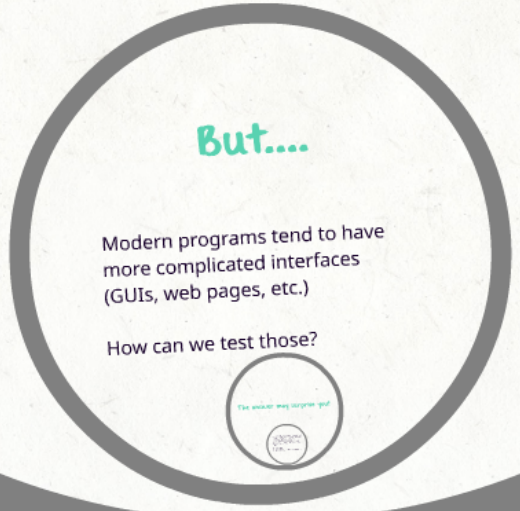
Lecture 15 - An Introduction to Testing Web Applications with Selenium

Lecture 15 - An Introduction to Testing Web Applications with Selenium

Image by Tom Mooring

Testing Web Apps

So far, we've talked about testing systems with simple input/output.
Manual testing - Humans perform operations (D1)
Unit testing - Operating on individual methods and functions (D2)
Systems Testing - General textual input/output



But....

Modern programs tend to have more complicated interfaces (GUIs, web pages, etc.)

How can we test those?

The answer may surprise you!

We can actually use many of the same tools and techniques to test more complicated interfaces. Now that you understand the basics of automated testing, it's possible to take what you've learned and apply it to a more complex interface.

But this remains -
EXPECTED BEHAVIOR vs OBSERVED BEHAVIOR

We can actually use many of the same tools and techniques to test more complicated interfaces. Now that you understand the basics of automated testing, it's possible to take what you've learned and apply it to a more complex interface.

But this remains -
EXPECTED BEHAVIOR vs OBSERVED BEHAVIOR

Testing the Web

The web is just text (HTML).

Specially formatted text, but text nonetheless.

Really, everything comes down to 1s and 0s. If your computer can display it, it can be tested.*

* It doesn't even need to be displayed, e.g. music can be tested.

Theoretically, then, we could test the web like so:

```
@Test
public void testWeb() {
  String expectedHtml = "<body><strong>Hello, world!</strong></body>";
  String pageText = getPage("http://example.com");
  assertEquals(expectedHtml, pageText);
}
```

Any downsides?

1. Change the page, change the entire test
   --> Fragile tests!
2. What about JavaScript?
3. Unreadable
4. Simplistic and low-level
   --> Kind of like programming in assembly
5. No understanding of e.g. links, textboxes

Solution

Web Testing Framework

Think of these as a higher-level programming language for testing.

```
1 pushl %ebp #
2 movl %esp, %ebp #,
3 subl $4, %esp #,
4 movl $1, -4(%ebp) #, a
5 leal -4(%ebp), %eax #,
6 addl $1, (%eax) #, a
7 leave
8 ret
```

→

```
void function1() {
  int a = 1;
  a = a + 1;
}
```

Or think of them as a library of functions.

Outside of class, who writes a linked list? Or Hashmap? Just import a library instead of writing it yourself.

Remember, we want to use the same principles we used for manual and our previous automated testing. We're just working at a higher layer of abstraction.

The web is just text (HTML).

Specially formatted text, but text nonetheless.

Really, everything comes down to 1s and 0s. If your computer can display it, it can be tested.*

* It doesn't even need to be displayed, e.g. music can be tested.

Theoretically, then, we could test the web like so:

```
@Test
public void testWeb() {
  String expectedHtml = "<body><strong>Hello,
world!</strong></body>";
  String pageText = getPage("http://example.com");
  assertEquals(expectedHtml, pageText);
}
```

Any downsides?

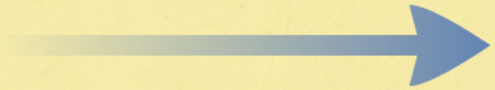
1. Change the page, change the entire test
   --> Fragile tests!
2. What about JavaScript?
3. Unreadable
4. Simplistic and low-level
   --> Kind of like programming in assembly
5. No understanding of e.g. links, textboxes

Solution

Web Testing Framework

Think of these as a higher-level programming language for testing.

```
1 pushl %ebp #
2 movl %esp, %ebp #,
3 subl $4, %esp #,
4 movl $1, -4(%ebp) #, A
5 leal -4(%ebp), %eax #,
6 addl $1, (%eax) #, A
7 leave
8 ret
```



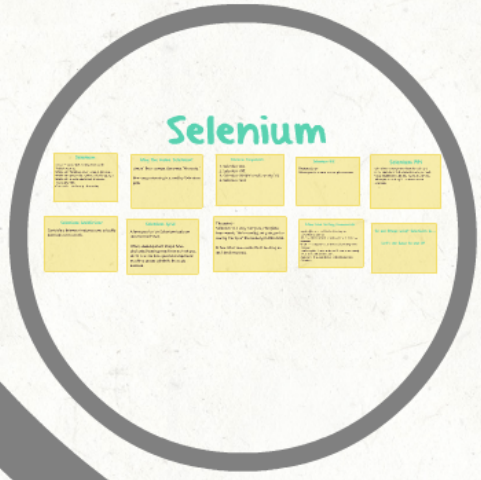
```
void function1() {
  int a = 1;
  a = a + 1;
}
```

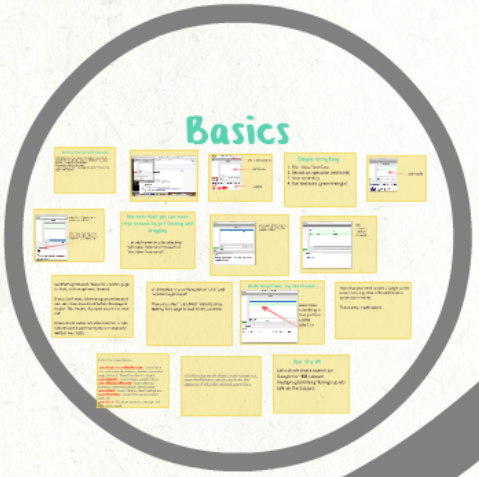
Or think of them as a library of functions.

Outside of class, who writes a linked list? Or Hashmap? Just import a library instead of writing it yourself.

Remember, we want to use the same principles we used for manual and our previous automated testing. We're just working at a higher layer of abstraction.

Testing the Web with Selenium





Selenium

Selenium

An open-source web testing framework.
Battle-hardened.
Works with Windows, OS X, Linux, other OSes
Works with Java, Ruby, Python, other languages.
Works with most modern web browsers.
Has its own IDE.
Can also be used for quick scripting.

Why the name Selenium?

One of their competitors was "Mercury."

Mercury poisoning is cured by Selenium pills.

Selenium Components

1. Selenium IDE
2. Selenium API
3. Selenium WebDriver (formerly RC)
4. Selenium Grid

Selenium IDE

Firefox add-on
Allows you to record and re-play macros

Selenium API

Behind the scenes, this is how the code you write interacts with the Selenium engine itself. You probably won't be dealing much with this unless you're porting Selenium to a new language.

Selenium WebDriver

Controls a browser instance and actually executes commands.

Selenium Grid

Allows you to run Selenium tests on remote machines.

Often, development shops have dedicated testing machines so that you don't need to have your development machine occupied while the tests execute.

The point -
Selenium is a very complex, complete framework. We're really just going to be seeing the tip of the iceberg in this class.

It has other uses aside from testing, as well (web macros).

Other Web Testing Frameworks

Apache JMeter - Used for load testing and performance testing
iMacros - More GUI like scripting. I used it for easy scraping.
Watir - Directly drives a test instead of taking over a browser.
TestComplete - A similar tool to Selenium but mostly restricted to Microsoft stacks
Capybara - One step above in abstraction from Selenium

So we know what Selenium is....

Let's see how to use it!

Selenium

An open-source web testing framework.
Battle-hardened.
Works with Windows, OS X, Linux, other OSes.
Works with Java, Ruby, Python, other languages.
Works with most modern web browsers.
Has its own IDE.
Can also be used for quick scripting.

Why the name Selenium?

One of their competitors was "Mercury."

Mercury poisoning is cured by Selenium pills.

Selenium Components

1. Selenium IDE
2. Selenium API
3. Selenium WebDriver (formerly RC)
4. Selenium Grid

Selenium IDE

Firefox add-on

Allows you to record and re-play macros

Selenium API

Behind the scenes, this is how the code you write interacts with the Selenium engine itself. You probably won't be dealing much with this unless you're porting Selenium to a new language.

Selenium WebDriver

Controls a browser instance and actually executes commands.

Selenium Grid

Allows you to run Selenium tests on remote machines.

Often, development shops have dedicated testing machines so that you don't need to have your development machine occupied while the tests execute.

The point -
Selenium is a very complex, complete framework. We're really just going to be seeing the tip of the iceberg in this class.

It has other uses aside from testing, as well (web macros).

Other Web Testing Frameworks

Apache JMeter - Used for load testing and performance testing
iMacros - More GUI-like scripting. I used it for easy scraping.
Watir - Directly drives a test instead of taking over a browser.
TestComplete - A similar tool to Selenium but mostly restricted to Microsoft stacks
Capybara - One step above in abstraction from Selenium

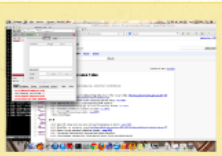
So we know what Selenium is....

Let's see how to use it!

Basics

Getting Started with Selenium

1. Download Firefox (getting Selenium IDE working in Chrome is possible, but more difficult. Google ChromeSelDriver for details)
2. GO TO http://docs.seleniumhq.org/
3. Download and install Selenium
4. Click on the "Go" icon in the upper right-hand corner, or go to Tools -> Selenium IDE

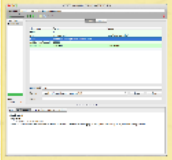


Simple Scripting

1. File... New Test Case
2. Record an operation (red circle)
3. Stop recording
4. Run test suite (green triangle)

Also note that you can move steps around by just clicking and dragging

... or add comments by selecting "Add New Comment" instead of "Add New Command"



waitForPageToLoad - Waits for another page to load, with an optional timeout.

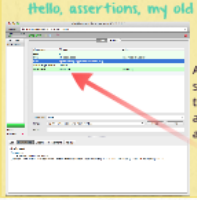
If you don't wait, Selenium goes as fast as it can, and may do a check before the page is ready. This means that your assertions may fail!

Intermittent (a/k/a non-deterministic or ND failures) are a common symptom of poorly written web tests.

clickAndWait -> a combination of "click" and "waitForPageToLoad"

There are other "...andWait" variants since waiting for a page to load is very common.

Hello, assertions, my old friend...



Assert that something is true, just like a JUnit assertion

Note that you need to give a target to the assertions, e.g., that it should be on a particular element.

This is simple with select.

Lots of fun assertions...

assertText / assertTextPresent - Assert that text exists (on an element (former) or entire page (latter)). Note that this is a regex!
assertCookie - Assert that a cookie exists.
assertElementPresent - Assert that an element exists somewhere on the page.
assertAlert - Assert that an alert took place.
assertEditable - Assert that an element is editable.
assertEval - Evaluate some JavaScript and assert the result.

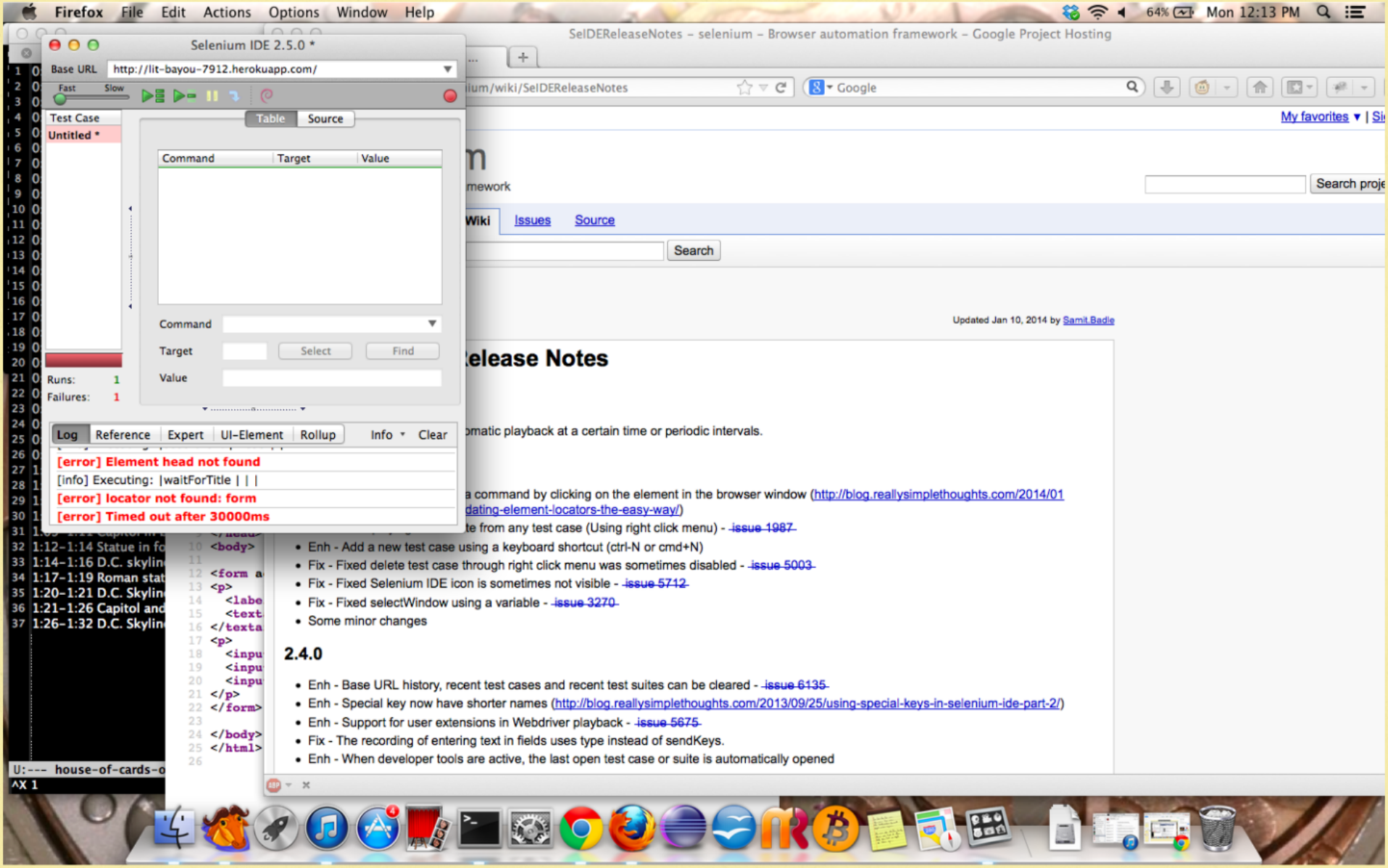
All of the asserts also have a not-variant, e.g., assertNotEditable, which checks for the opposite of what the original assert does.

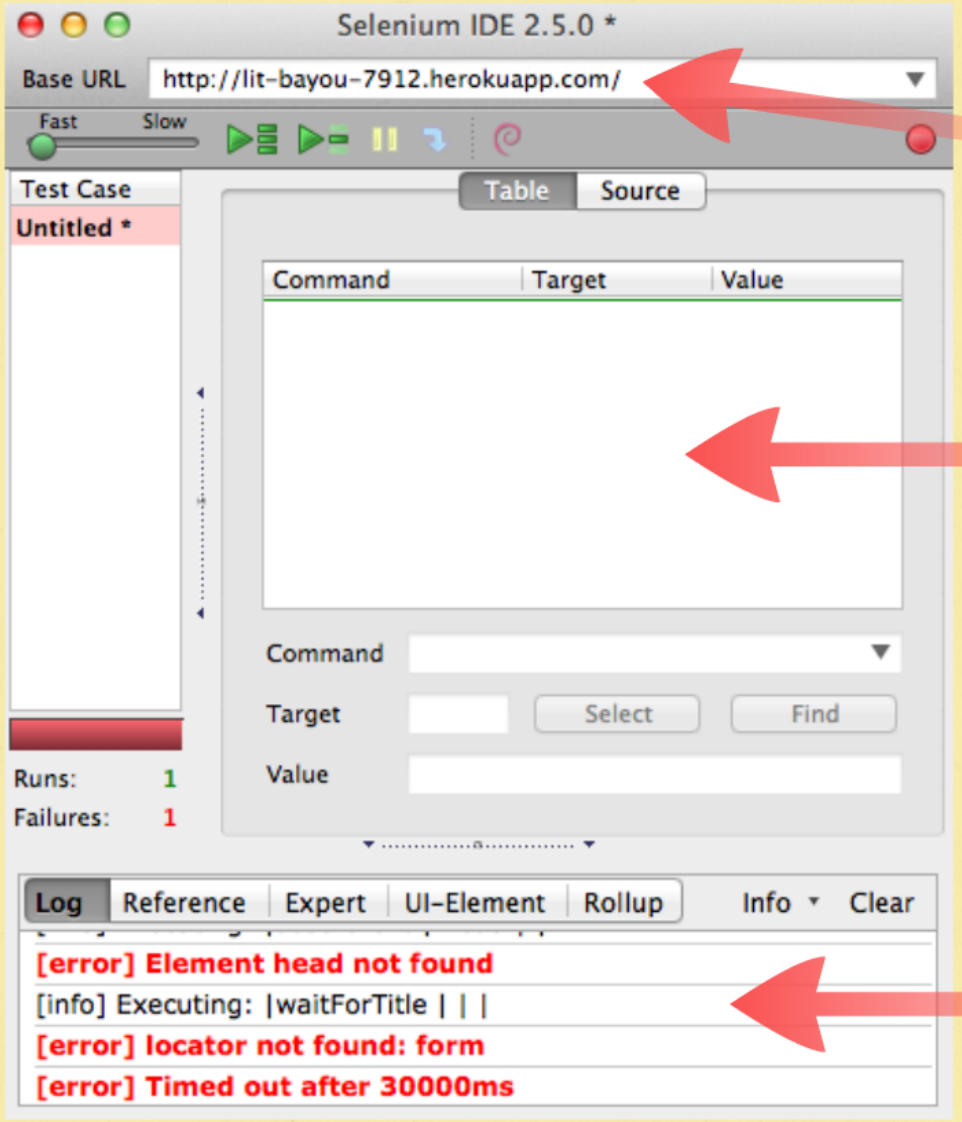
You Try It!

Let's check that a search on Google for "Bill Laboon metaprogramming" brings up my talk on the subject.

Getting Started with Selenium

1. Download Firefox (getting Selenium IDE working in Chrome is possible, but more difficult. Google ChromeDriver for details)
2. Go to http://docs.seleniumhq.org/
3. Download and install Selenium
4. Click on the "Se" icon in the upper right-hand corner, or go to Tools -> Selenium IDE


Firefox File Edit Actions Options Window Help
Mon 12:13 PM
Selenium IDE 2.5.0 *
Base URL http://lit-bayou-7912.herokuapp.com/
Fast Slow
Test Case
Untitled *
Table Source
Command Target Value
Command
Target Select Find
Value
Runs: 1
Failures: 1
Log Reference Expert UI-Element Rollup Info Clear
[error] Element head not found
[info] Executing: |waitForTitle | | |
[error] locator not found: form
[error] Timed out after 30000ms
SelDEReleaseNotes - selenium - Browser automation framework - Google Project Hosting
Google
My favorites
Wiki Issues Source
Search
Updated Jan 10, 2014 by Samit.Badle
elease Notes
omatic playback at a certain time or periodic intervals.
a command by clicking on the element in the browser window (http://blog.reallysimplethoughts.com/2014/01
dating-element-locators-the-easy-way/)
te from any test case (Using right click menu) - issue 1987
Enh - Add a new test case using a keyboard shortcut (ctrl-N or cmd+N)
Fix - Fixed delete test case through right click menu was sometimes disabled - issue 5003
Fix - Fixed Selenium IDE icon is sometimes not visible - issue 5712
Fix - Fixed selectWindow using a variable - issue 3270
Some minor changes
2.4.0
Enh - Base URL history, recent test cases and recent test suites can be cleared - issue 6135
Enh - Special key now have shorter names (http://blog.reallysimplethoughts.com/2013/09/25/using-special-keys-in-selenium-ide-part-2/)
Enh - Support for user extensions in Webdriver playback - issue 5675
Fix - The recording of entering text in fields uses type instead of sendKeys.
Enh - When developer tools are active, the last open test case or suite is automatically opened
U:--- house-of-cards-o
^X 1



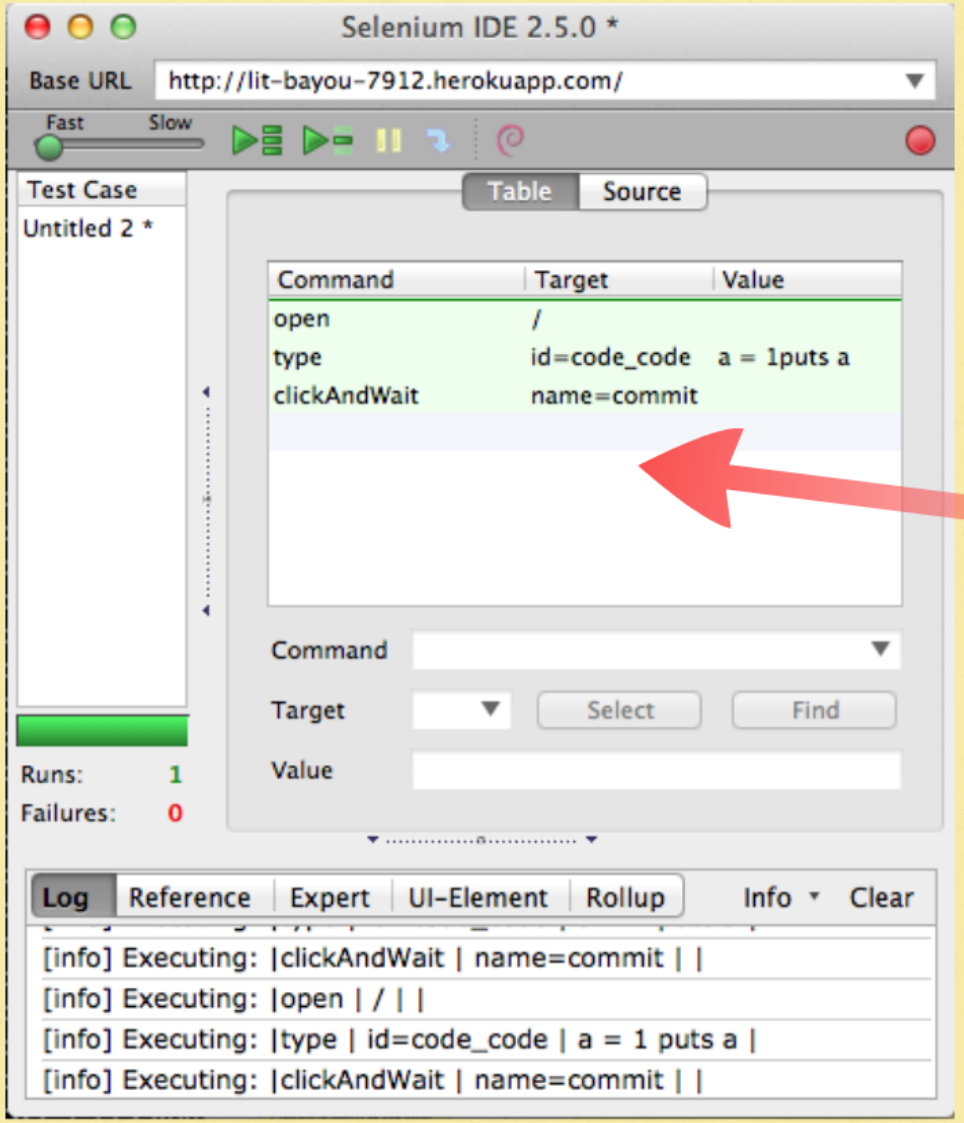
URL to start script at

Commands

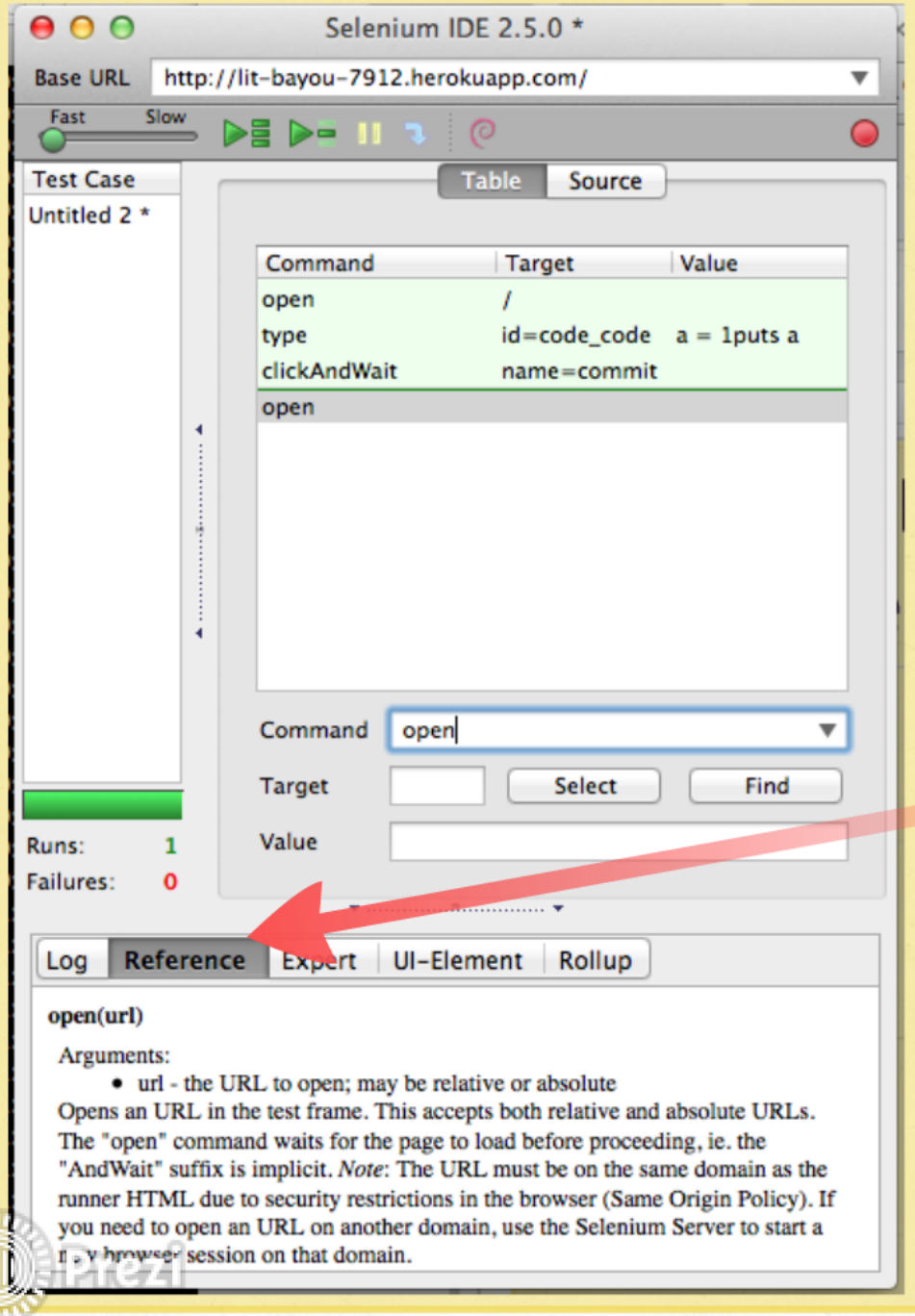
Logging

Simple Scripting

1. File... New Test Case
2. Record an operation (red circle)
3. Stop recording
4. Run test suite (green triangle)



Our code

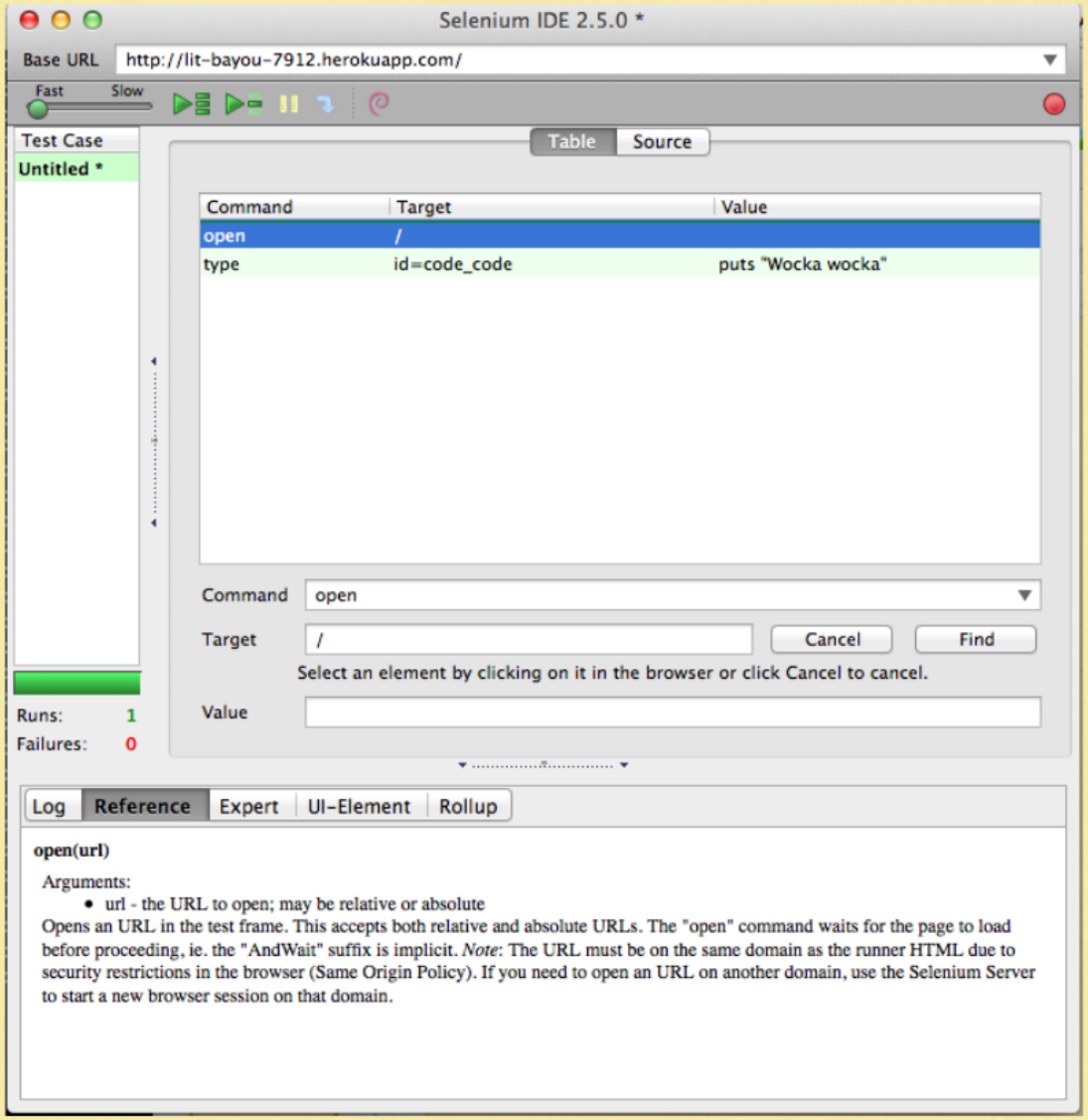


open <URL> - Opens either an absolute or relative URL

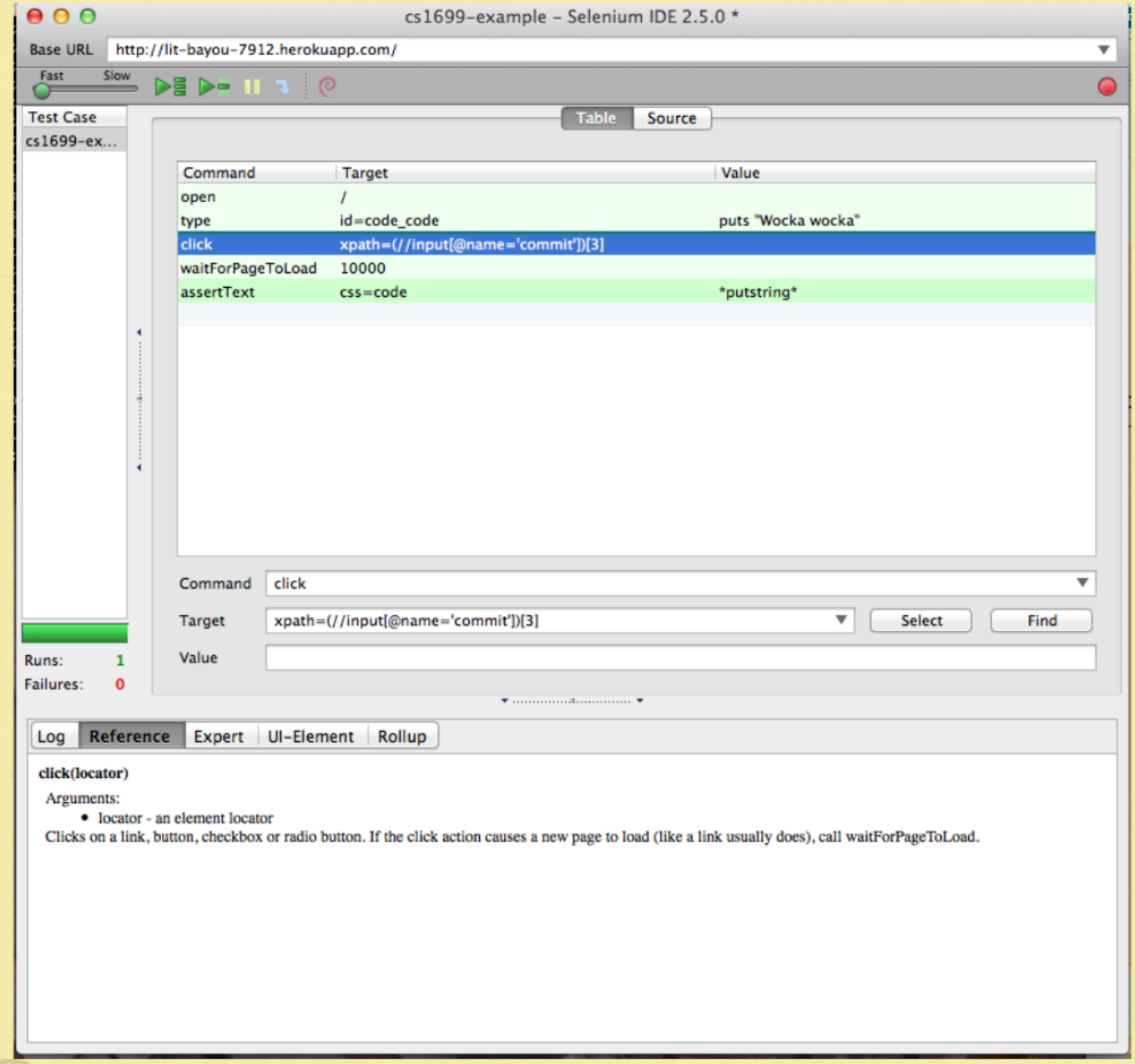
Note that you can check what an operation does by clicking on the "Reference" tab at the bottom

Also note that you can move steps around by just clicking and dragging

... or add comments by selecting "Add New Comment" instead of "Add New Command"



type <target> <value> will type a string in the appropriate target (textbox or similar)



click
<element>
- clicks on
an element

waitForPageToLoad - Waits for another page to load, with an optional timeout.

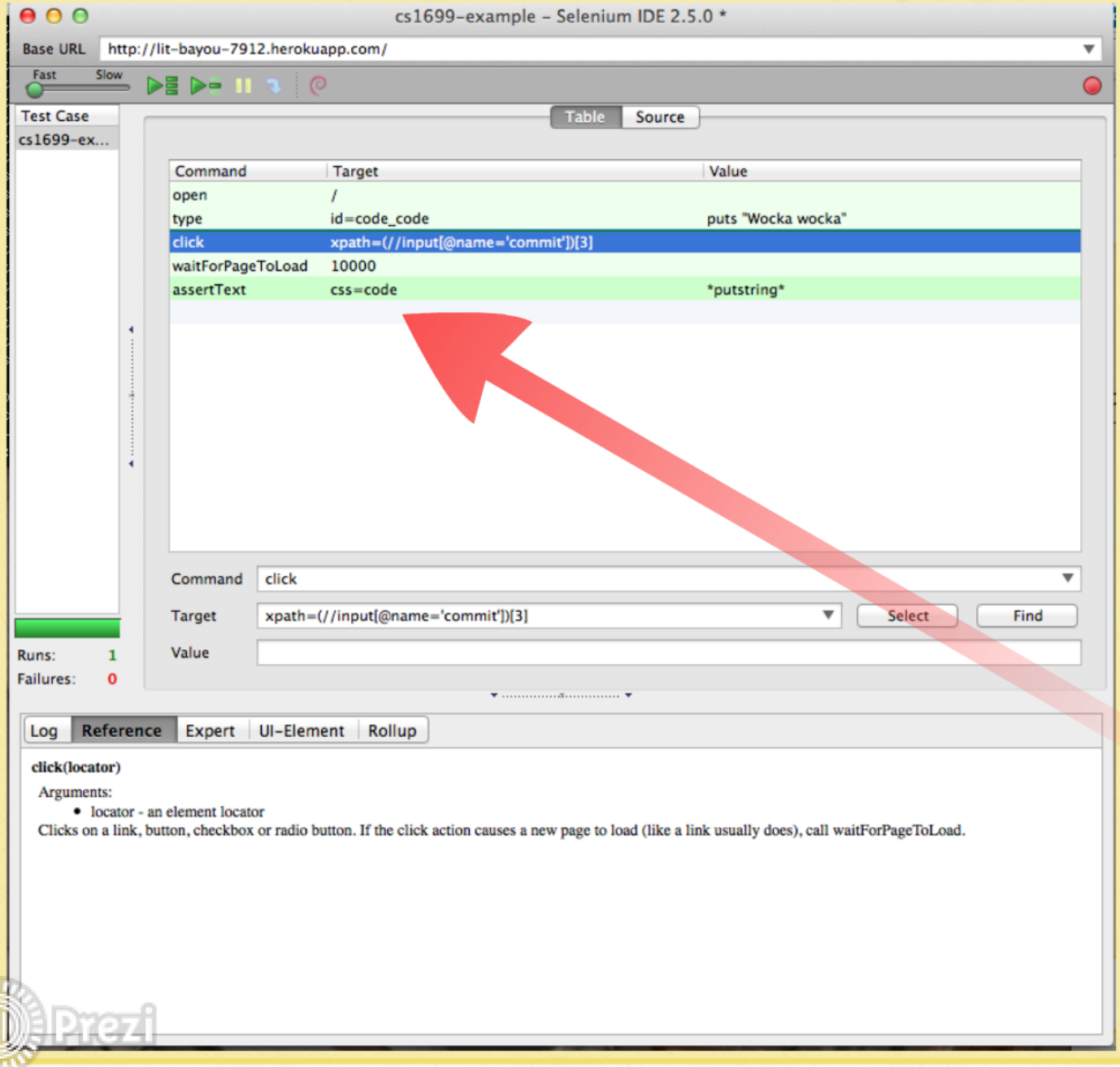
If you don't wait, Selenium goes as fast as it can, and may do a check before the page is ready. This means that your assertions may fail!

Intermittent (a/k/a non-deterministic or ND failures) are a common symptom of poorly written web tests.

clickAndWait -> a combination of "click" and "waitForPageToLoad"

There are other "...andWait" variants since waiting for a page to load is very common.

Hello, assertions, my old friend...



Assert that something is true, just like a JUnit assertion

Note that you need to give a target to the assertions, e.g., that it should be on a particular element.

This is simple with select.

Lots of fun assertions...

assertText / assertTextPresent - Assert that text exists (on an element (former) or entire page (latter)). Note that this is a regex!
assertCookie - Assert that a cookie exists.
assertElementPresent - Assert that an element exists somewhere on the page.
assertAlert - Assert that an alert took place.
assertEditable - Assert that an element is editable.
assertEval - Evaluate some JavaScript and assert the result.

All of the asserts also have a not-variant, e.g., assertNotEditable, which checks for the opposite of what the original assert does.

You Try It!

Let's check that a search on Google for "Bill Laboon metaprogramming" brings up my talk on the subject.

More Selenium

Next Lecture!

Next Lecture!

Lecture 15 - An Introduction to Testing Web Applications with Selenium

Image by Tom Mooring