs
Use tools and frameworks

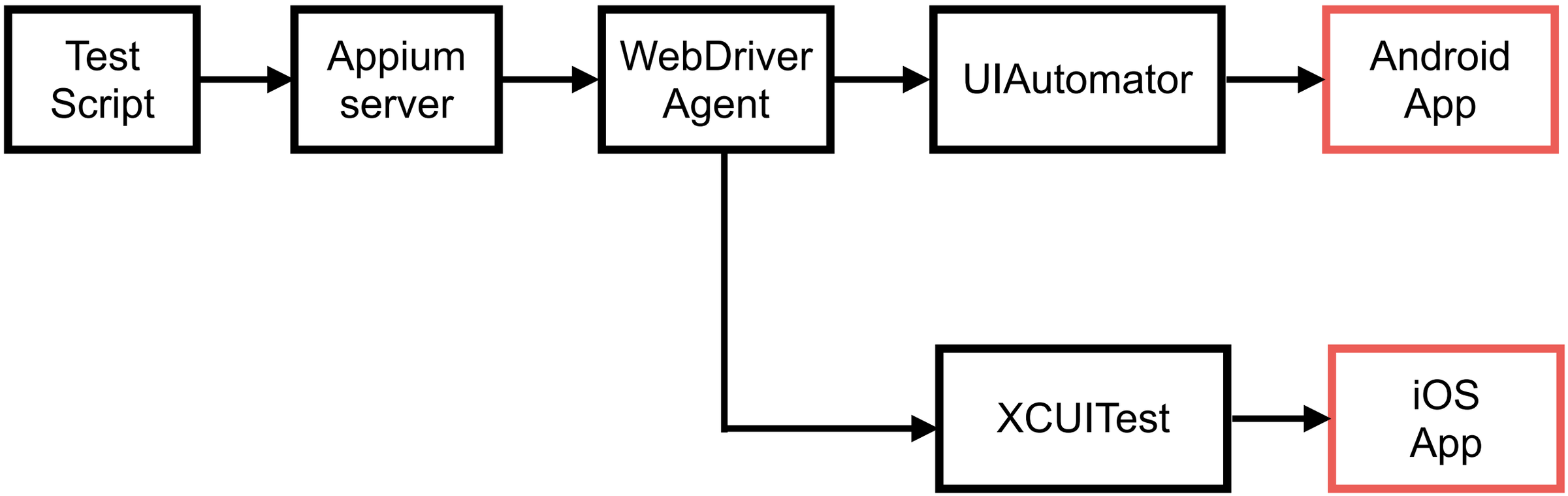
Customize waiting

Parallel testing

How to fix Flaky test ?

Isolate test
Eliminate randomness
Increase robustness of test case
Simplify the logic of test scripts

Flaky test with Appium !!

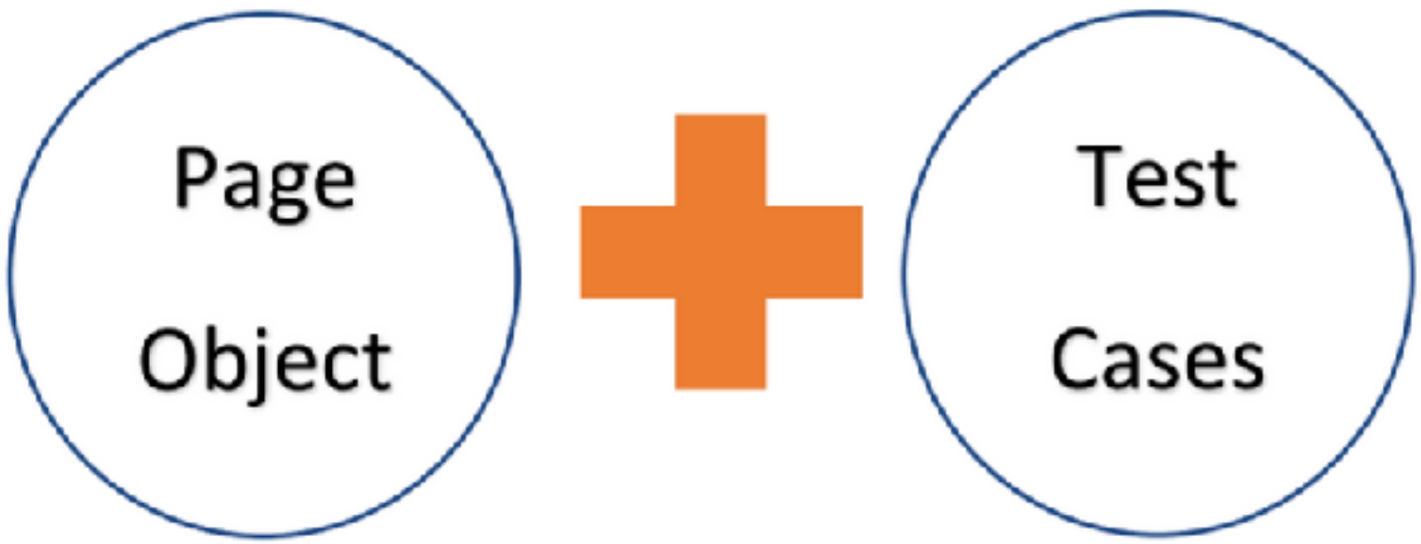


Make it Right

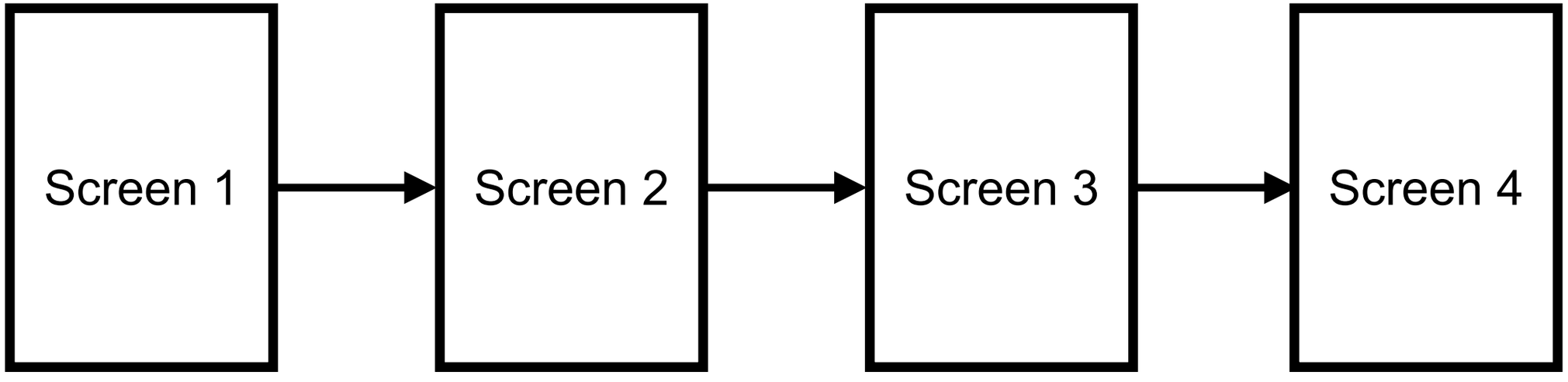
Page Object Pattern

Page Object Pattern

Maintainable test cases
Reduce code duplication
Working as a team



Use Page Object Pattern



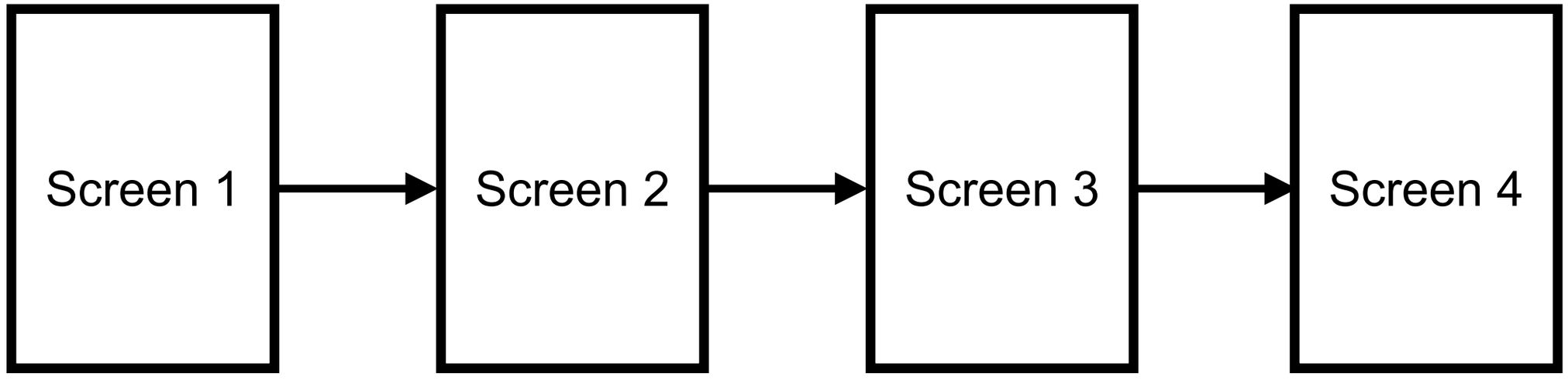
Keyword A
Keyword B

Keyword A

Keyword A

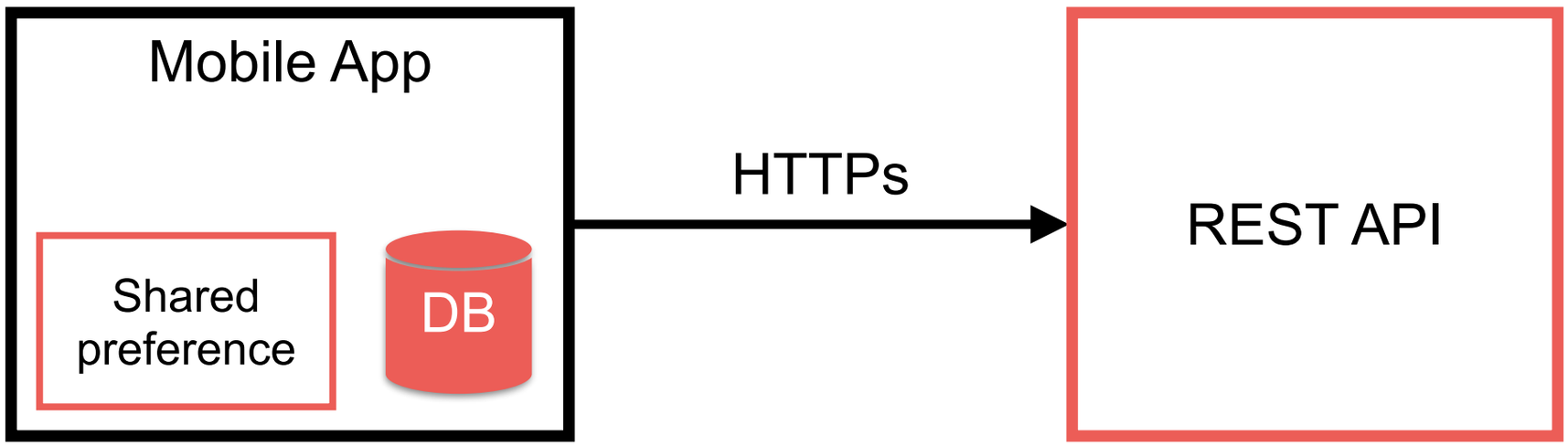
Keyword A

Use Page Object Pattern

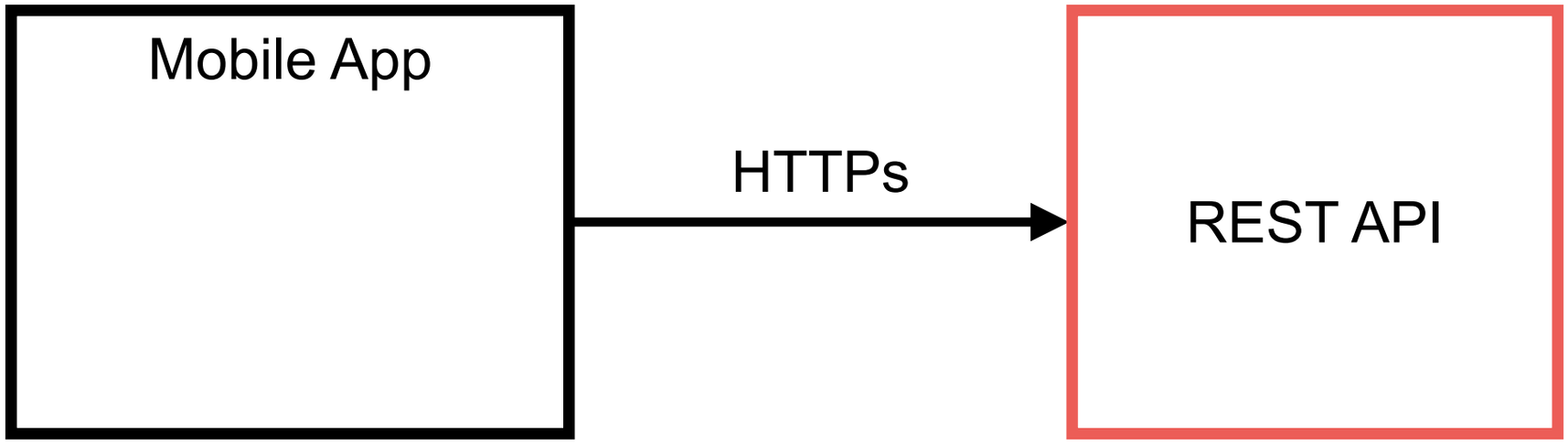


Manage dependencies

Manage dependencies

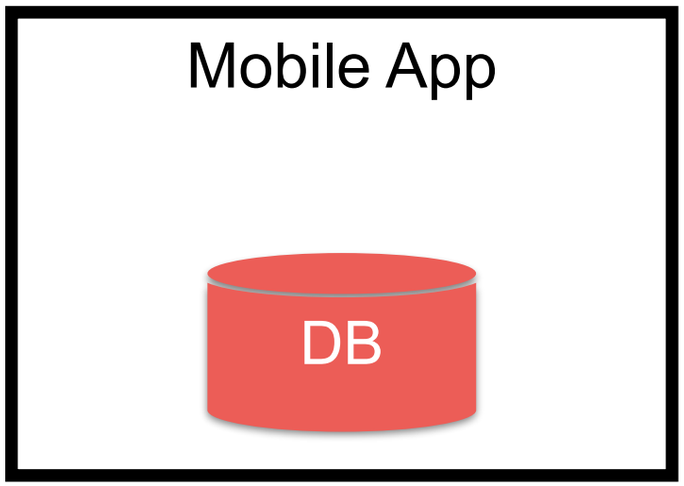


Manage REST API ?

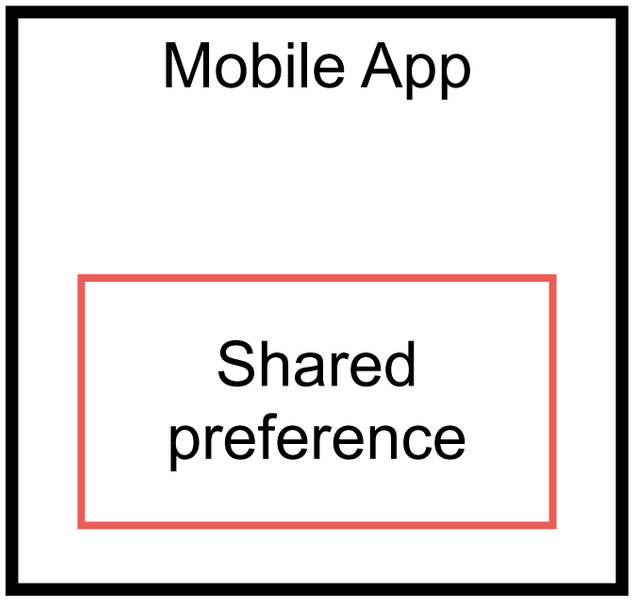


1. Network status ?
2. Mock API server (success/failure) ?
3. Intercept request ?

Manage Database ?



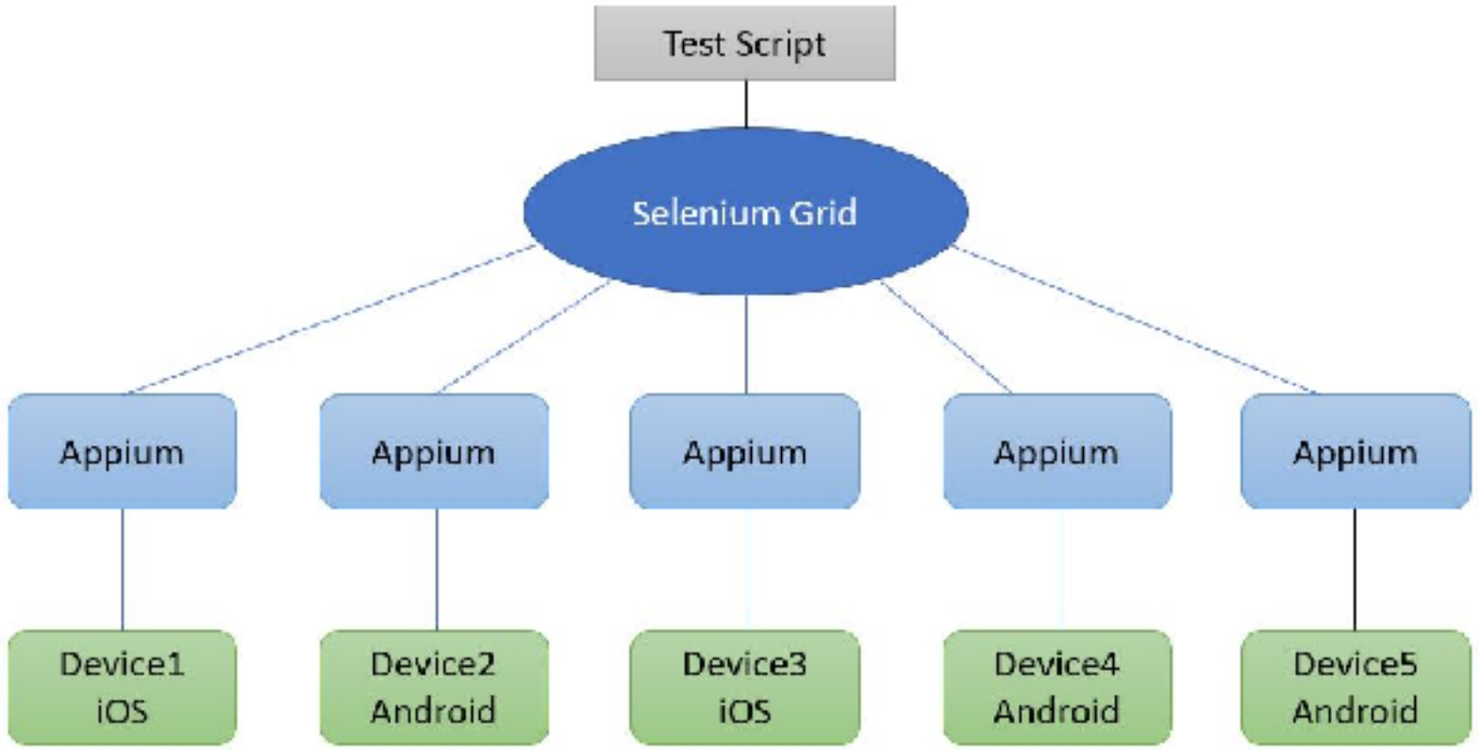
Manage SharedPreference ?



Make it Fast

Appium Grid

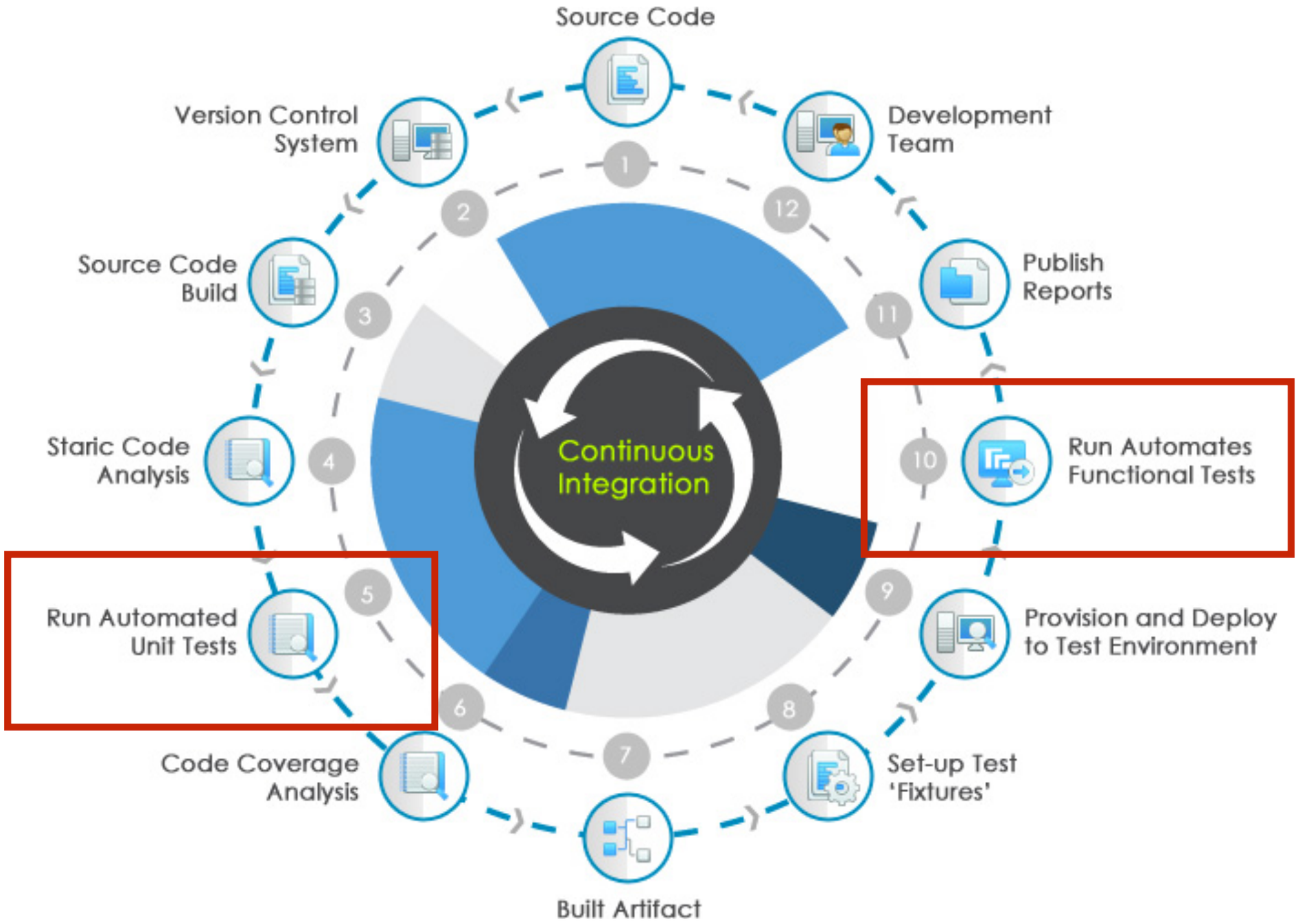
Proxy server that allow to run parallel tests on multiple devices simultaneously



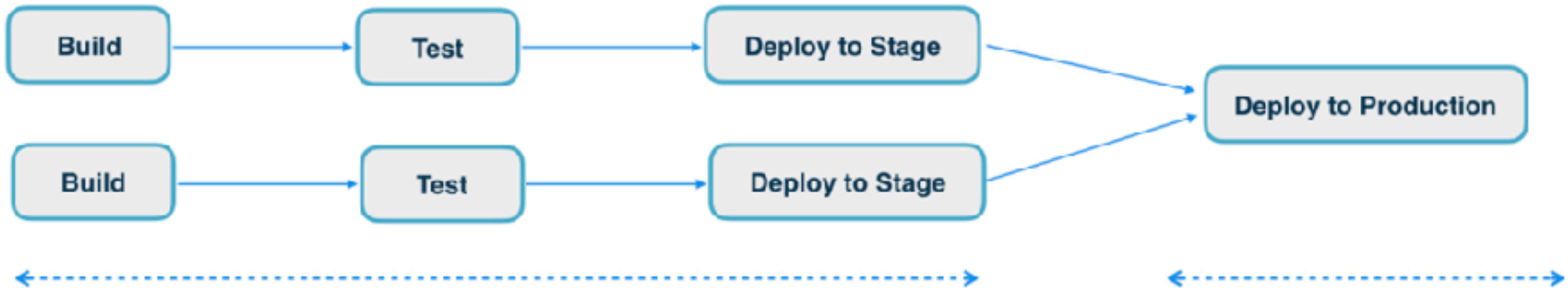
https://appium.io/docs/en/2.1/guides/grid/
https://github.com/appium/appium-docker-android

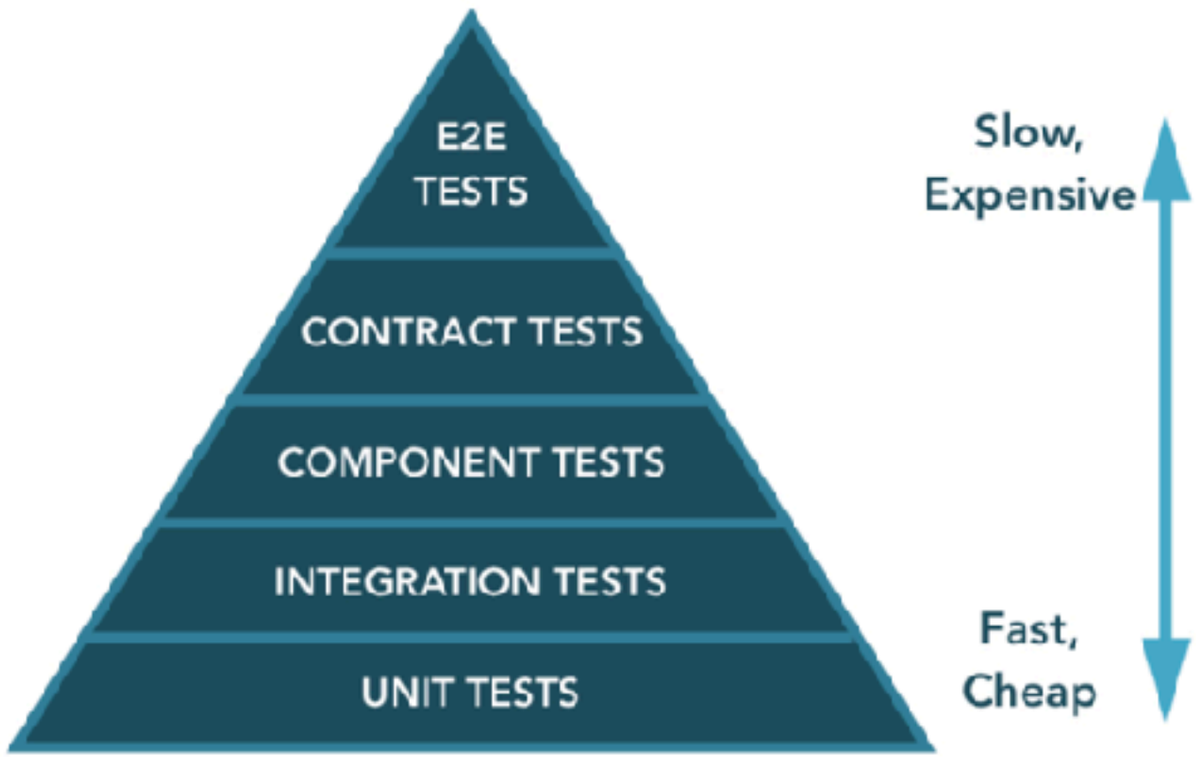
Continuous Integration

Continuous integration



Test strategy

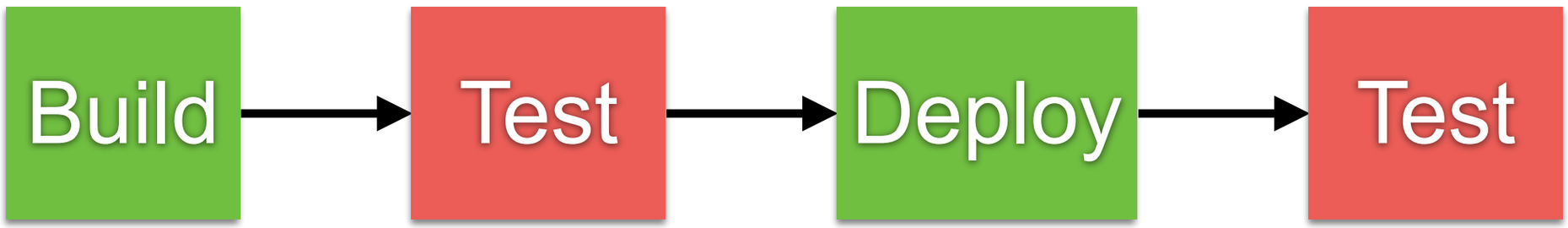




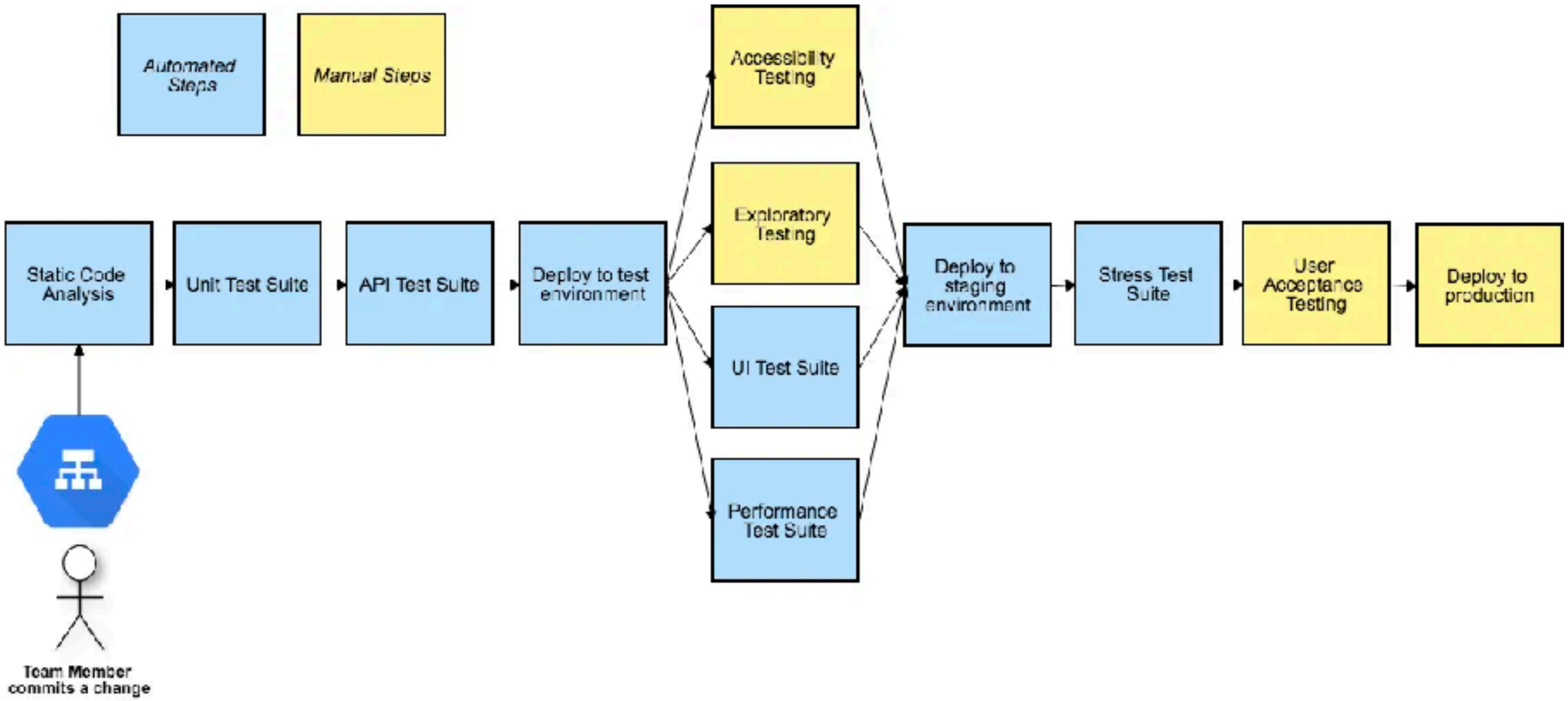
Monitoring
Distributed Tracing
Fault-injection Testing

Canary Deployments
Blue-Green Deployments
A/B Testing

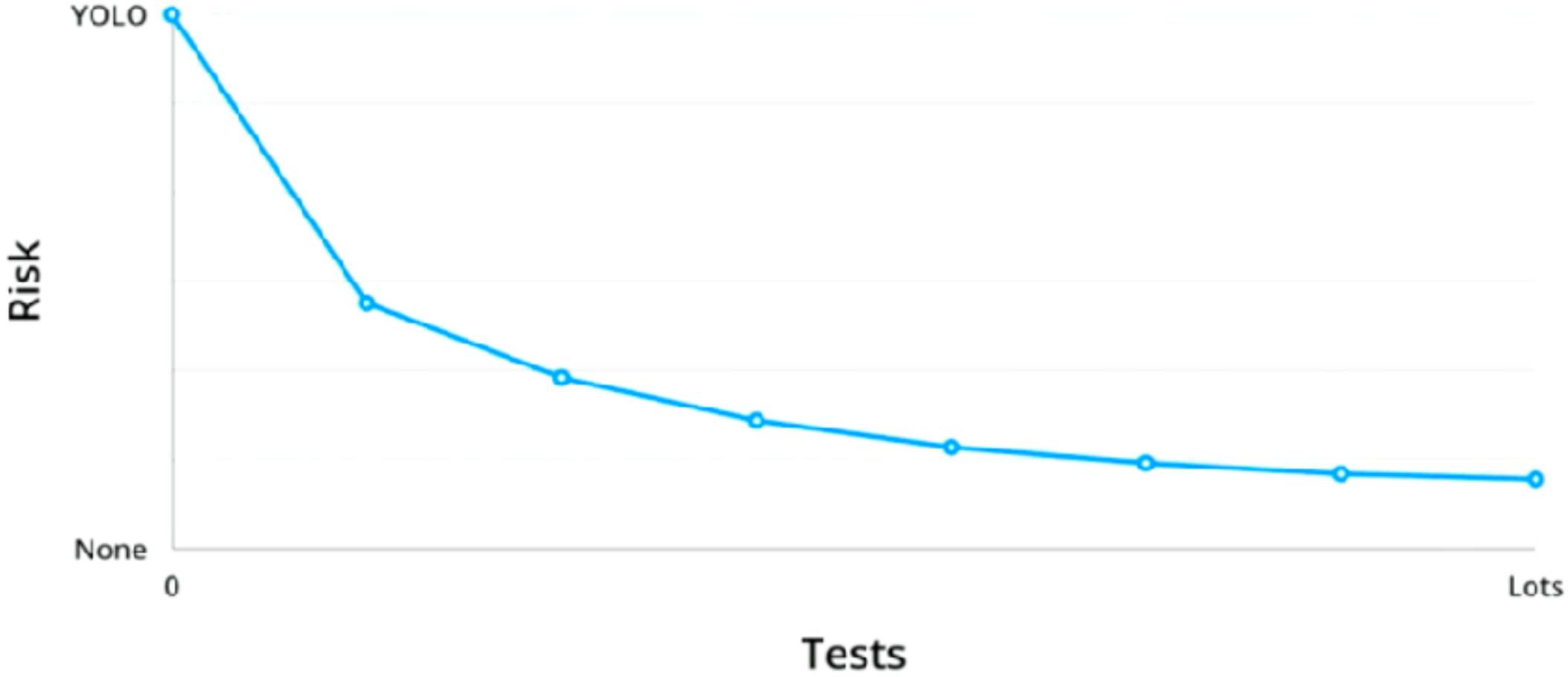
Design your pipeline



Design your pipeline/process



Reduce risk with tests



Start with your journey