Selenium Webdriver Primer

Spensa Technologies, Inc
Sept. 22, 2016

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Testing vs Checking

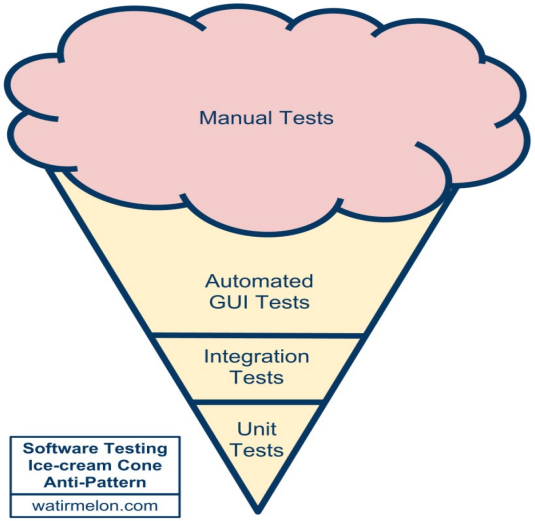
<u>Testing is...</u>

* Exploring & Learning
* Experimenting
* Judgment & Values
* Answers the question
  "*Is there a problem?*"

<u>Checking is...</u>

* Confirming
* Pass / Fail
* "It Works" vs "It Operates"

Typical Testing Pyramid

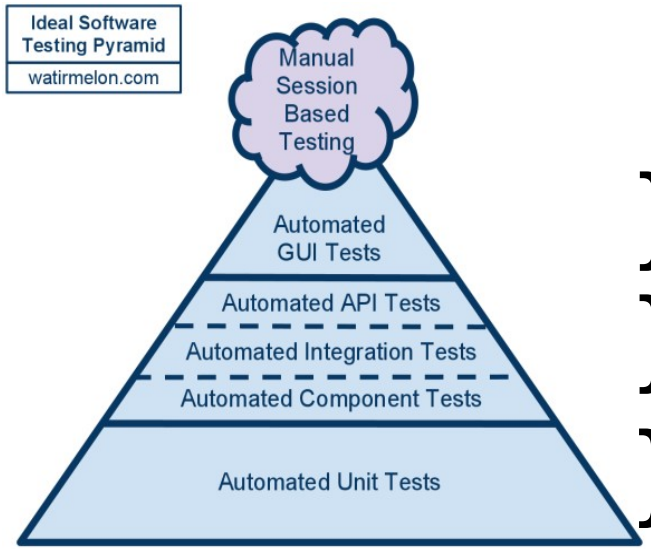


Too many GUI & Manual Tests

Very few Unit & Integration Tests

Ideal Automated Testing Pyramid & Ice-cream Cone Antipattern - http://watirmelon.com/2012/01/31/introducing-the-software-testing-ice-cream-cone/

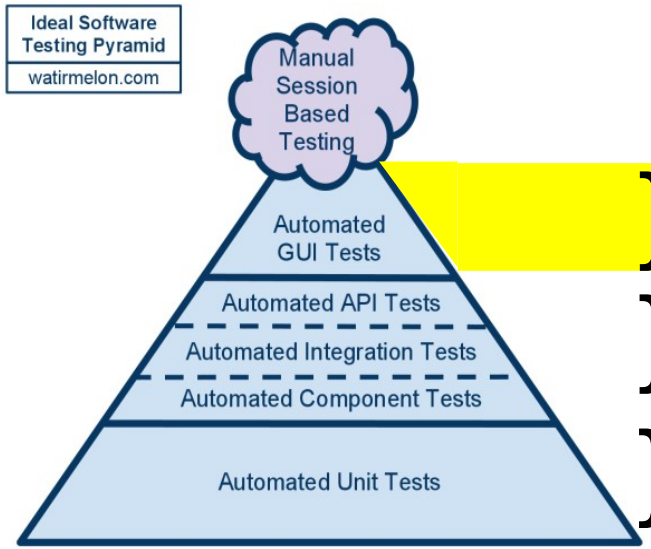
Ideal Testing Pyramid



} User Interface Tests
} Service Layer Tests
} Unit Tests

Ideal Automated Testing Pyramid & Ice-cream Cone Antipattern - http://watirmelon.com/2012/01/31/introducing-the-software-testing-ice-cream-cone/

Ideal Testing Pyramid



} User Interface Tests

} Service Layer Tests

} Unit Tests

Ideal Automated Testing Pyramid & Ice-cream Cone Antipattern - http://watirmelon.com/2012/01/31/introducing-the-software-testing-ice-cream-cone/

Automated Testing Tools

Web Crawlers

CrawlJax

IBM AppScan

Pros:

- Little Developer Coordination
- Semi directed exploration
- Web App is a black box

Cons:

- Time consuming to run
- No authority to judge results

Automated Testing Tools

Test Recorders

Selenium

QuickTest Pro

Sahi Pro

Pros:

- Very customizable
- Produces specific targeted tests
- Programmable in a script

Cons:

- Time consuming to build tests
- Allows for brittle test designs

Automated Testing Tools

Test Recorders

Selenium

QuickTest Pro

Sahi Pro

- Developed By Jason Huggins and Simon Stewart at ThoughtWorks
- Browser vendor support through W3C spec
- Automation written in “your favorite language”...
- Worldwide support Community

Automated Testing Tools

Test Recorders

Selenium

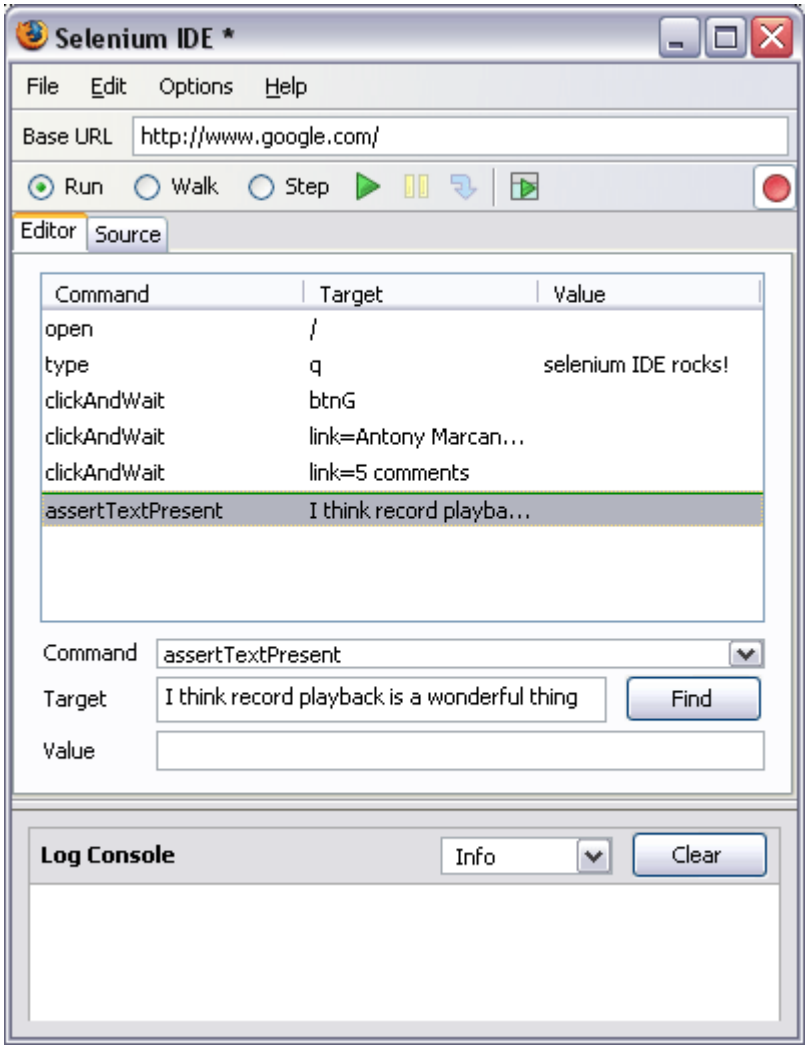
QuickTest Pro

Sahi Pro

What can it do?

- Open web browser
- Locate elements on page
- Type in or click elements
- Wait for triggered events
- Simulate moving the mouse

A brief word about Selenium IDE...

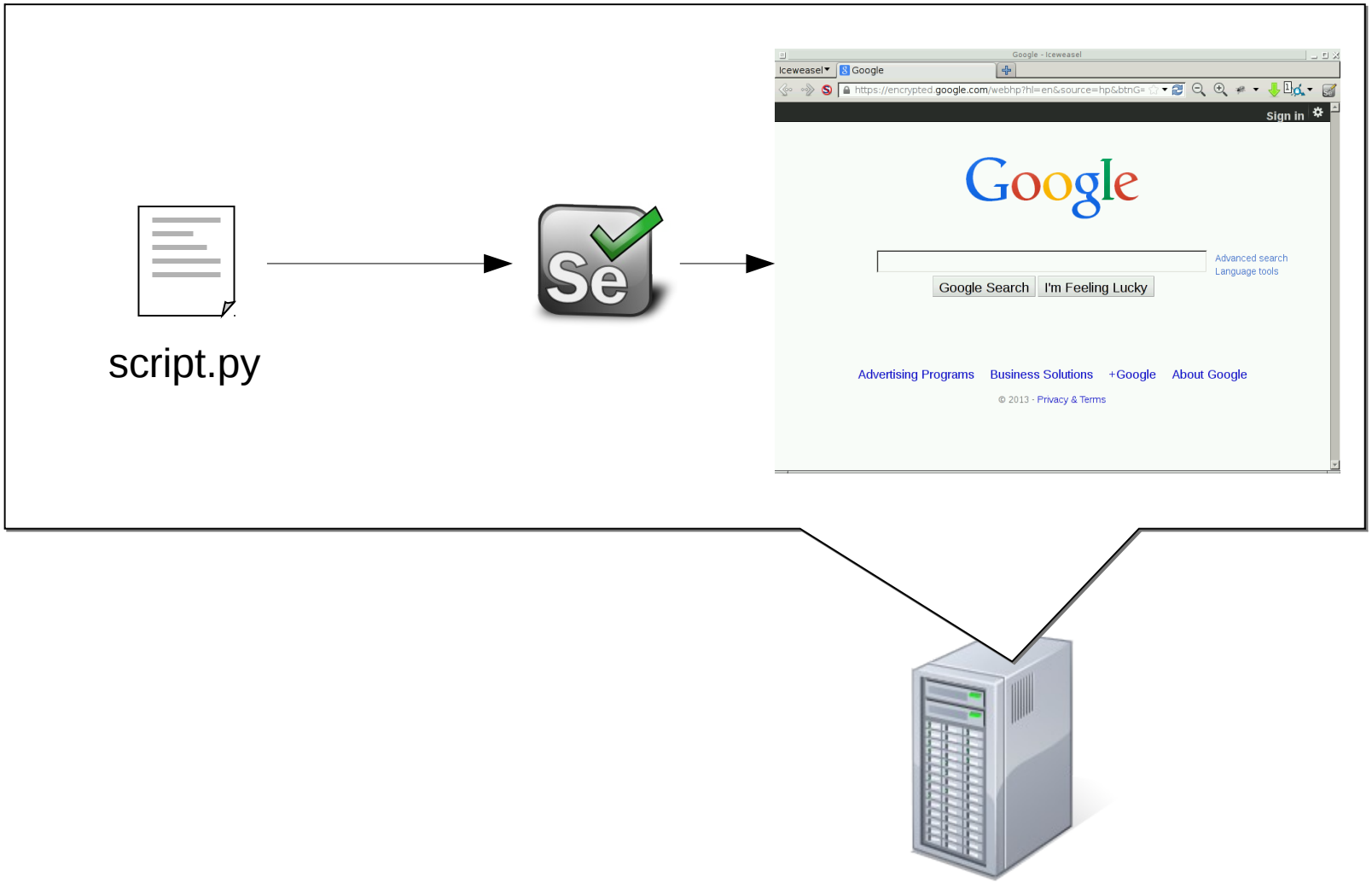


What can it do?

- Record actions, replay as tests
- Works in Firefox only
- Selenium 1.0 style tests
- Tests can be brittle

Try it out, then move on

How Selenium Works



Login

Log in with your Hub account.

Username:

Forgot your Username?

Password:

Forgot your Password?

☐ Remember Me

Login

No account?

Register. It's free!

Is this really free?

Yes! Use of HUBzero resources and tools is *free* for registered users. There are no hidden costs or fees.

Why is registration required for parts of HUBzero?

Our sponsors ask us who uses HUBzero and what they use it for. Registration helps us answer these questions. Usage statistics also focus our attention on improvements, making the HUBzero experience better for *you*.

Login

Log in with your Hub account.

Username:

hctest

Forgot your Username?

Password:

Forgot your Password?

☐ Remember Me

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Login | Register

Search

HUB0

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You are here: Login

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Loading the Selenium Webdriver module:

```
from selenium import webdriver
```

Start a web browser:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
```

Navigating to a web page:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)
```

Closing a web browser:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)
...
browser.quit()
```

Finding elements on a web page:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)

browser.find_element(...)
browser.find_element_by_*(...)

browser.quit()
```

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Forgot your Username?

Password:

Forgot your Password?

☐ Remember Me

Login

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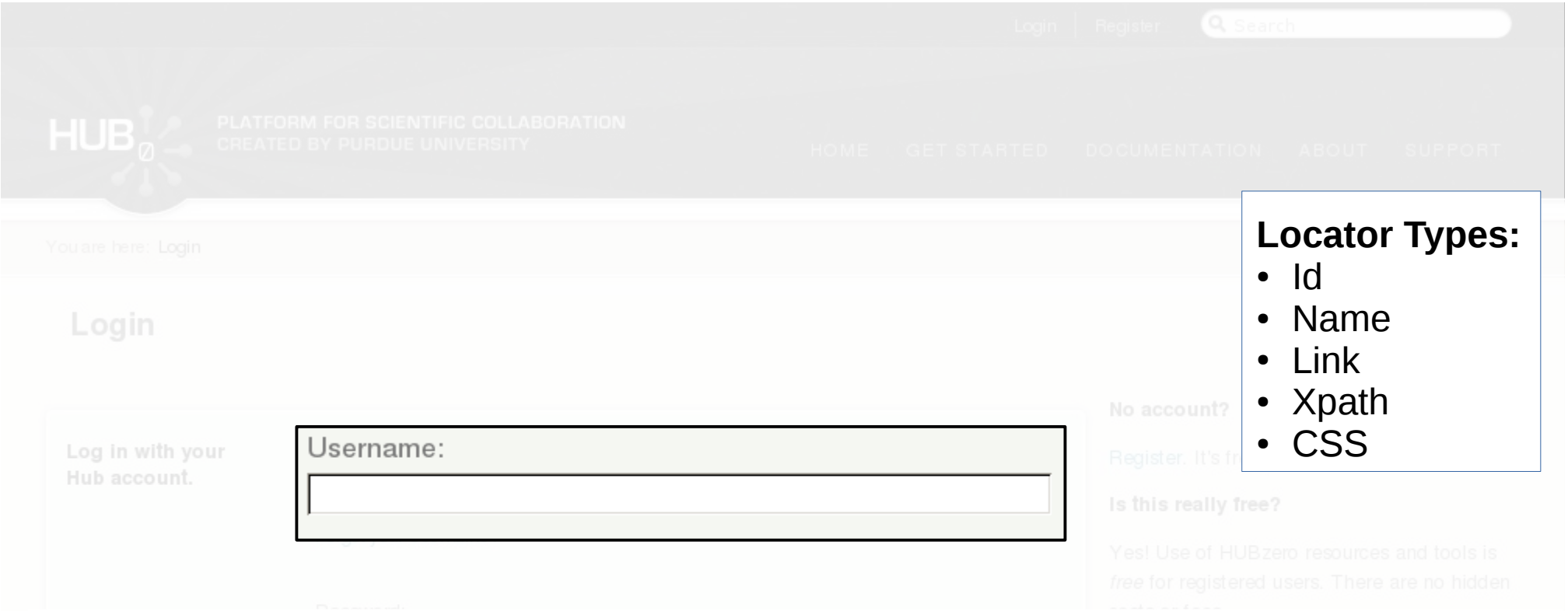
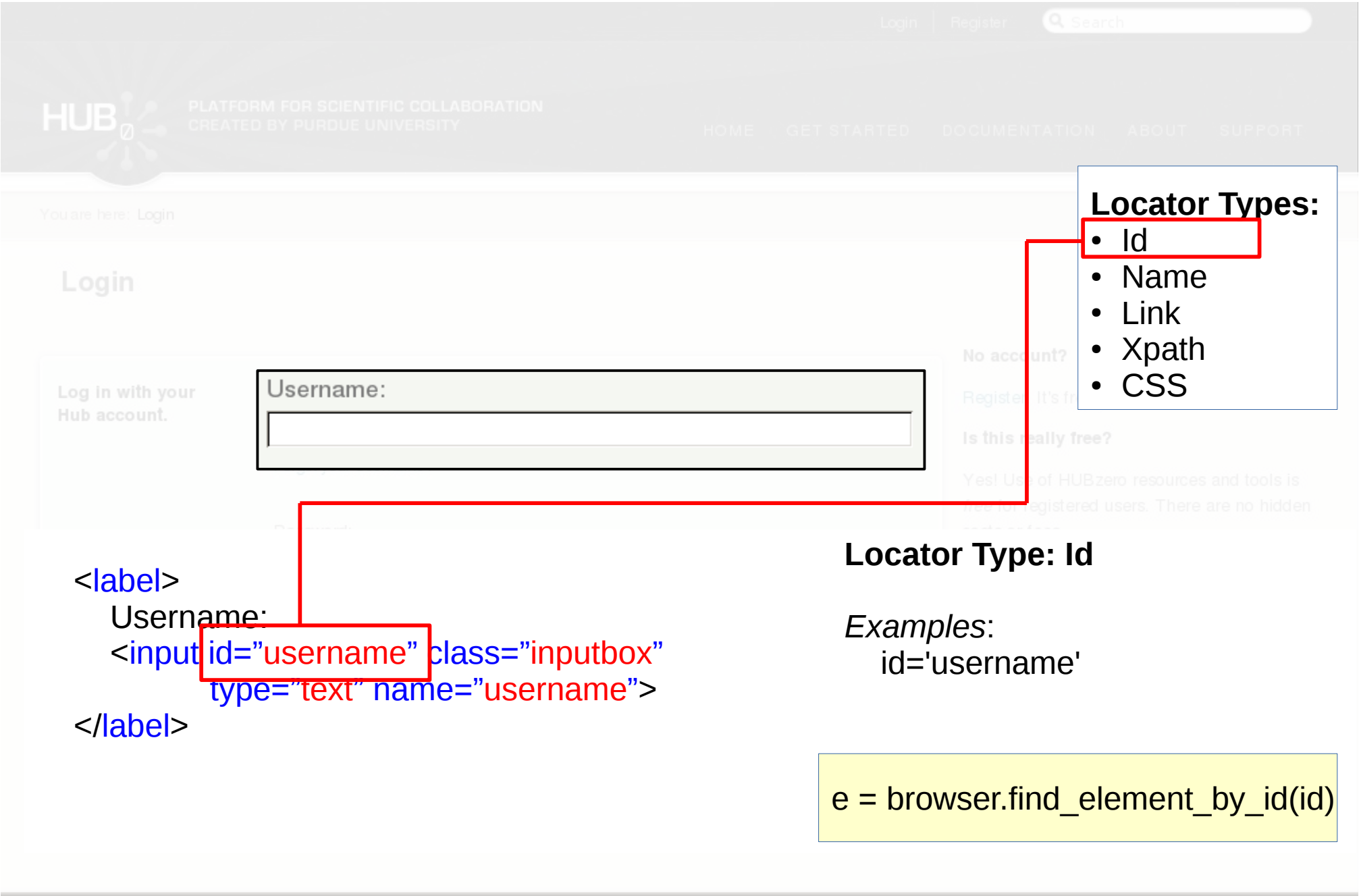


Locator Types:

- Id
- Name
- Link
- Xpath
- CSS

```
<label>
   Username:
   <input id="username" class="inputbox"
          type="text" name="username">
</label>
```



Locator Types:

- Id
- Name
- Link
- Xpath
- CSS

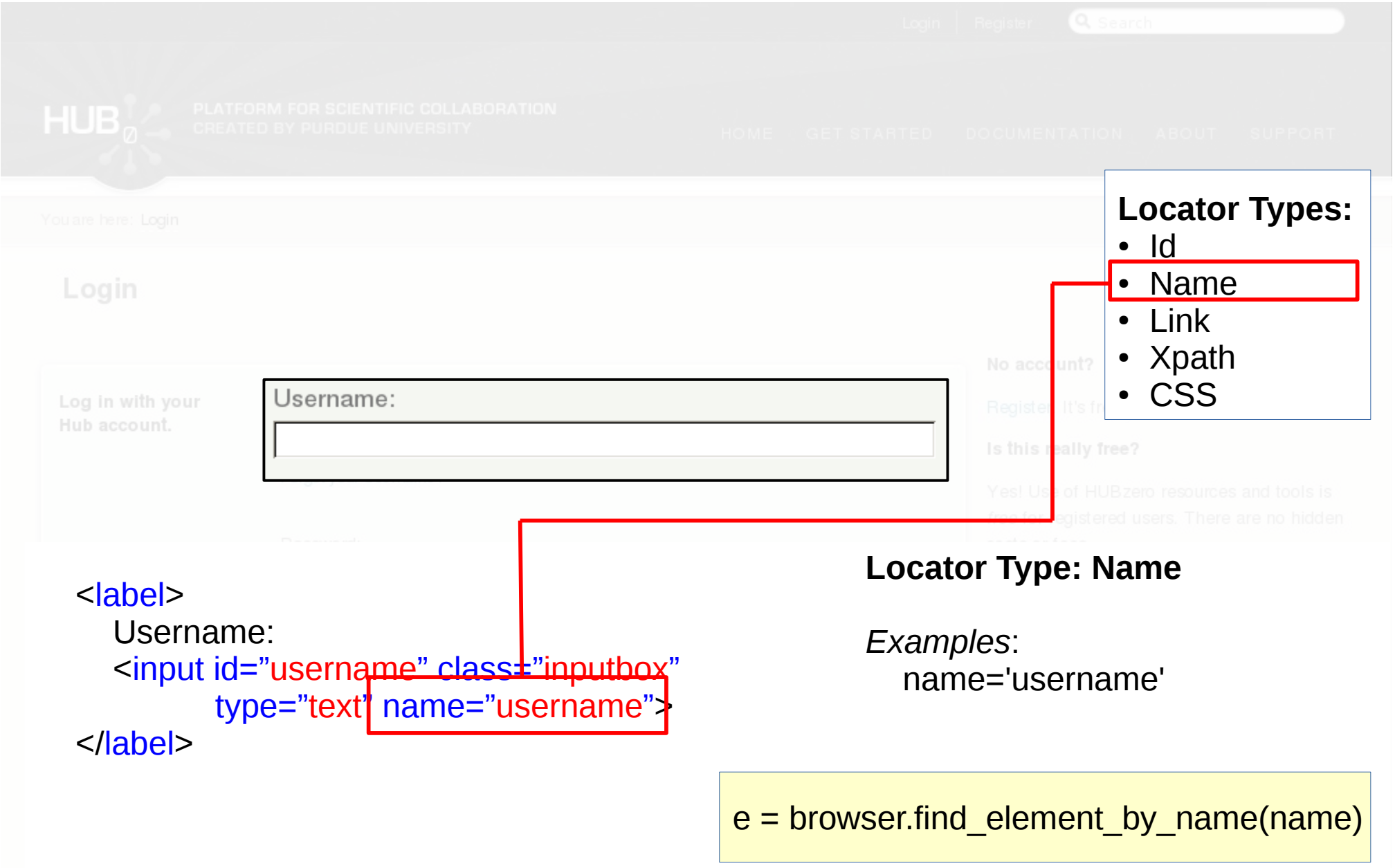
```
<label>
    Username:
    <input id="username" class="inputbox"
           type="text" name="username">
</label>
```

Locator Type: Id

Examples:

id='username'

```
e = browser.find_element_by_id(id)
```



Locator Types:

- Id
- Name
- Link
- Xpath
- CSS

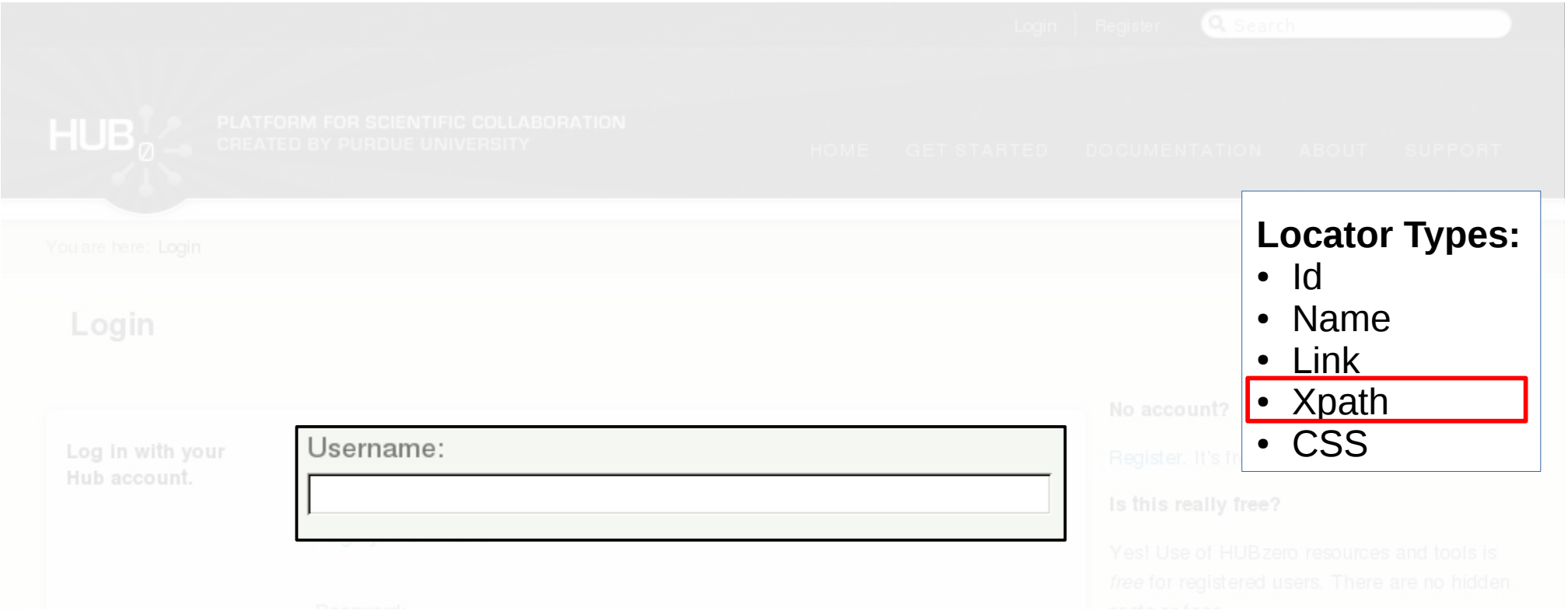
```
<label>
   Username:
   <input id="username" class="inputbox"
          type="text" name="username">
</label>
```

Locator Type: Name

Examples:

name='username'

```
e = browser.find_element_by_name(name)
```



Locator Types:

- Id
- Name
- Link
- Xpath
- CSS

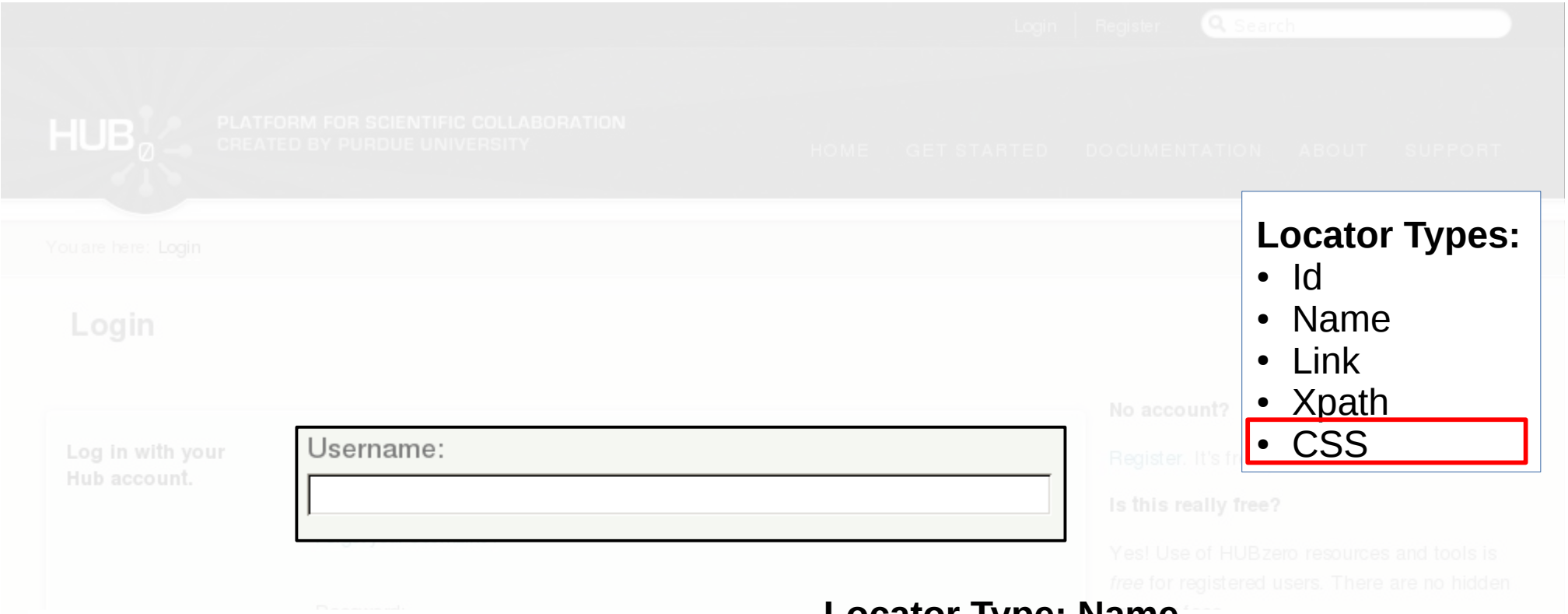
```
<label>
   Username:
   <input id="username" class="inputbox"
          type="text" name="username">
</label>
```

Locator Type: Name

Examples:

loc = "//input[@id='username']"
loc = "//input[contains(@class,'inputbox')]"

```
e = browser.find_element_by_xpath(loc)
```



Locator Types:

- Id
- Name
- Link
- Xpath
- CSS

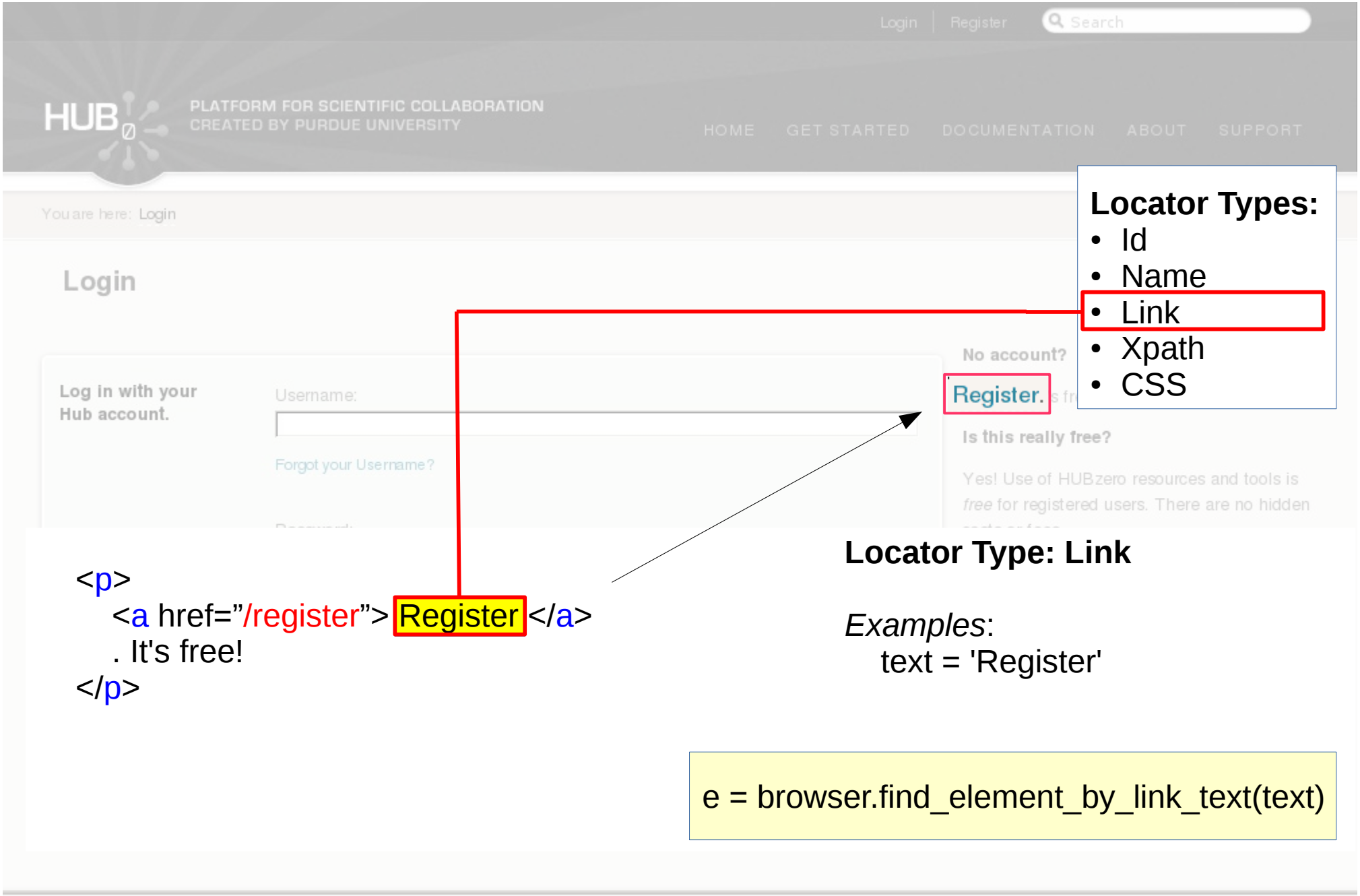
Locator Type: Name

```
<label>
   Username:
   <input id="username" class="inputbox"
          type="text" name="username">
</label>
```

Examples:

loc = "input[id='username']"
loc = "#username"
loc = ".inputbox"

```
e = browser.find_element_by_css_selector(loc)
```



Locator Types:

- Id
- Name
- Link
- Xpath
- CSS

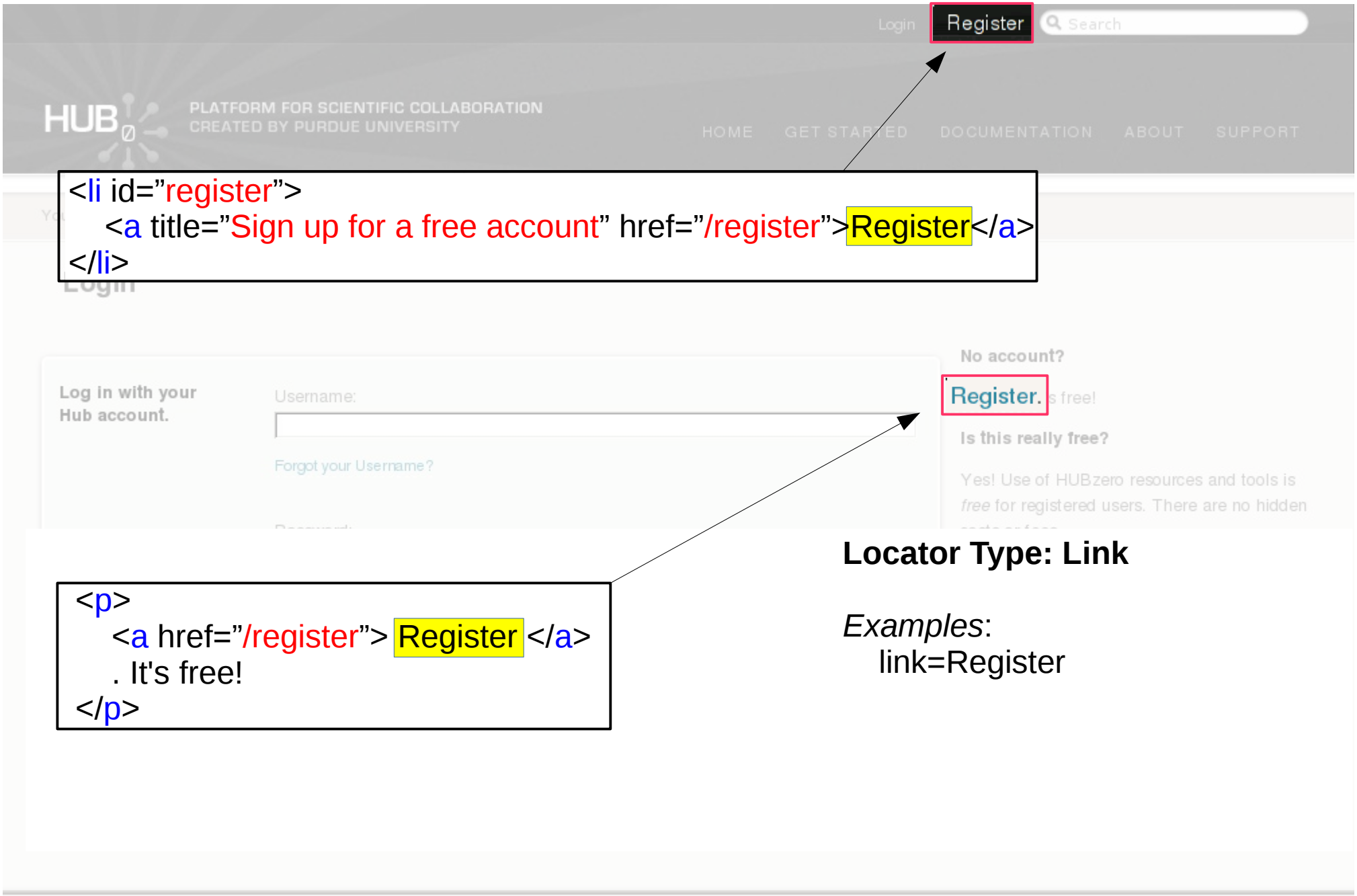
```
<p>
    <a href="/register"> Register </a>
    . It's free!
</p>
```

Locator Type: Link

Examples:

text = 'Register'

```
e = browser.find_element_by_link_text(text)
```




```
<li id="register">
    <a title="Sign up for a free account" href="/register">Register</a>
</li>
```

```
<p>
    <a href="/register"> Register </a>
    . It's free!
</p>
```

Locator Type: Link

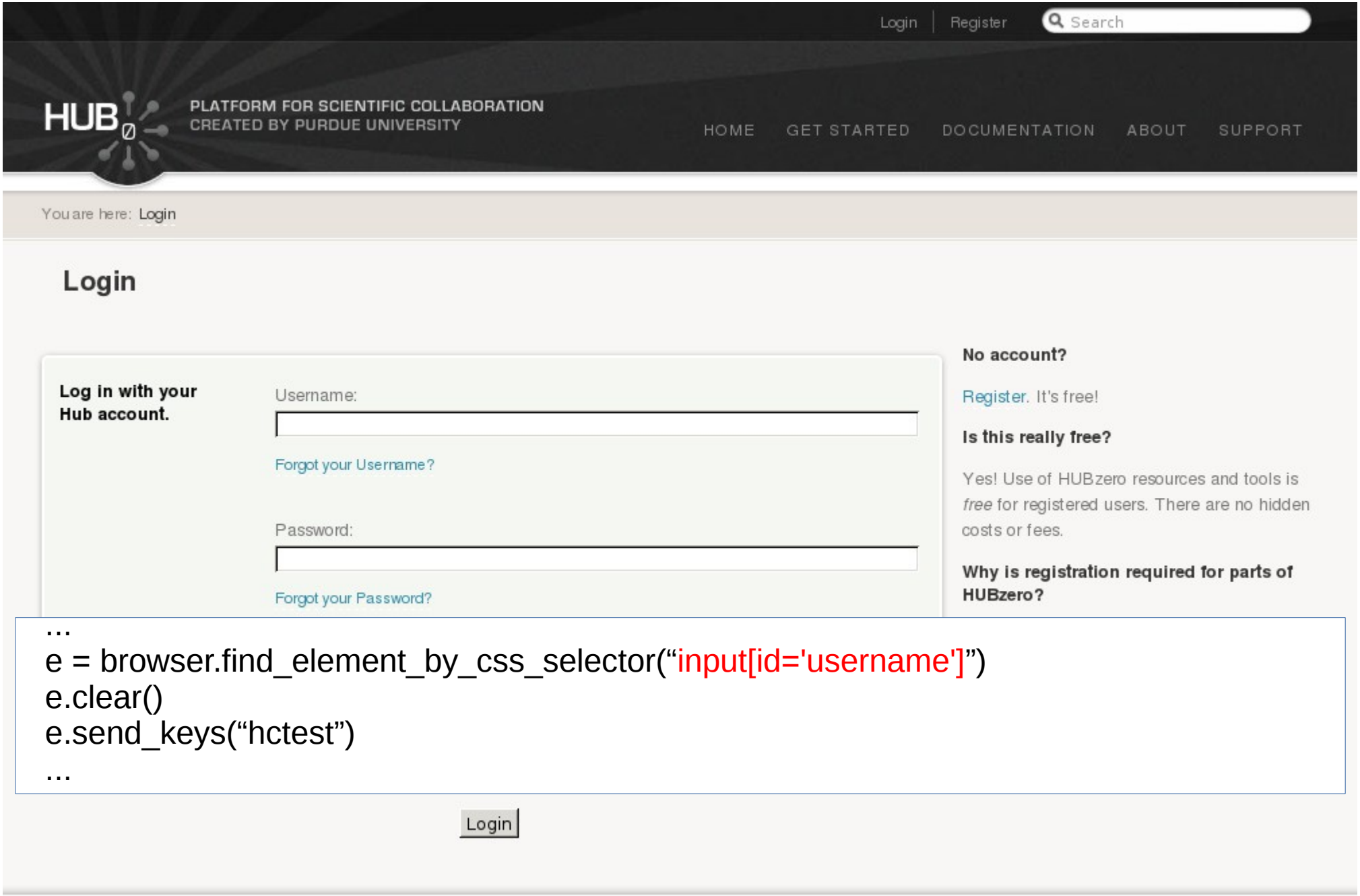
Examples:
link=Register


```
<li id="register">
    <a title="Sign up for a free account" href="/register">Register</a>
</li>
```

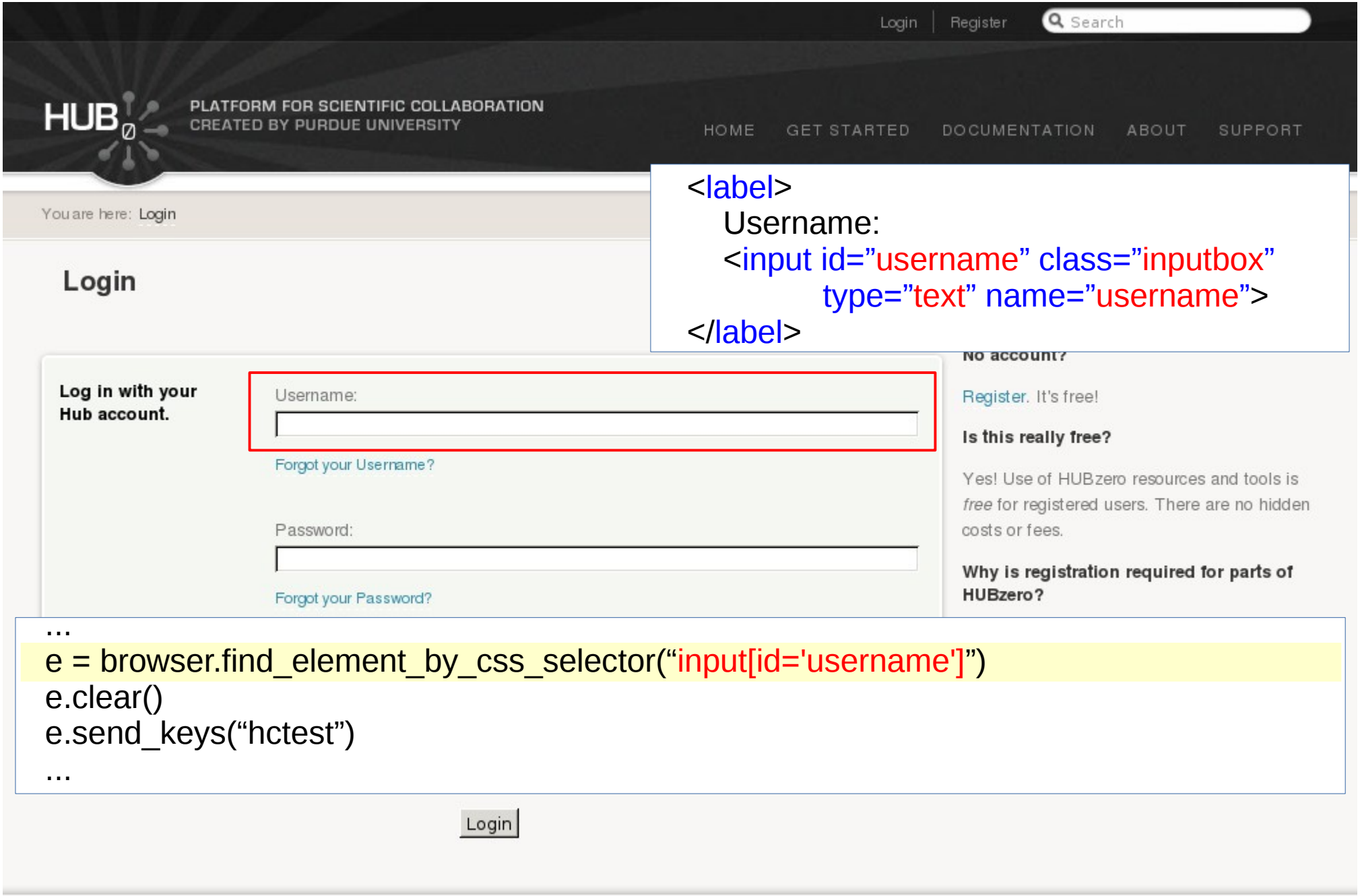
```
<p>
    <a href="/register"> Register </a>
    . It's free!
</p>
```

```
css="li[id='register'] > a"
```

```
css="a[title='Sign up for a free account']"
```

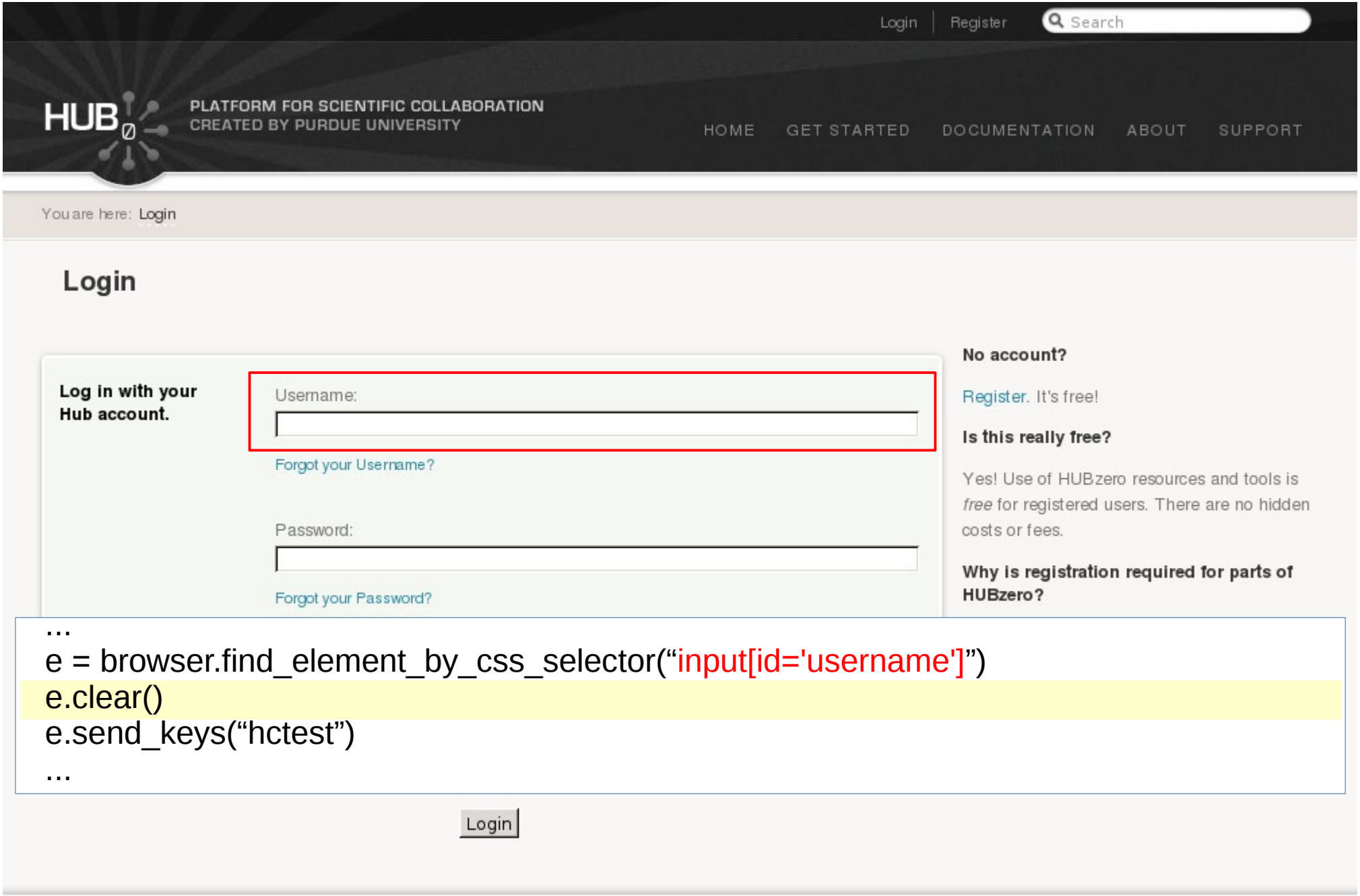



```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")
...
```

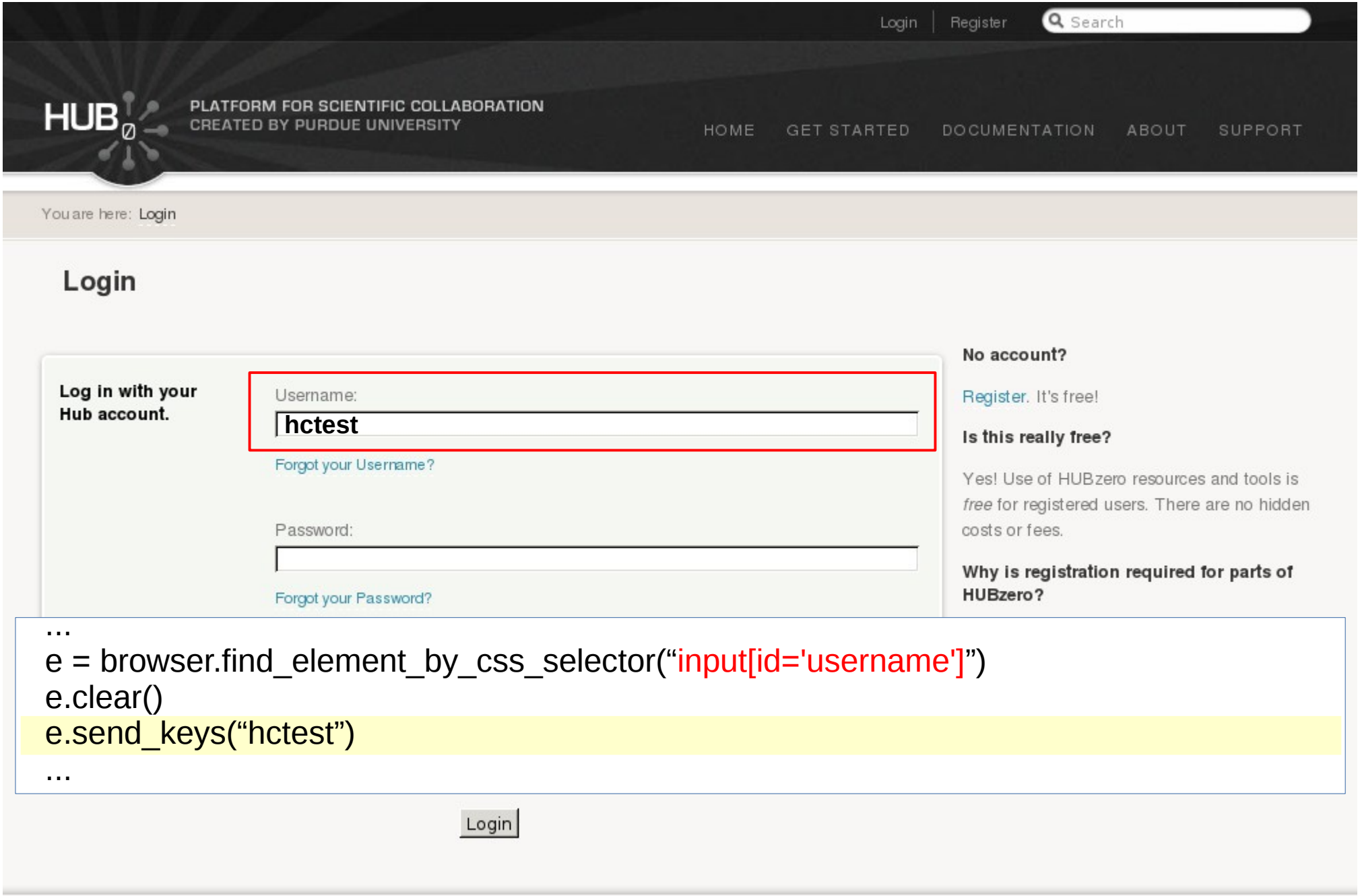



```
<label>
   Username:
   <input id="username" class="inputbox"
          type="text" name="username">
</label>
```

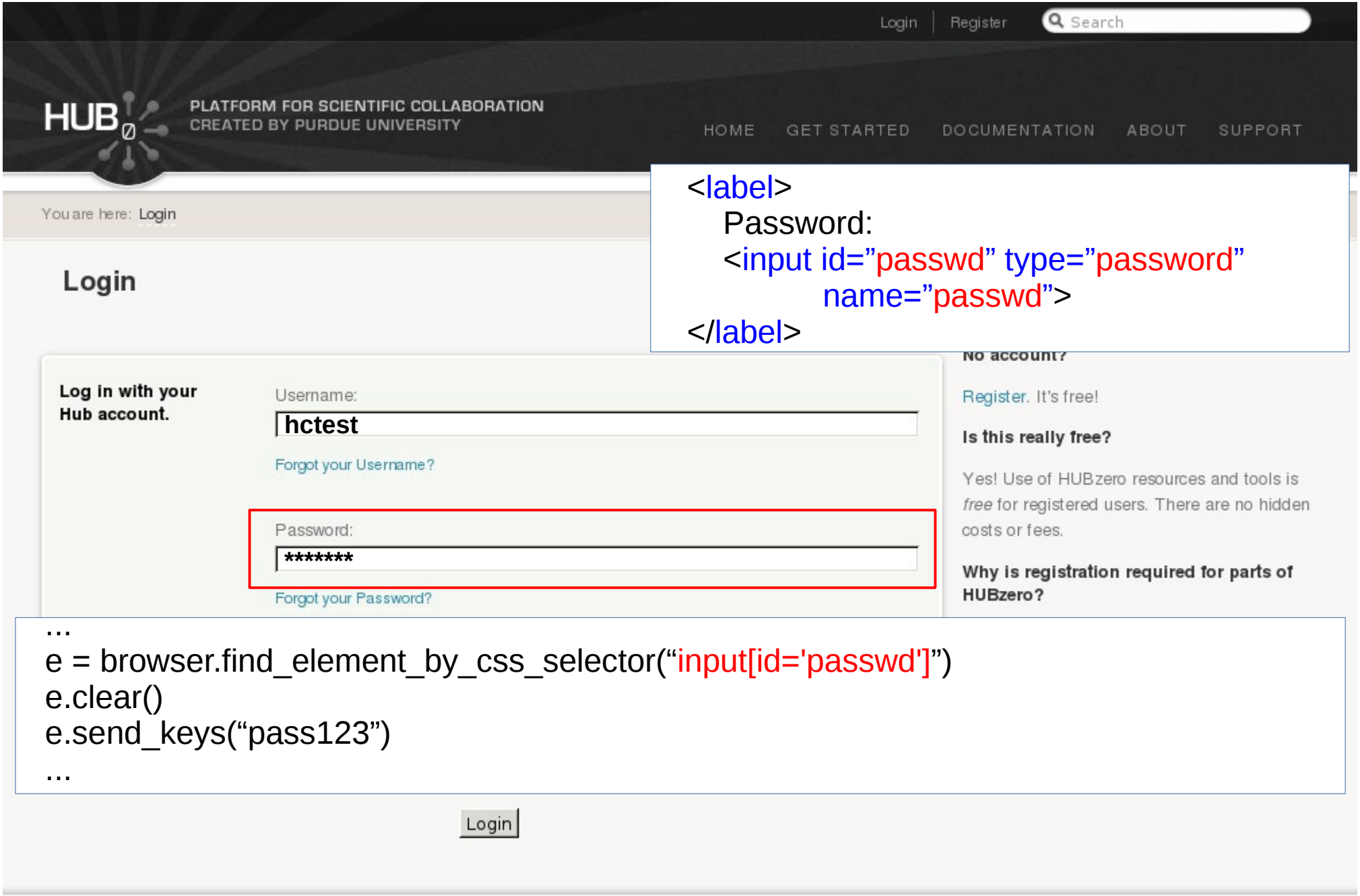
```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")
...
```




```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")
...
```

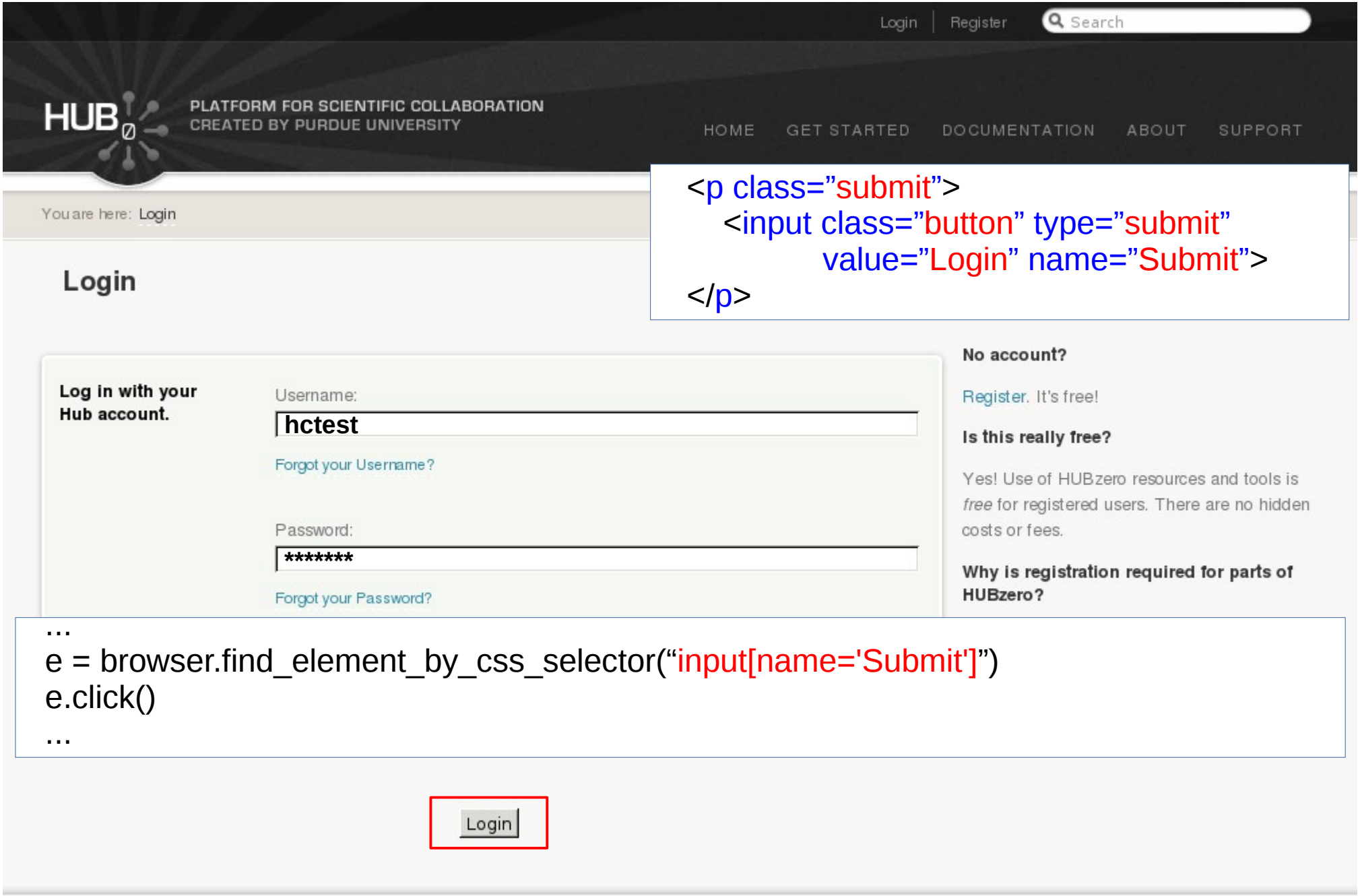



```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")
...
```



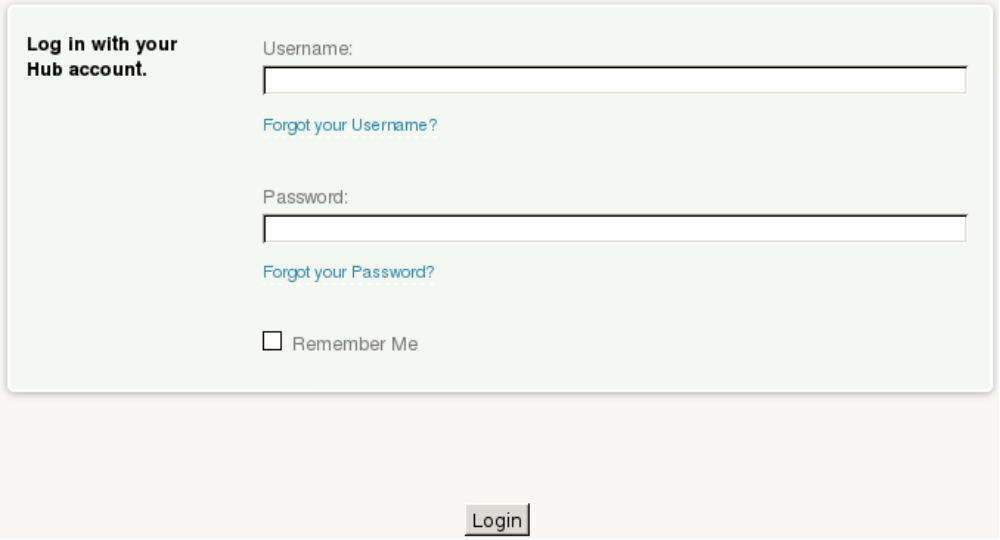

```
<label>
    Password:
    <input id="passwd" type="password"
           name="passwd">
</label>
```

```
...
e = browser.find_element_by_css_selector("input[id='passwd']")
e.clear()
e.send_keys("pass123")
...
```




```
<p class="submit">
   <input class="button" type="submit"
          value="Login" name="Submit">
</p>
```

```
...
e = browser.find_element_by_css_selector("input[name='Submit']")
e.click()
...
```




```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")

e = browser.find_element_by_css_selector("input[id='passwd']")
e.clear()
e.send_keys("pass123")

e = browser.find_element_by_css_selector("input[name='Submit']")
e.click()
...
```

Login automation script

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)

e = browser.find_element_by_css_selector(“input[id='username']”)
e.clear()
e.send_keys(“hctest”)

e = browser.find_element_by_css_selector(“input[id='passwd']”)
e.clear()
e.send_keys(“pass123”)

e = browser.find_element_by_css_selector(“input[name='Submit']”)
e.click()

assert(...)

browser.quit()
```

Derrick Kearney (dkearney) Logout | My Account | 701 New Message(s) Search

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You are here: Members › Derrick Kearney

- Dashboard
- Profile
- Contributions 14
- Groups 5
- Favorites
- Messages 701
- Resume
- Blog
- Projects 1

Derrick Kearney ▸ Dashboard

Personalize Dashboard

Introduction

Welcome to your customizable dashboard page!

To get started, click the "Personalize Dashboard" button towards the top of this page. You will then be presented with a list of modules you may add to your page. At any time you may remove any unwanted modules or rearrange the current modules by drag-and-drop!

My Tools

Recent | Favorites | All Tools

- Hello World
- Structure
- Calculator
- Integer
- Workspace

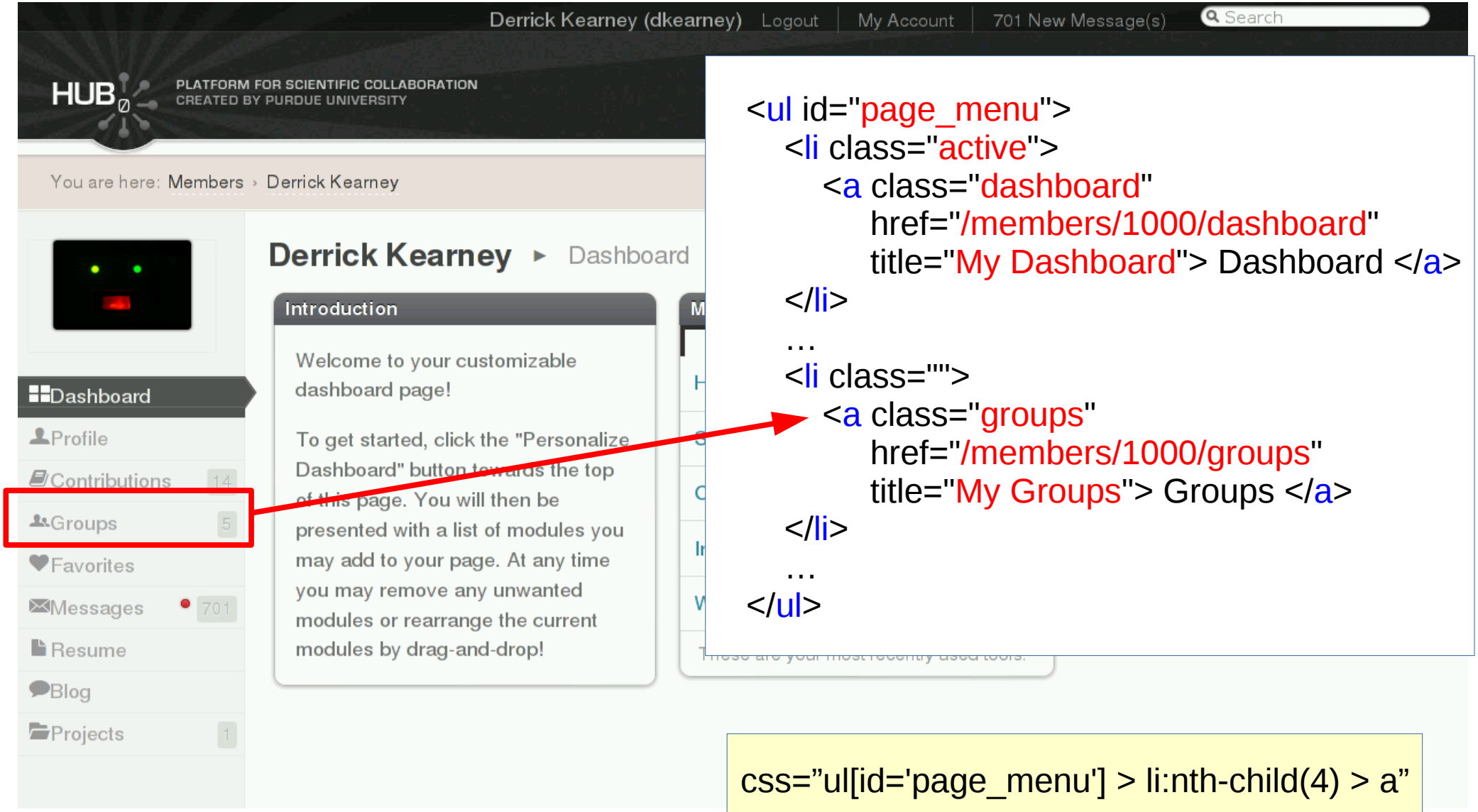
These are your most recently used tools.

My Sessions

- Workspace
- Workspace
- Workspace (11:17 pm)

Storage (manage)

88% of 30GB




```
<ul id="page_menu">
    <li class="active">
        <a class="dashboard"
            href="/members/1000/dashboard"
            title="My Dashboard"> Dashboard </a>
    </li>
    …
    <li class="">
        <a class="groups"
            href="/members/1000/groups"
            title="My Groups"> Groups </a>
    </li>
    …
</ul>
```

```
css="ul[id='page_menu'] > li:nth-child(4) > a"
```

```
css="ul[id='page_menu'] a[class='groups']"
```

```
css="#page_menu .groups"
```

Traversing tables and lists:

 # Printing the text of the first link, from all list items:

```
...
elist = browser.find_elements_by_css_selector('#page_menu li')

for e in elist:
    link = e.find_element_by_css_selector('a')
    print 'link text = %s' % (link.text())
...
```

```
<ul id="page_menu">
    <li class="active">
        <a class="dashboard"
            href="/members/1000/dashboard"
            title="My Dashboard"> Dashboard </a>
    </li>
    …
    <li class="">
        <a class="groups"
            href="/members/1000/groups"
            title="My Groups"> Groups </a>
    </li>
    …
</ul>
```

Traversing tables and lists:

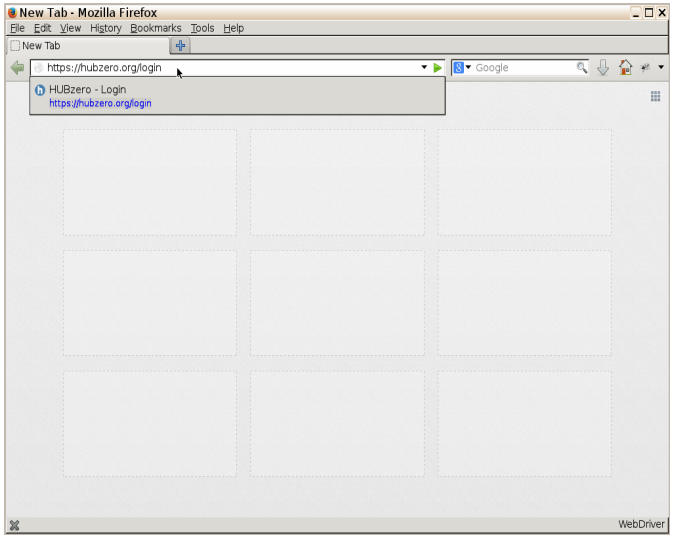
 # Printing the title attribute of the first link, from all list items:

```
...
elist = browser.find_elements_by_css_selector('#page_menu li')

for e in elist:
    link = e.find_element_by_css_selector('a')
    print 'link text = %s' % (link.get_attribute('title'))
...
```

```
<ul id="page_menu">
    <li class="active">
        <a class="dashboard"
            href="/members/1000/dashboard"
            title="My Dashboard"> Dashboard </a>
    </li>
    …
    <li class="">
        <a class="groups"
            href="/members/1000/groups"
            title="My Groups"> Groups </a>
    </li>
    …
</ul>
```

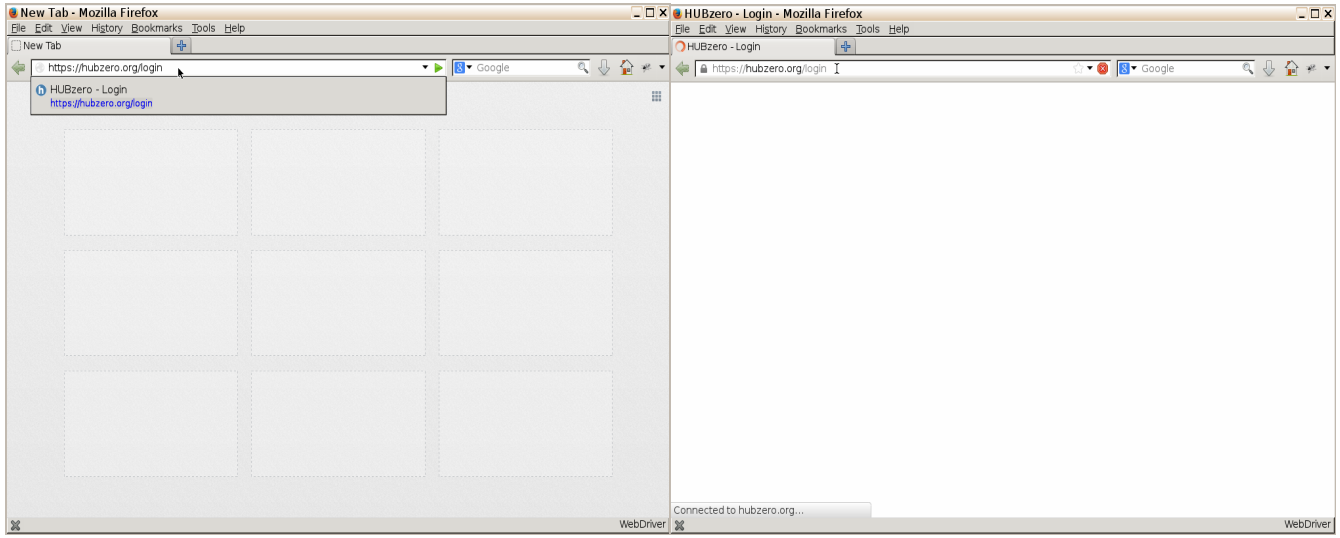
Implicit waits:

```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()

browser.get(url)

e = browser.find_element_by_css_selector(“input[id='username']”)
e.clear()
e.send_keys('hctest')

browser.quit()
```



Implicit waits:

```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()

browser.get(url)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```



Implicit waits:

```
from selenium import webdriver

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e.clear()
e.send_keys('hctest')

browser.quit()
```
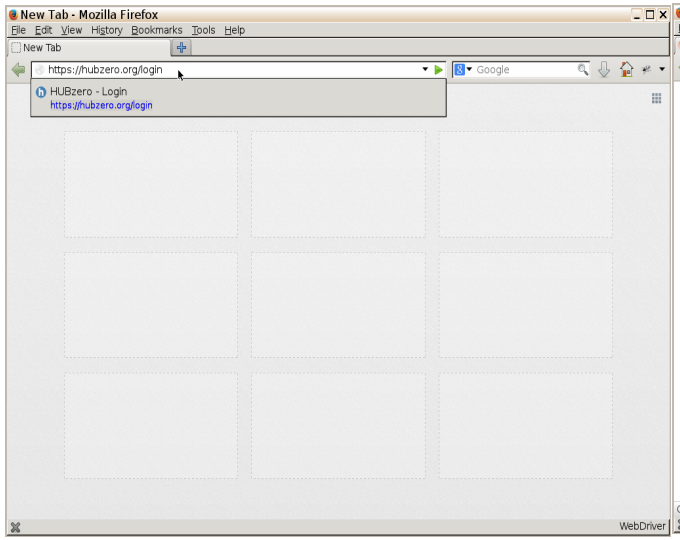
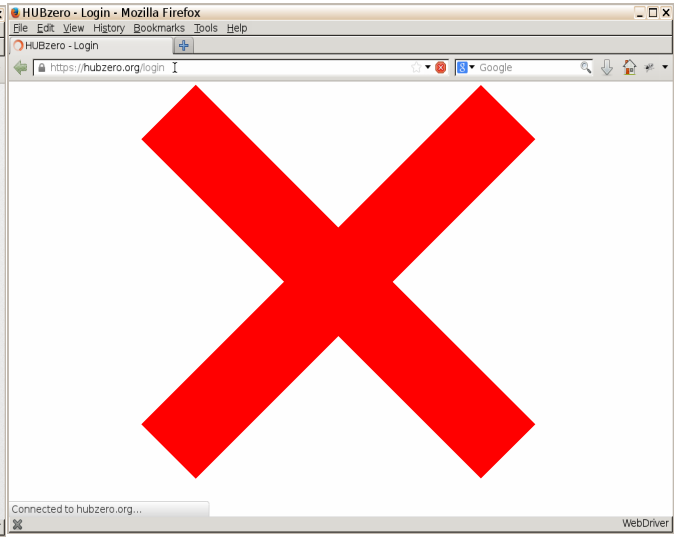
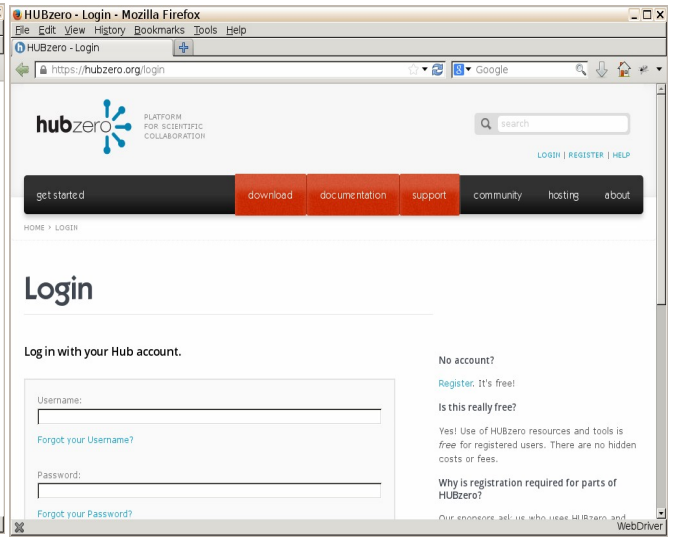
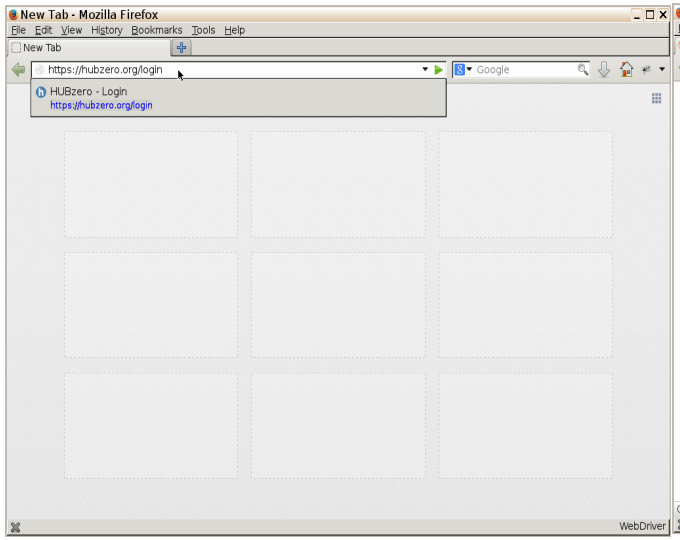



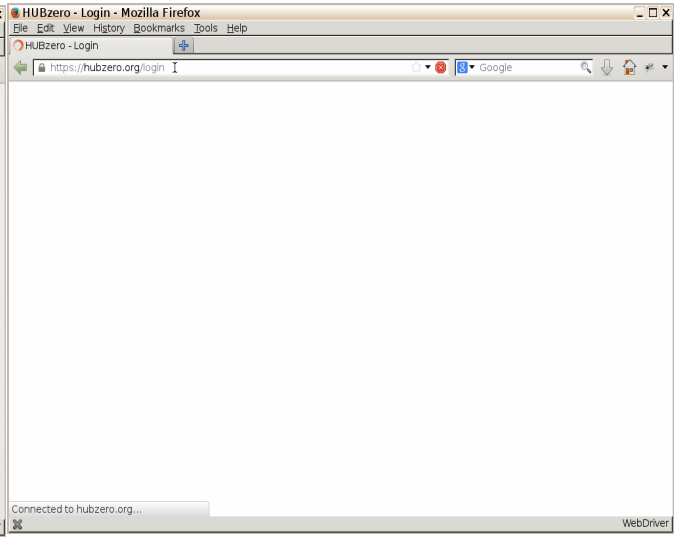


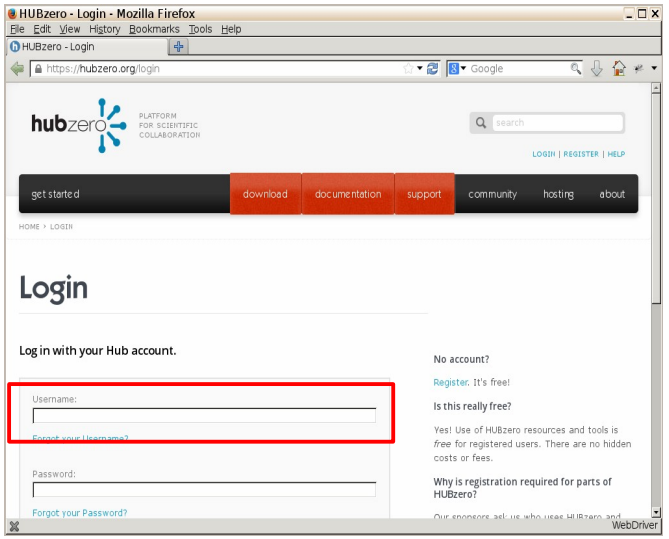


Implicit waits:

```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()
browser.implicitly_wait(30)
browser.get(url)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```







Explicit waits:

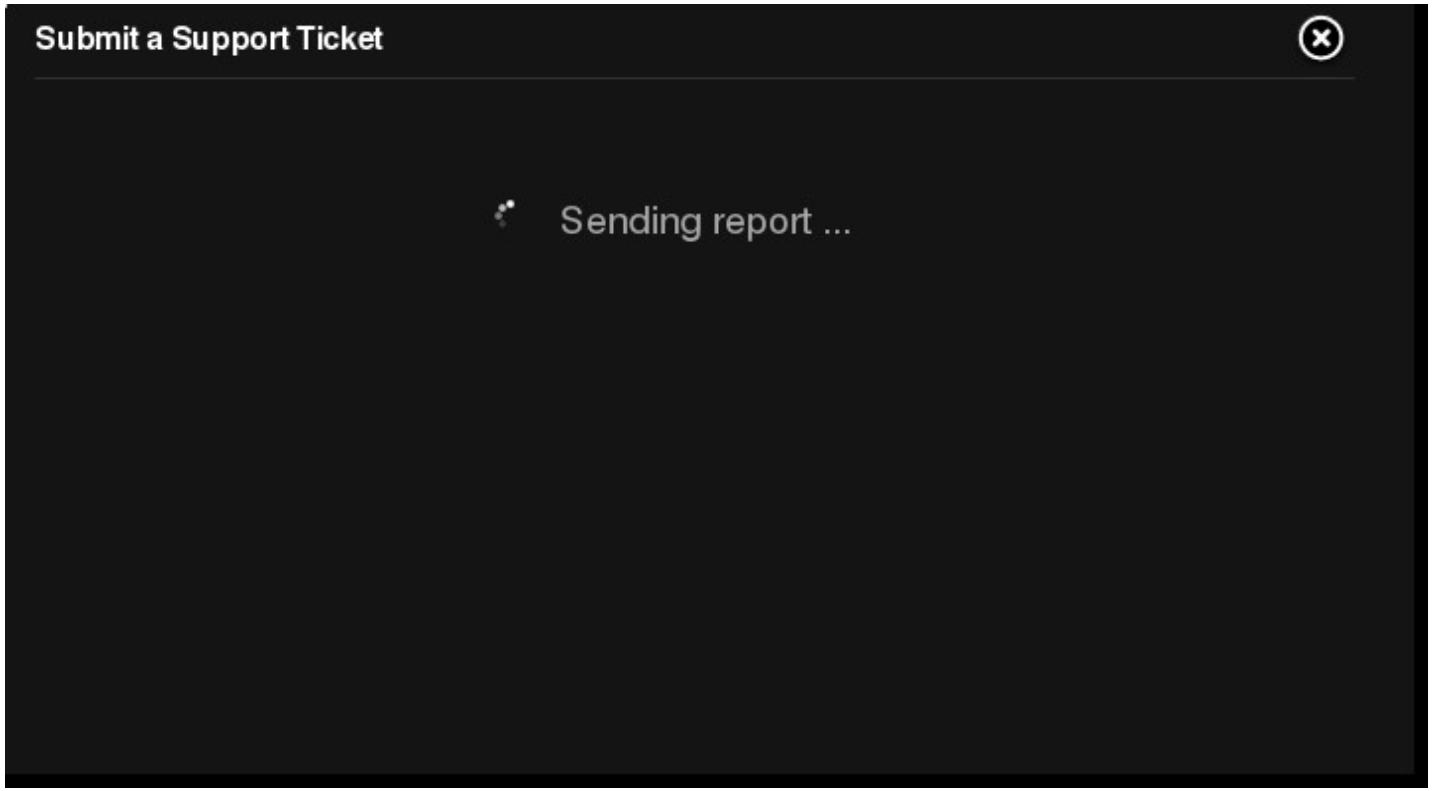
```
from selenium import webdriver
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()
browser.get(url)

wait = WebDriverWait(browser, 10)
wait.until(CONDITION)

e = browser.find_element_by_css_selector(“input[id='username']”)
e.clear()
e.send_keys('hctest')

browser.quit()
```

Explicit waits:

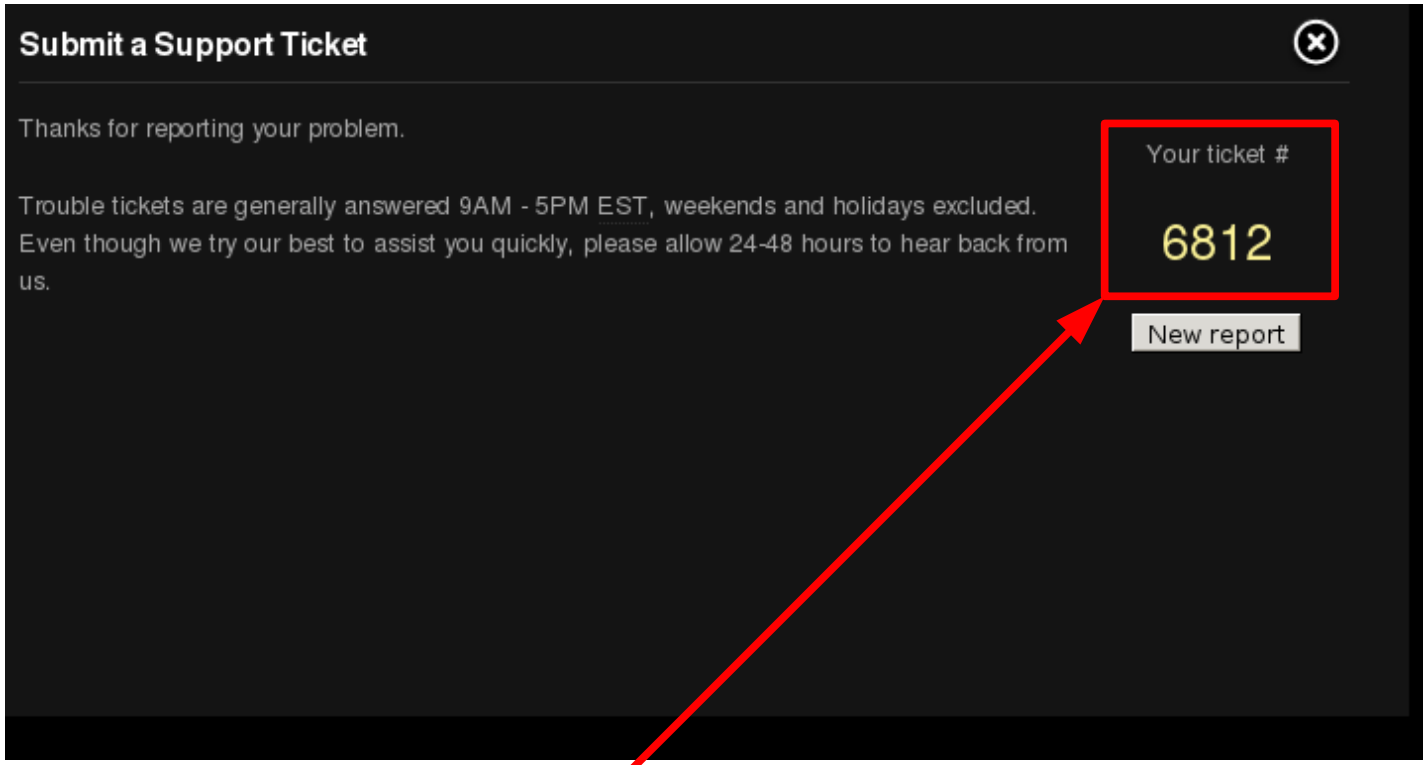
```
from selenium import webdriver
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()
browser.get(url)

wait = WebDriverWait(browser, 10)
wait.until(EC.visibility_of_element_located(
                    (By.CSS_SELECTOR,'#username'))))

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```

Dealing with AJAX:

Dealing with AJAX:



Dealing with AJAX:




```
<div id="trSuccess">
    <div>
        <p>Your ticket #
            <span>
                <a title="View ticket" href="/support/ticket/6812">6812</a>
            </span>
        </p>
    </div>
</div>
```

Dealing with AJAX:

```
…

submit_ticket()

# wait for the page to refresh
wait = WebDriverWait(browser, 60)
e = wait.until(lambda browser :
                    browser.find_element_by_id("trSuccess").is_displayed())

ticket_number = e.find_element_by_css_selector('a').text()
...
```

```
<div id="trSuccess">
    <div>
        <p>Your ticket #
            <span>
                <a title="View ticket" href="/support/ticket/6812">6812</a>
            </span>
        </p>
    </div>
</div>
```

QUESTIONS?
MOVIES?
MORE?

Selenium Webdriver Primer

Spensa Technologies, Inc
Sept. 22, 2016

Derrick Kearney
github.com/codedsk
telldsk@gmail.com

Testing vs Checking

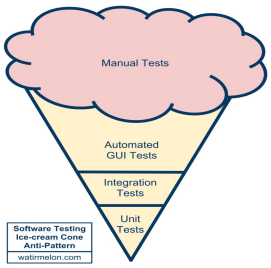
Testing is...	**Checking is...**
* Exploring & Learning * Experimenting * Judgment & Values * Answers the question "*Is there a problem?*"	* Confirming * Pass / Fail * "It Works" vs "It Operates"

There is an ongoing conversation within Testing communities that questions whether testing can be automated. Some people say that testing cannot be automated, but checking can. And that the automation scripts people write and call tests are really just checks.

As you are exploring, you may see these terms being used. It took me a while to understand the difference. Here is what I think is going on.

When people talk about Testing, they say it is the use of tools to gain knowledge about how the system works. It involves exploring and learning. They say you can't automate testing because testing involves having values and using judgment to decide what should happen next. It answers the question "Is there a problem?"

Typical Testing Pyramid



Too many GUI & Manual Tests

Very few Unit & Integration Tests

Ideal Automated Testing Pyramid & Ice-cream Cone Antipattern - http://watirmelon.com/2012/01/31/introducing-the-software-testing-ice-cream-cone/

Another thing you may run into is the Testing Pyramid. It is important to consider what kind of testing you want to be doing and how much time, effort, or resources you want to spend at each level.

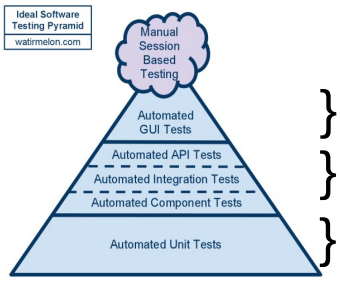
There are always things to test. This pattern gives us an idea of the resource allocation that seems to have worked for other people.

The testing pyramid splits resources into checking the business logic, which include the graphical user interface and public facing api, and checking the technology logic, which includes your core functions and libraries that get called by the business logic.

Here, we see the dreaded Ice-cream Cone Antipattern.

A lot of resources are focused on building automated checks for the graphical user interface and manually testing the business level, while too few resources are allocated toward making sure the technology layer works.

Ideal Testing Pyramid



} User Interface Tests
} Service Layer Tests
} Unit Tests

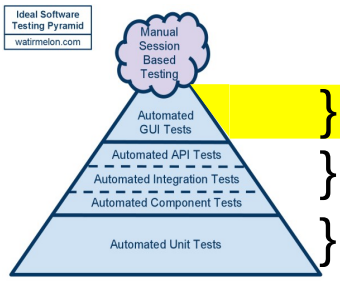
Ideal Automated Testing Pyramid & Ice-cream Cone Antipattern -
http://watirmelon.com/2012/01/31/introducing-the-software-testing-ice-cream-cone/

Ideally, your organization's testing pyramid would look like this.

Right away we notice that the bottom layer of the Pyramid, the most broad layer and the largest by area, is unit testing, followed slightly above it by component and integration testing. These show that you should spend the majority of your testing effort building a broad base of unit and component tests that check that the pieces of your program operate as you expect them to. This follows along with the pieces of your software you expect to use the most. Many of the hard errors you'll find are going to be deep in the software and these functions will be used the most, in the technology layer.

Above the unit and component tests are what are called the business facing tests. The business layer portion of the pyramid is smaller. The idea is that if you do the legwork of making sure the lowest level pieces of your software work properly, you don't need to spend as many resources checking if the pieces above work properly because you

Ideal Testing Pyramid



} User Interface Tests
} Service Layer Tests
} Unit Tests

Ideal Automated Testing Pyramid & Ice-cream Cone Antipattern -
http://watirmelon.com/2012/01/31/introducing-the-software-testing-ice-cream-cone/

Today we are going to be focusing on building tests for the business layer and in particular, the graphical user interface.

There are many tools that are available to perform testing at the graphical user interface level and they usually fall within two categories.

Automated Testing Tools

Web Crawlers

CrawlJax

IBM AppScan

Pros:

- Little Developer Coordination
- Semi directed exploration
- Web App is a black box

Cons:

- Time consuming to run
- No authority to judge results

The first category of tools are web crawlers. These include tools like Crawljax and IBM AppScan. Web Crawlers need little developer coordination. This allows people to quickly get started running the programs.

Because these tools are crawling a website, they can get into a bit of trouble navigating to places they shouldn't be. These tools usually allow the user to set a blacklist of urls not to visit.

The best thing is that they treat the web application as a black box. The user doesn't have to do much work to get them up and running. Unfortunately, because they need to traverse and exhaust the whole website graph, they can take a really long time to run. Additionally there is no authority to tell if a behavior that is experienced while navigating it correct or incorrect for the web application.

Automated Testing Tools

Test Recorders

Selenium

QuickTest Pro

Sahi Pro

Pros:

- Very customizable
- Produces specific targeted tests
- Programmable in a script

Cons:

- Time consuming to build tests
- Allows for brittle test designs

On the other hand there are other tools that fall into the category of test recorders. These include applications like Selenium Webdriver, QuickTest Pro, and Sahi Pro. Test recorders allow the user to provide explicit web application navigation based on actions that were previously recorded. This makes them very customizable and able to produce targeted tests. With some, you can incorporate them in a script.

Automated Testing Tools

Test Recorders

Selenium

QuickTest Pro

Sahi Pro

- Developed By Jason Huggins and Simon Stewart at ThoughtWorks
- Browser vendor support through W3C spec
- Automation written in “your favorite language”...
- Worldwide support Community

8

Of these tools, I only have experience with Selenium Webdriver and that is the one we will be talking about today.

It was developed by Jason Huggins and later combined with another tool by Simon Stewart at ThoughtWorks.

It works with many of the major browsers by using the browser's own internal automation. There is a team of people working on a W3C specification, that includes browser vendors. Once that is completed it will help standardize the protocols and capabilities that some vendors may provide that others do not.

Selenium officially supports a hand full of programming languages like Python, Java, C#, and Ruby. Other language bindings are provided by 3rd parties.

There is a huge community to provide support for the library. They hold conferences around the world, there are mailing lists and google hangouts, and the documentation is pretty

Automated Testing Tools

Test Recorders

Selenium

QuickTest Pro

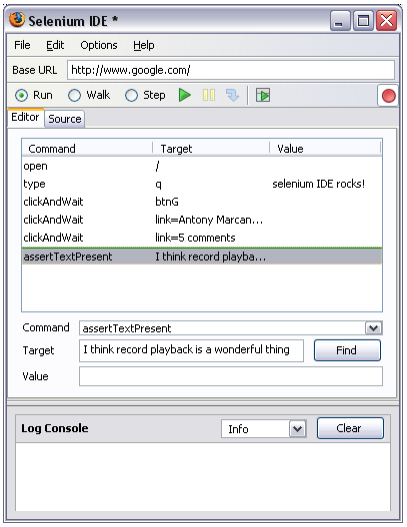
Sahi Pro

What can it do?

- Open web browser
- Locate elements on page
- Type in or click elements
- Wait for triggered events
- Simulate moving the mouse

Most of the stuff you'll end up doing with Selenium will be pretty simple. Much of the automation will be Opening a web browser, navigating to a URL, locating an element on the web page, interacting with the element by typing into it or clicking it or reading it, waiting for an event to be triggered, or moving the mouse over objects and evaluating the result.

A brief word about Selenium IDE...



What can it do?

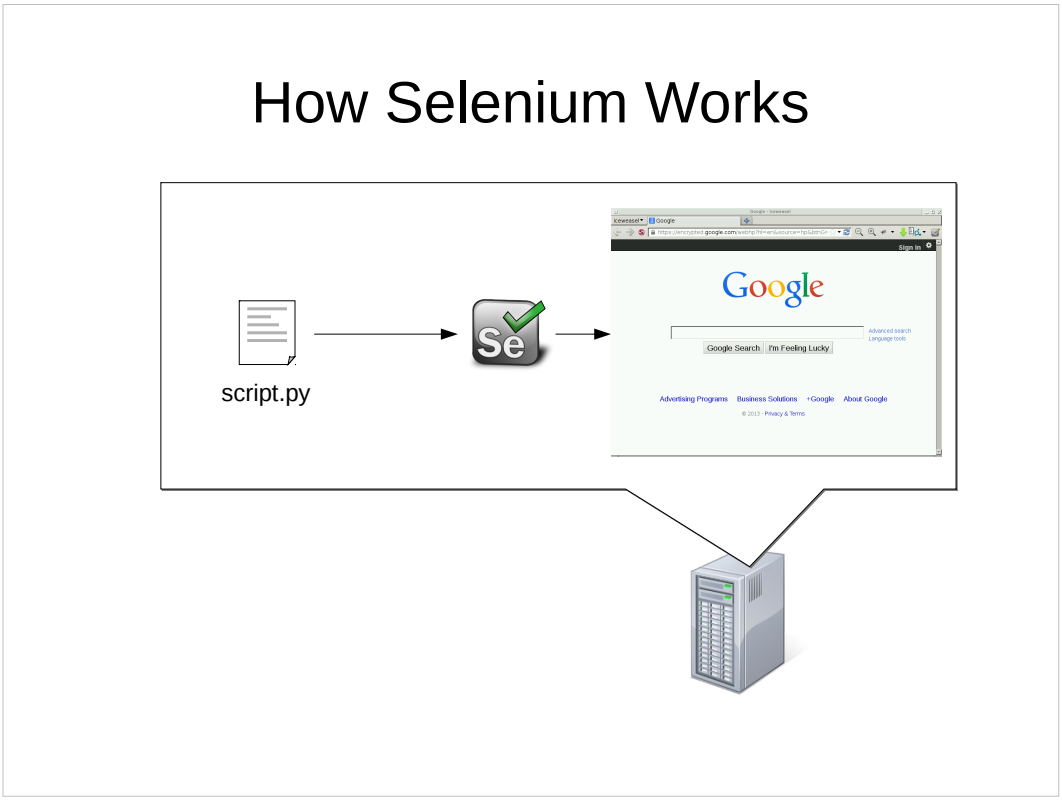
- Record actions, replay as tests
- Works in Firefox only
- Selenium 1.0 style tests
- Tests can be brittle

Try it out, then move on

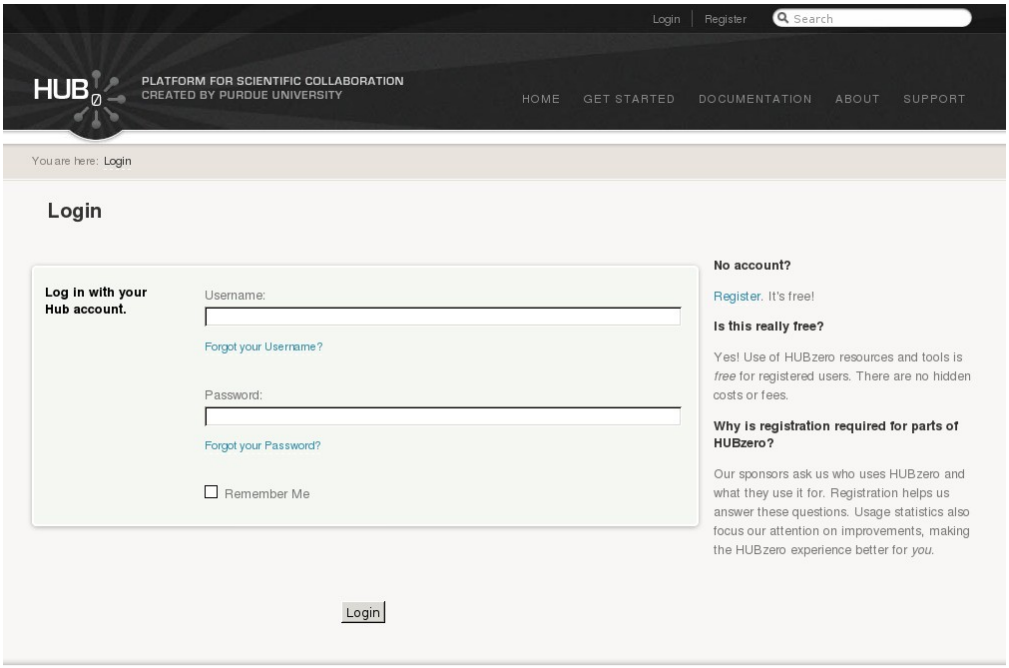
Let me take some time here to mention Selenium IDE. So far I've been talking about Selenium WebDriver, otherwise known as Selenium 2.0.

A long time ago there was a Selenium 1.0. People don't speak about it now a days unless they have to. It worked by running a little server in the background and your script would send JSON command to the server, and the server would then talk to the browser. I think this caused some problems like CSRF. But now there is version 2.0 (and soon version 3.0?)

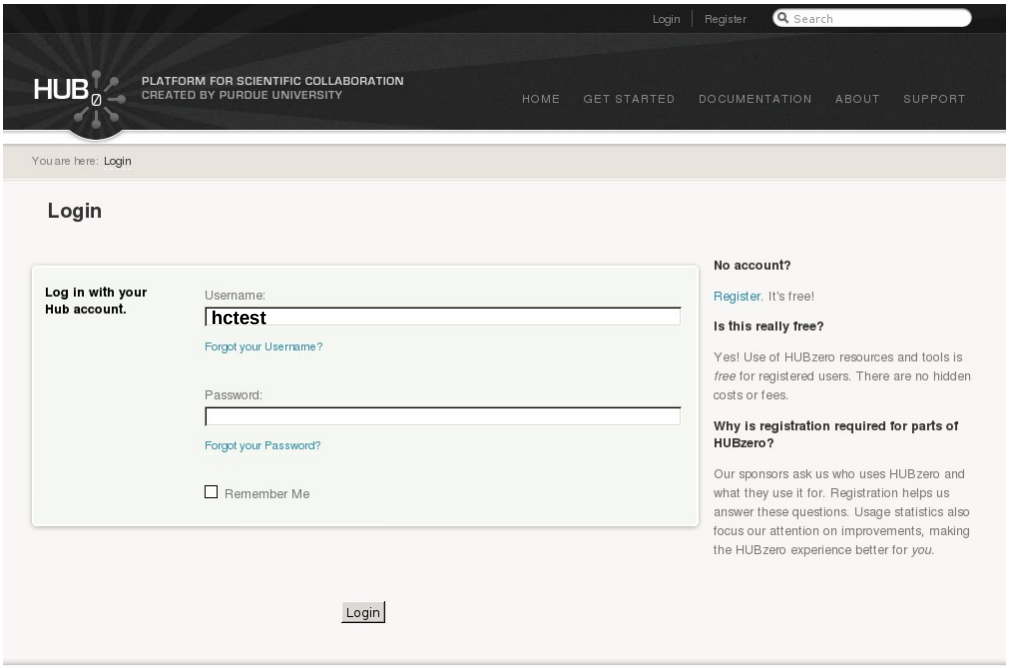
Newer versions of the Selenium binaries have been backwards compatible but I think I heard that will be ending with the newest releases. Selenium 1.0 is dying. So if you are getting started with it, try it out, get to understand how to locate element on the web page, but then move on to using WebDriver.



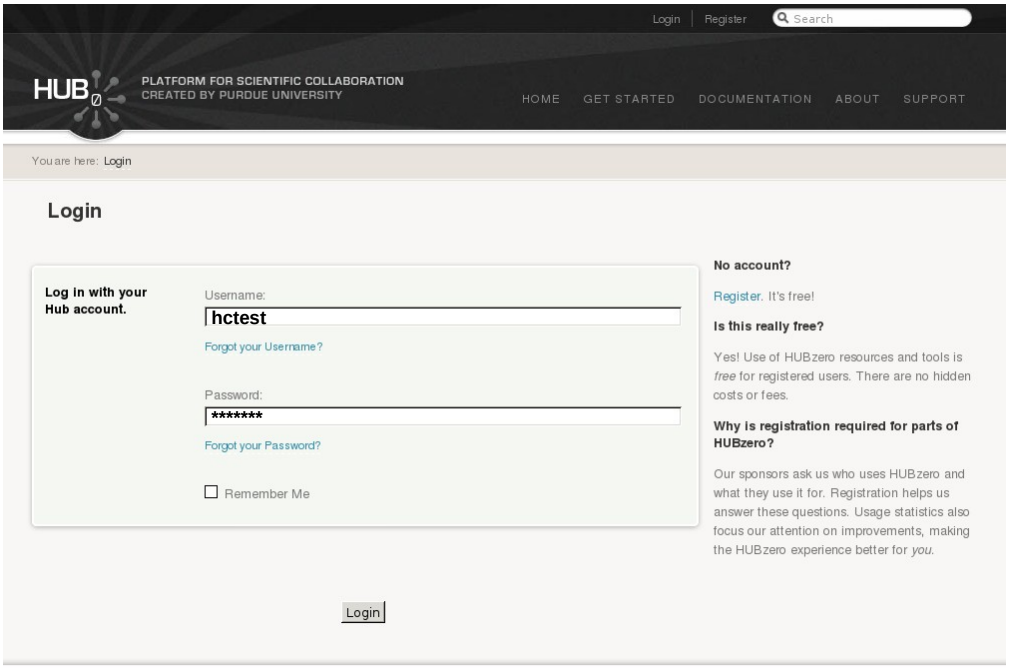
The general way Selenium works is that you write a script or a program that interacts with the Selenium library, and that launches a web browser that has an open port listening for automation commands. Automation commands are accepted by the browser, the browser performs actions and then sends some results back to your program.



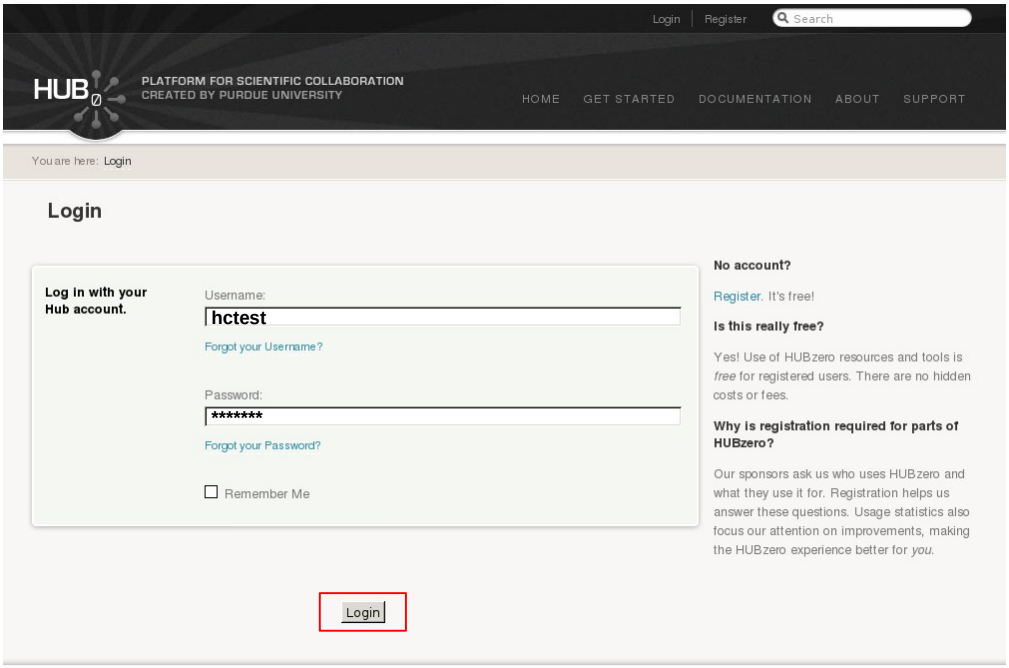
Lets start off by writing a script that will login to a website. Login pages are quite common. This is the page for an older version of HUBzero.org.



If we were to login manually, we would first, locate the username field and type our username into the field.



Then we would locate the password field and type our password into it



And lastly locate the button labeled login and click it.

Loading the Selenium Webdriver module:

```
from selenium import webdriver
```

These steps can also be done in Selenium. Our first step is to import the Selenium WebDriver libraries into our script.

Start a web browser:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
```

Next we launch a browser by instantiating the webdriver dot browser name class.

Navigating to a web page:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)
```

Next we navigate to our destined url using the get() method of our browser object

Closing a web browser:

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)
...
browser.quit()
```

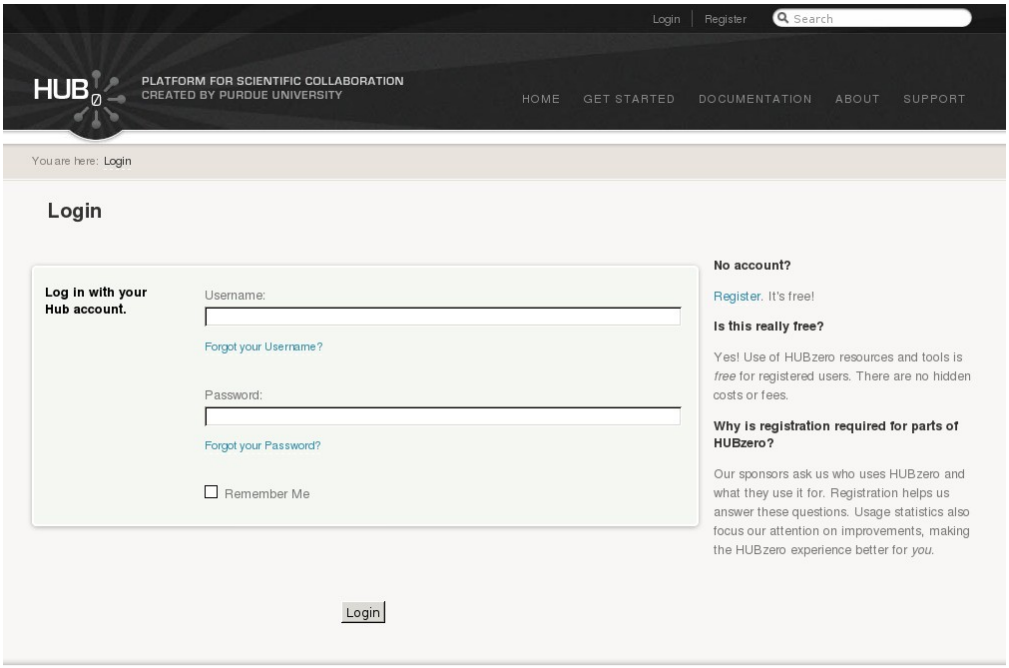
And when we are all done, we'll need to close the browser, so we add a call to the browser.quit() method here.

Finding elements on a web page:

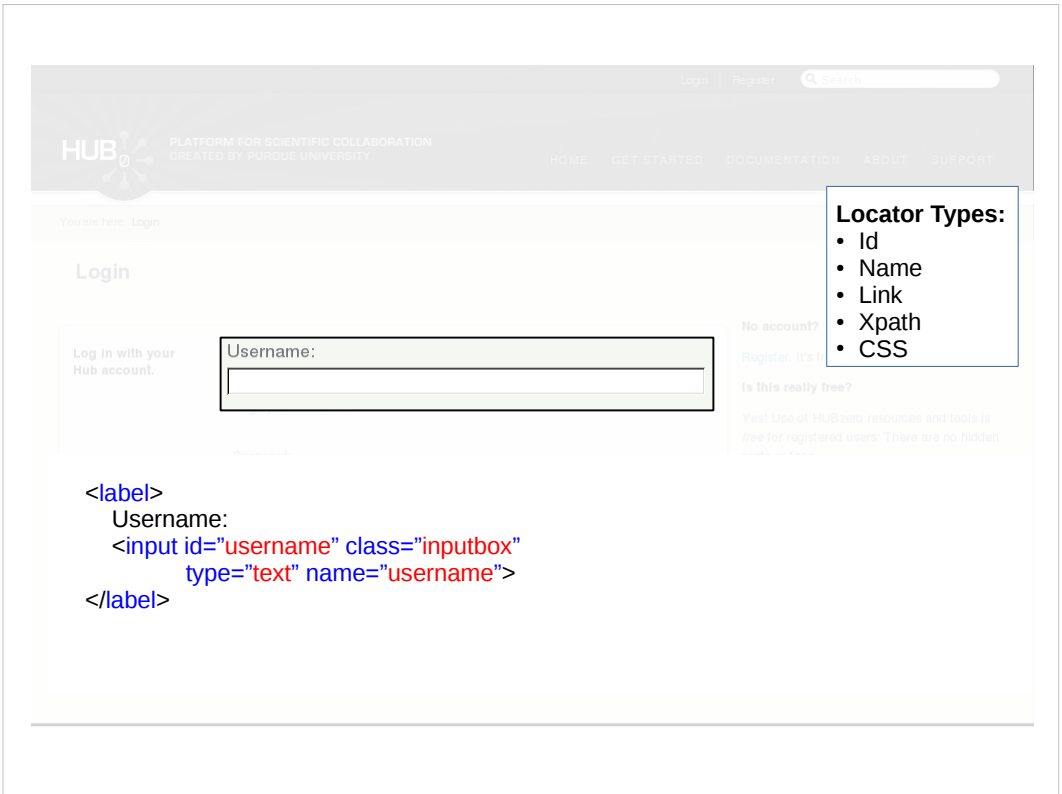
```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)

browser.find_element(...)
browser.find_element_by_*(...)

browser.quit()
```

Opening and immediately closing a browser isn't fun. Remember, our original goal was to login to the website.

After we open the browser and navigate to the login web page, we need to look for the username and password fields on the web page. The browser object provides a few functions to help us out. There are the find_element and find_element_by functions.



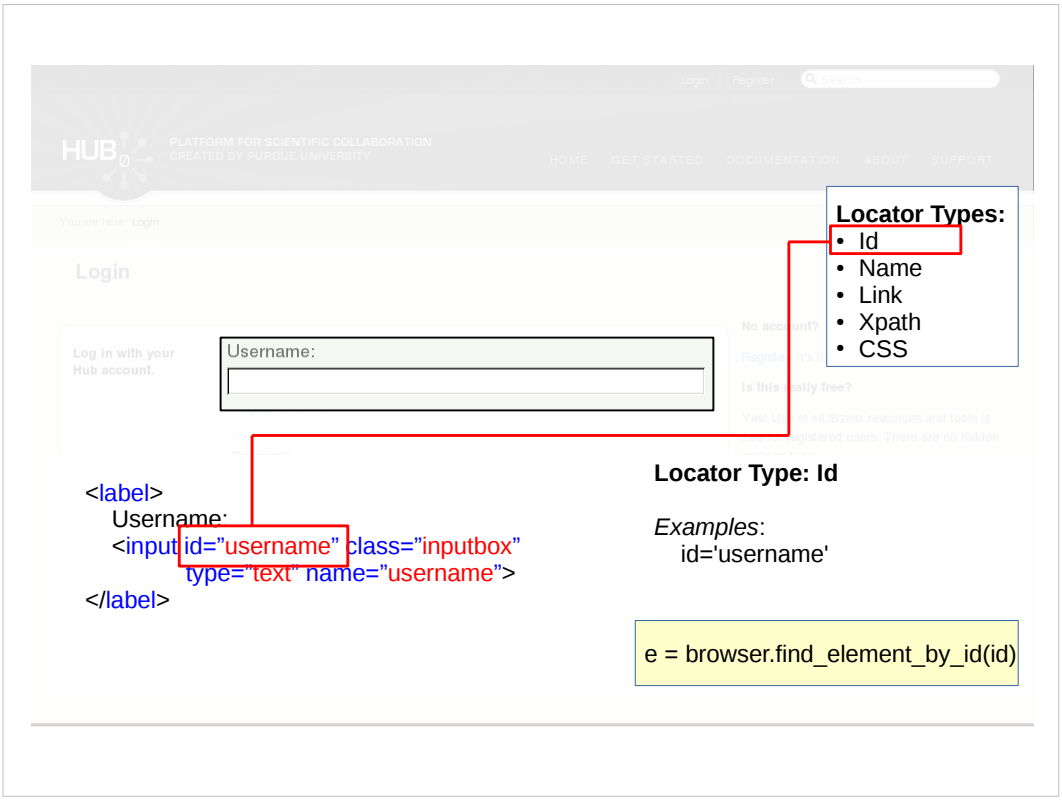
Recall that this is what our login page looks like



And we are interested in finding the username field. There are a number of ways to locate elements on the web page. They all deal with figuring out a way to name the element.

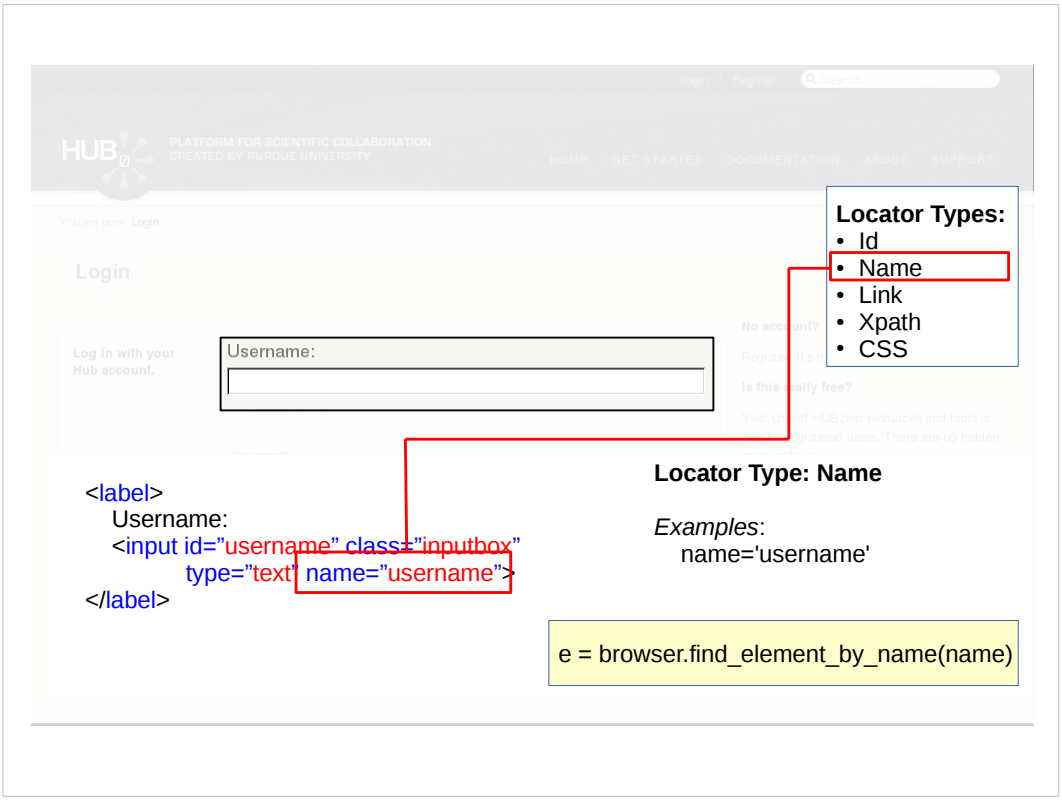
This naming of elements is often referred to as locator strategies.

The HTML for our username field looks like this. It is an input field with an id of username, a class attribute of inputbox, a type of text, and a name of username.

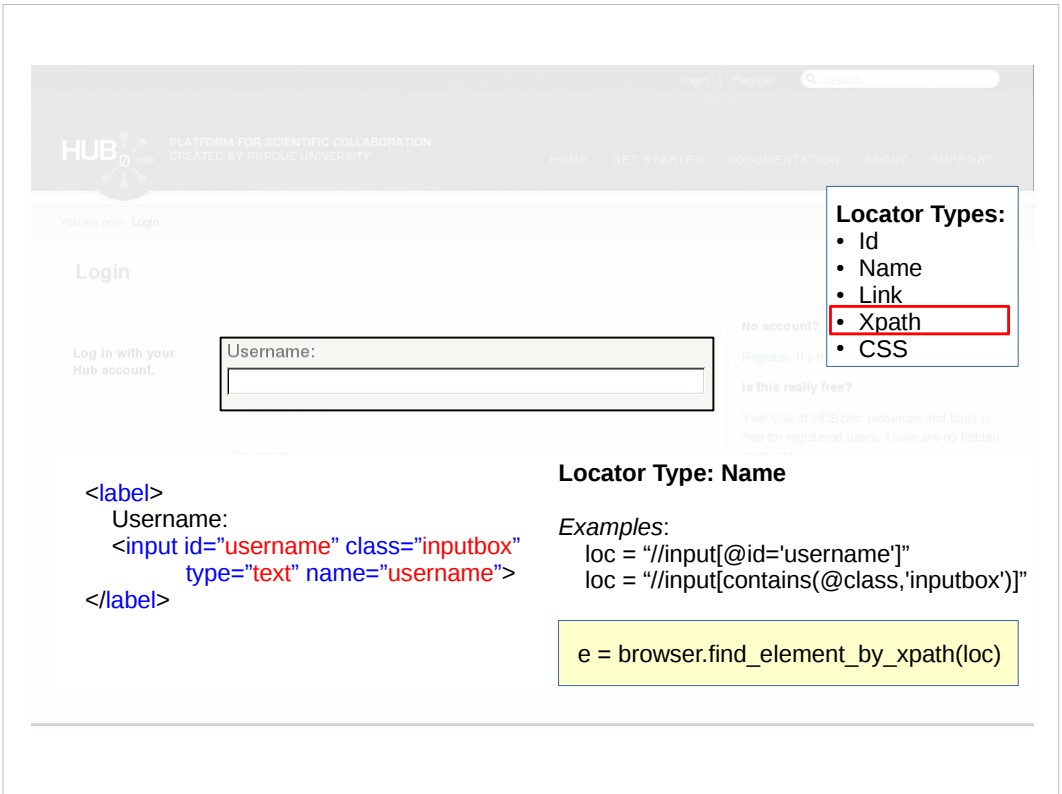


We could use the input element's id to identify the element. Id's on a web page are supposed to be unique so they tend to be good locators to use.

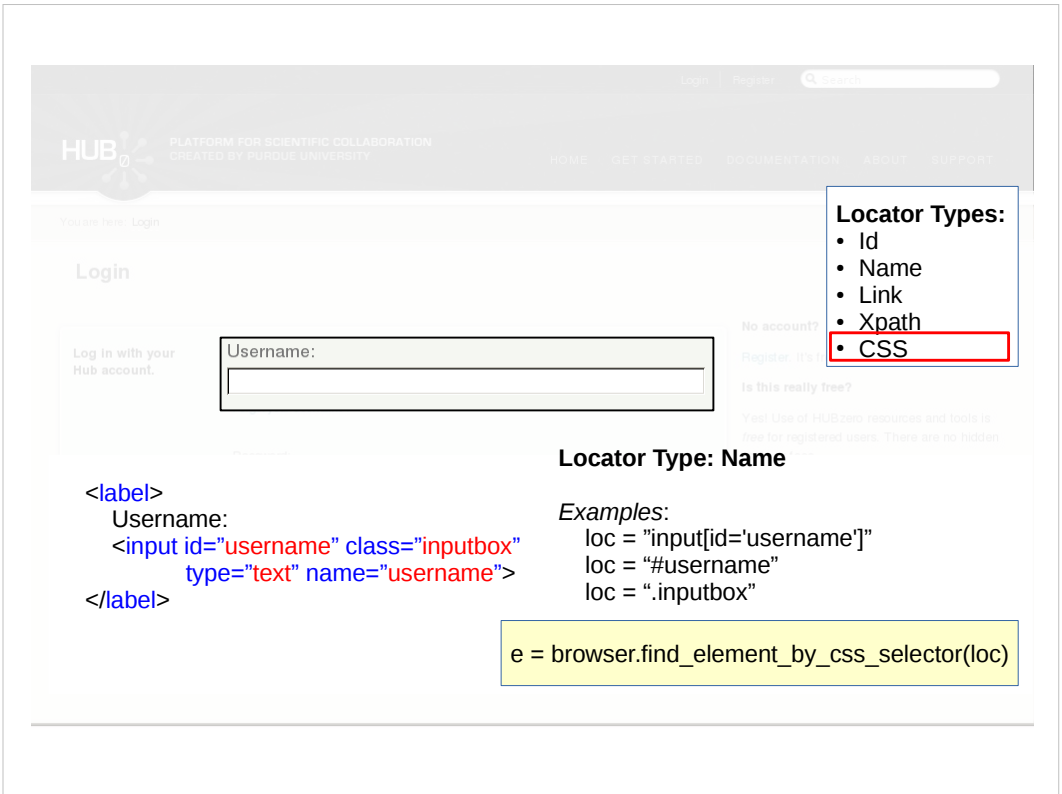
To use the element's id, you can hand the id to the find_element_by_id method. And it would find and return an object that represents the username element.



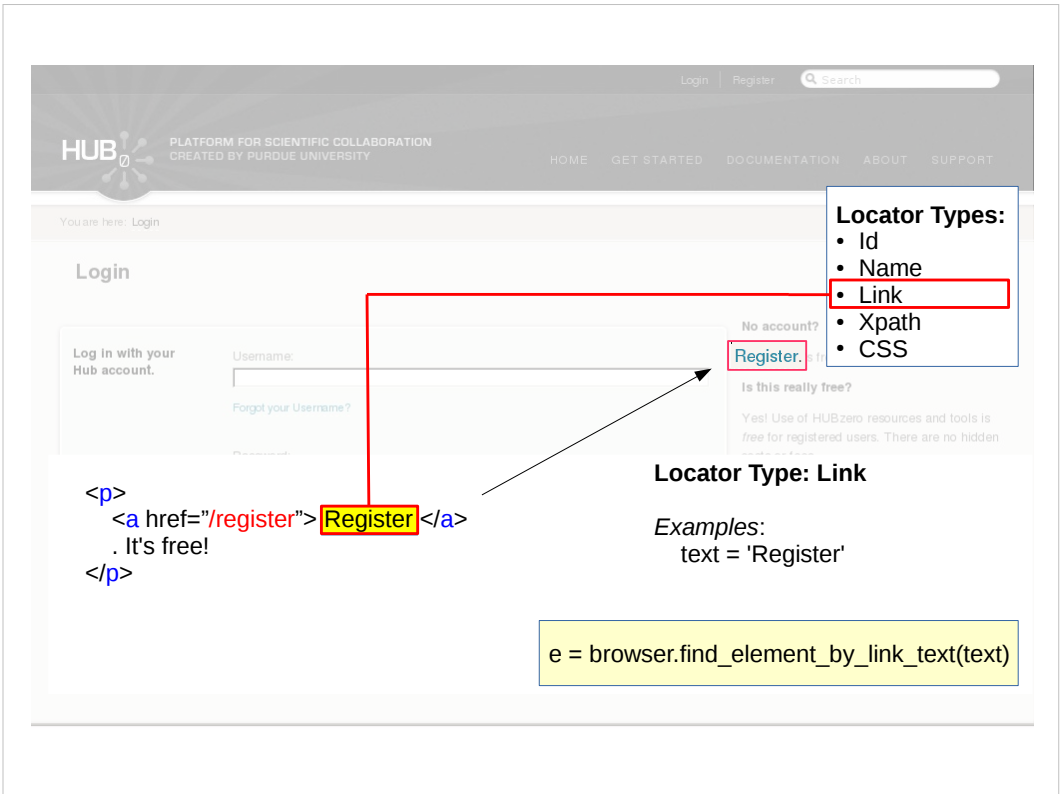
Similarly, we could use the name attribute and hand that to the find_element_by_name method. If there is only one element on the web page with that name attribute, it will return the element we want.



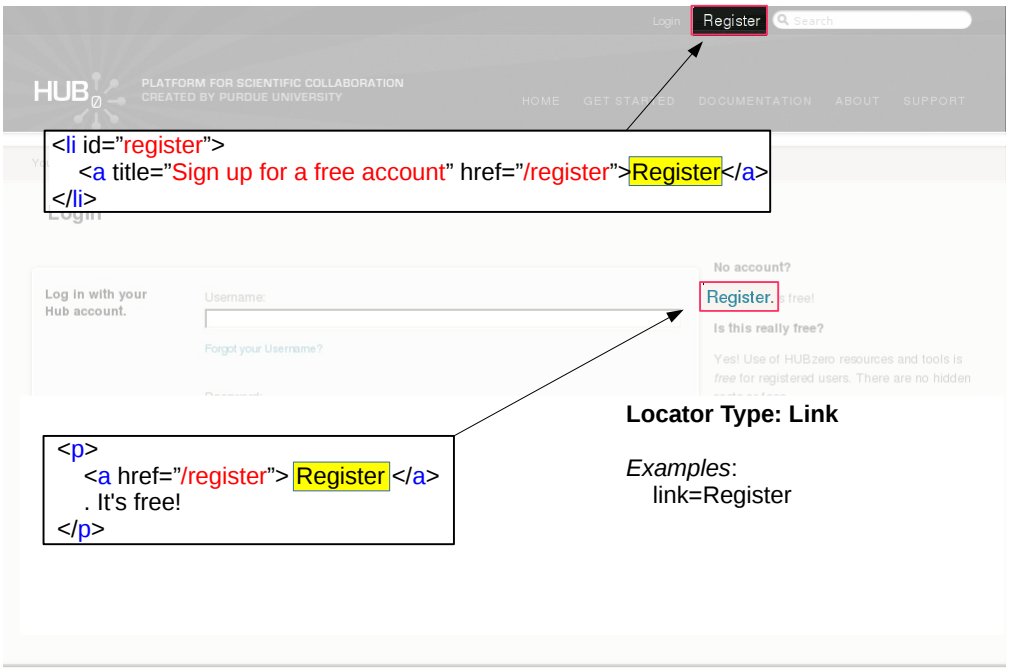
Selenium also understands XPATH locators. We could use the XPATH language to build a locator that uses one of the input field's attributes to identify it, and then hand the locator to the find_element_by_xpath method.



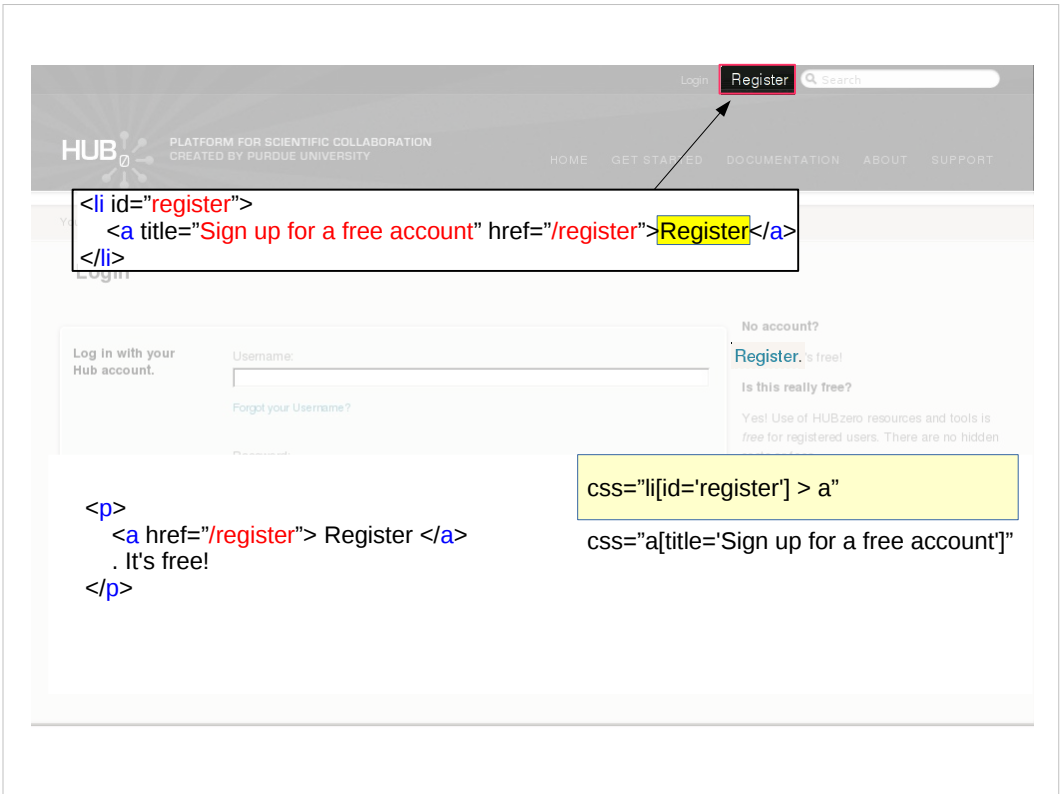
Selenium also understand CSS selectors. So we could use a CSS selector and hand that to the find_element_by_css_selector to get an object representing our element on the web page.



Now, there is also a find_element_by_link_text method. You can include the text of a link and ask it to give you back an element, but using link text is a bad idea. It tends to make brittle locators. As soon as someone changes the text of the link, your automation will fail.

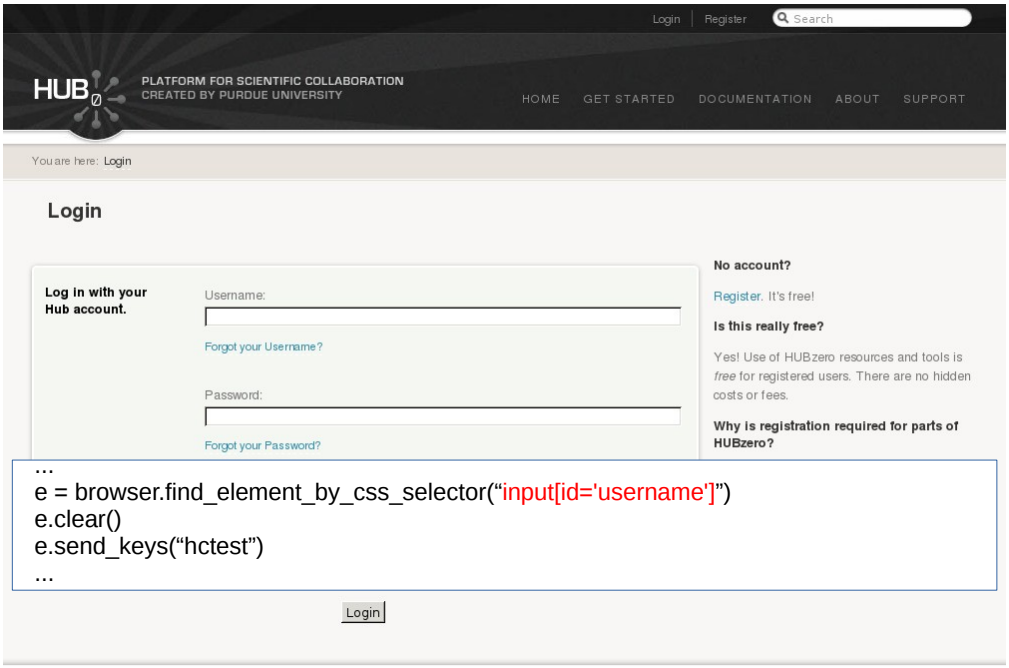


Also, what happens if your web page has two links with the same text, like in this example. There is a “Register” link at the top of the page, and another one in the middle. Which do you get back?



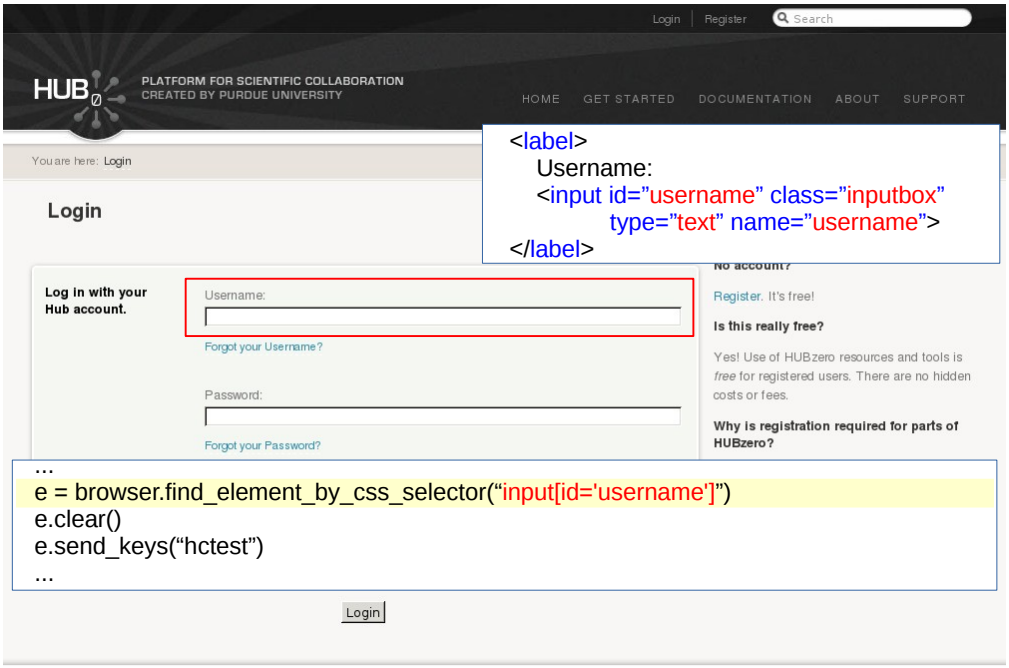
It is better to choose a different, more flexible locator like an id or class, something that won't change often.

This example shows why it is important to instrument your code for automation. If you don't build in the hooks for automation, but using good id and class names, locating elements becomes difficult.

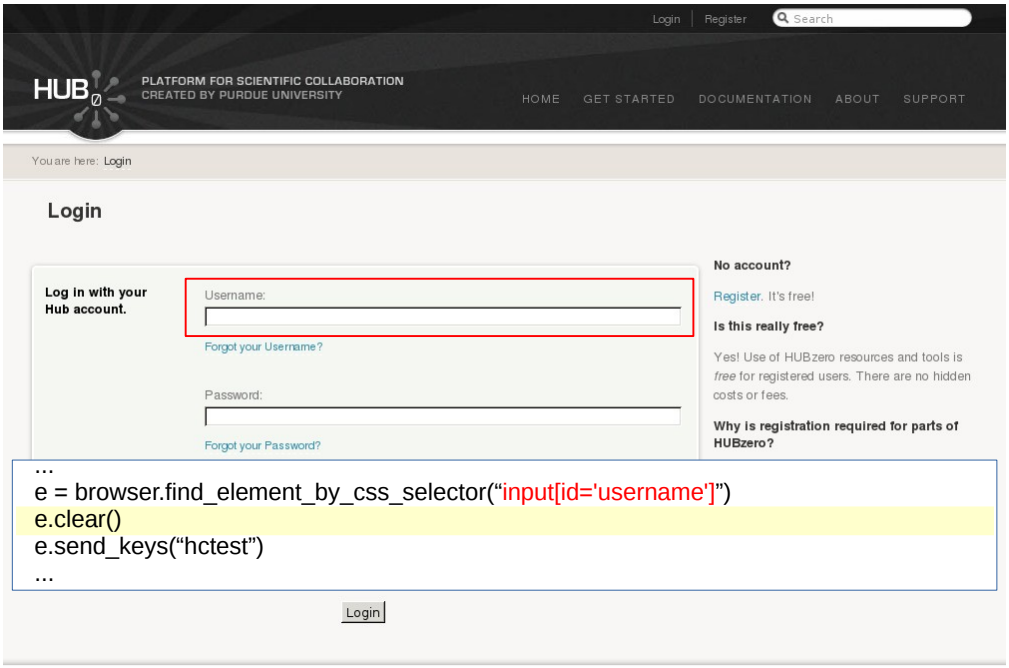



```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")
...
```

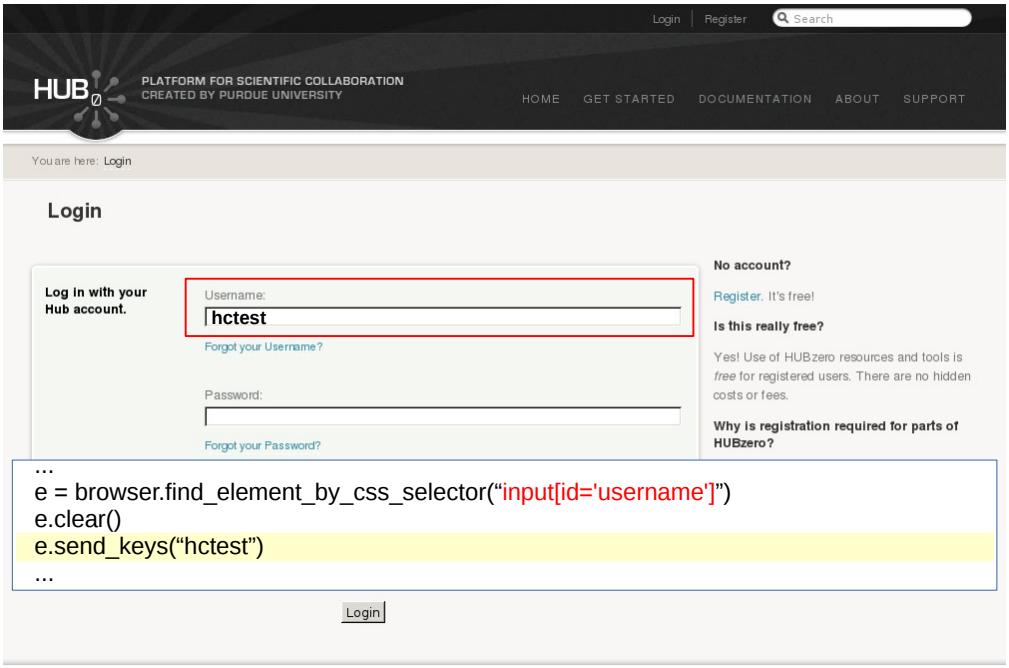
Let's get back to our example. We are going to use a css selector to locate our element



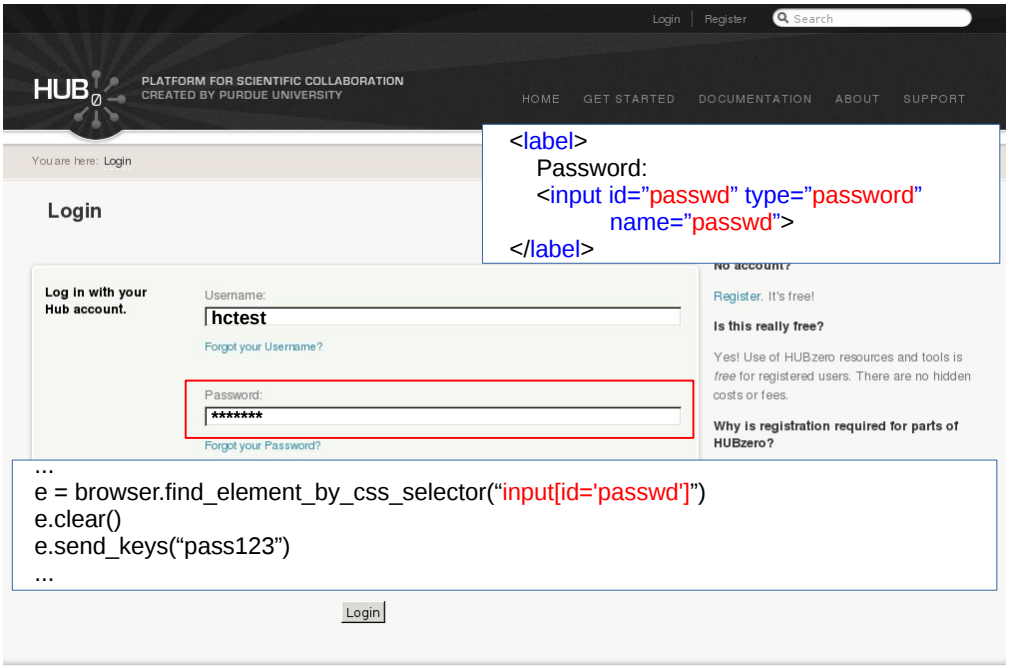
Our first step is to locate the element



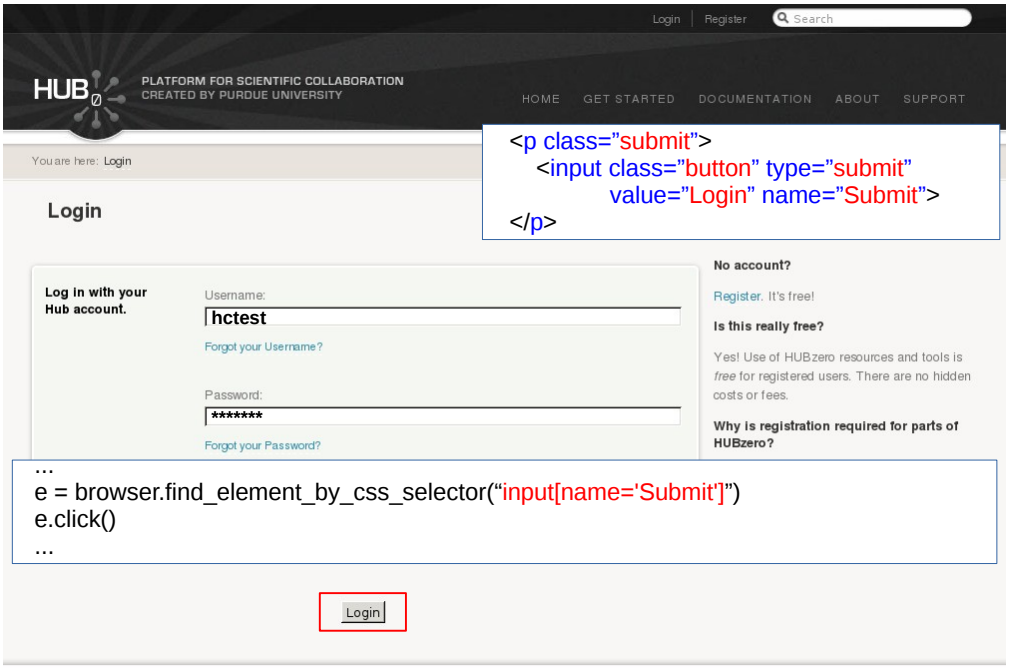
Next we clear it out, remove any text that may have been in the field.



And lastly, we use the send_keys() method to type text into the field.



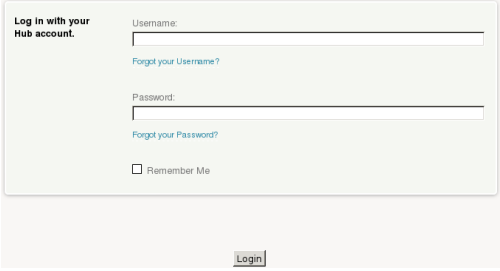
We do the same thing with the password field. First we locate the element representing the input field, then we clear it out, and last we send keys to it.




```
<p class="submit">
   <input class="button" type="submit"
          value="Login" name="Submit">
</p>
```

```
...
e = browser.find_element_by_css_selector("input[name='Submit']")
e.click()
...
```

Our last step is to locate the “Login” button on the page. From the HTML for the widget, we see we can use the field's name attribute as a locator. Once we find the element, we can call the click method to press it.




```
...
e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys("hctest")

e = browser.find_element_by_css_selector("input[id='passwd']")
e.clear()
e.send_keys("pass123")

e = browser.find_element_by_css_selector("input[name='Submit']")
e.click()
...
```

So all together, our automation for the page looks like this.

Locate, clear, and type into the username field
Locate, clear, and type into the password field
Then locate and click the login button.

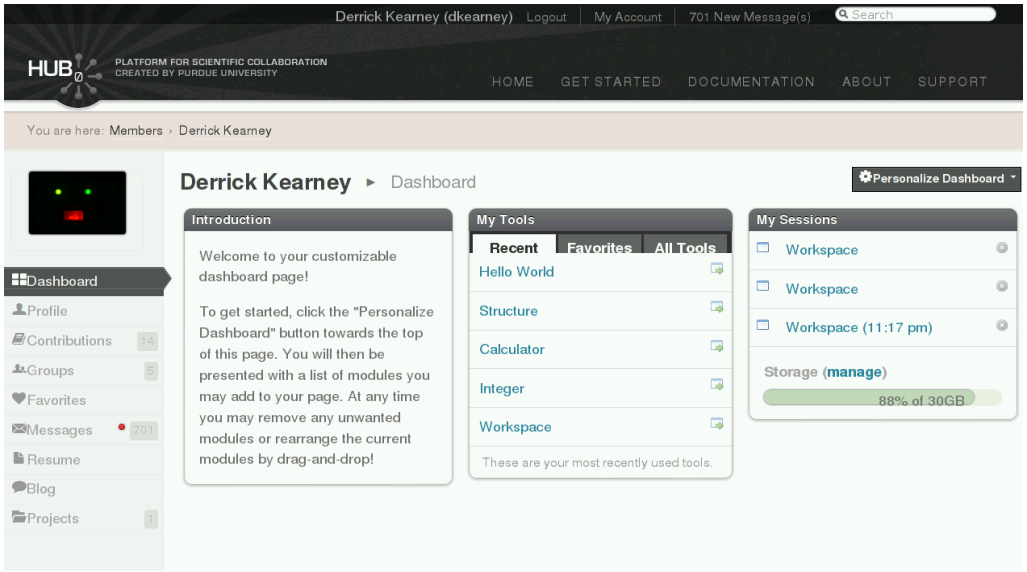
After you have logged in, you can check that login was successful by locating an element that is only on the web page when you have successfully logged in is present on the page.

Alternatively, you would check for a login failure message, but this may slow down all of your successful logins.

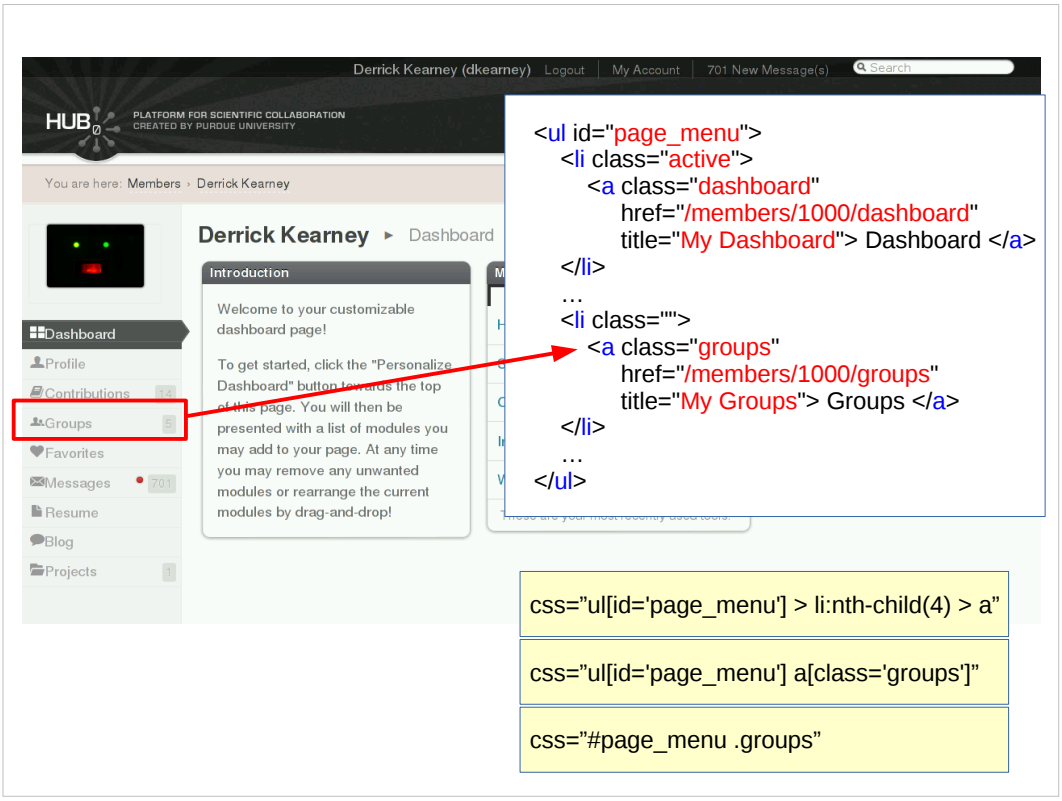
Login automation script

```
from selenium import webdriver

url = 'http://hubzero.org'

browser = webdriver.Firefox()
browser.get(url)

e = browser.find_element_by_css_selector(“input[id='username']”)
e.clear()
e.send_keys(“hctest”)

e = browser.find_element_by_css_selector(“input[id='passwd']”)
e.clear()
e.send_keys(“pass123”)

e = browser.find_element_by_css_selector(“input[name='Submit']”)
e.click()

assert(...)

browser.quit()
```

Here is a look at the whole login automation script.



Here is another example of using locators to find elements. After logging into the website, I get a menu on the left side of the web page. How could I read the link names and cycle through the links until I found one I was interested in?



The HTML for the side menu looks like this. And if I wanted to access the 4th link in the menu, the Groups link, I would need to write a locator to identify it.

The first locator I may try is ul > li 4th child > a
This is a brittle locator, if the website is redesigned and another element is placed in the list, the Groups link may move to 5th position or 3rd position.

The next locator fixes these problem by using the class attribute.

We can rewrite the second locator to make it shorter as seen in the third locator.

Traversing tables and lists:

 # Printing the text of the first link, from all list items:

```
...
elist = browser.find_elements_by_css_selector('#page_menu li')

for e in elist:
    link = e.find_element_by_css_selector('a')
    print 'link text = %s' % (link.text())
...
```

```
<ul id="page_menu">
    <li class="active">
        <a class="dashboard"
            href="/members/1000/dashboard"
            title="My Dashboard"> Dashboard </a>
    </li>
    …
    <li class="">
        <a class="groups"
            href="/members/1000/groups"
            title="My Groups"> Groups </a>
    </li>
    …
</ul>
```

If we wanted to print the text of each link in the list, we could use the find_elements_by_css_selector method to return all elements that match our locator, not just the first. There are a whole host of complimentary methods that return a list of element objects instead of a single element object.

In a for loop, we can loop through our list of element objects, and for each object, call the text method to get the text of the widget.

Traversing tables and lists:

 # Printing the title attribute of the first link, from all list items:

```
...
elist = browser.find_elements_by_css_selector('#page_menu li')

for e in elist:
    link = e.find_element_by_css_selector('a')
    print 'link text = %s' % (link.get_attribute('title'))
...
```

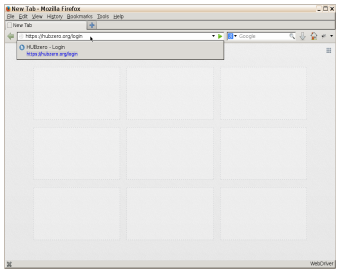
```
<ul id="page_menu">
    <li class="active">
        <a class="dashboard"
            href="/members/1000/dashboard"
            title="My Dashboard"> Dashboard </a>
    </li>
    …
    <li class="">
        <a class="groups"
            href="/members/1000/groups"
            title="My Groups"> Groups </a>
    </li>
    …
</ul>
```

Similarly, if we wanted to print the title attribute of the first link for all list items, we could use the find_elements_by_css_selector to get the list of matching element objects. Next, in our for loop, iterate over each element object, calling the get_attribute() method.

This pretty much concludes the basics of using the Selenium WebDriver library. There are a few more topics that I think are helpful to know about.

Implicit waits:

```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()

browser.get(url)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```



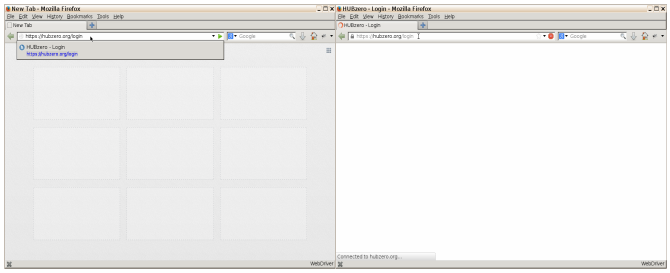
The first being waiting strategies.

If you run enough scripts, you'll eventually see errors like this happening.

You open your browser, navigate to a url

Implicit waits:

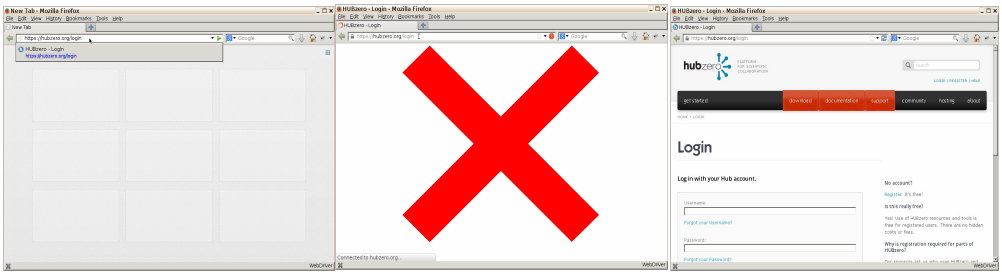
```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()

browser.get(url)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```



And before the web page finishes loading, your script is looking for an element on the page.

Implicit waits:

```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()

browser.get(url)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```

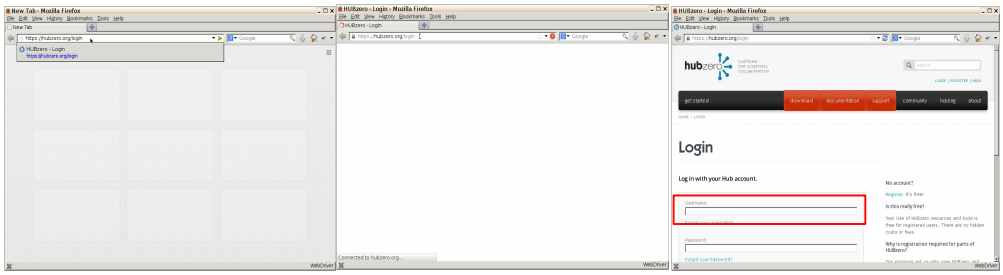


It fails to find the element and your automation dies. Just as it dies, the web page finishes loading.

With modern web pages and ajax, it is really hard to tell when a web page has “finished” loading. There is no “finished” tag that you can look for.

Implicit waits:

```
from selenium import webdriver

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()
browser.implicitly_wait(30)
browser.get(url)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```



To help give your automation a little flexibility, you can add what is called an implicit wait to your element lookup. You only need to call the implicit wait method once for the browser object. It add a polling strategy to the lookup methods. So if the find_element method doesn't find the element on the first try, it will sleep and try again every half second or so until it reaches the timeout you set.

Here the wait is implicit because you did not have to set it explicitly for each find_element call. The wait is implied.

Explicit waits:

```
from selenium import webdriver
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()
browser.get(url)

wait = WebDriverWait(browser, 10)
wait.until(CONDITION)

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```

Alternatively, there are explicit wait as well. To use an explicit wait, you ned to include the WebDriverWait class and you can also include the expected_condition class. The WebDriverWait class creates the explicit wait object that will wait until either some condition is met, or the timeout is passed.

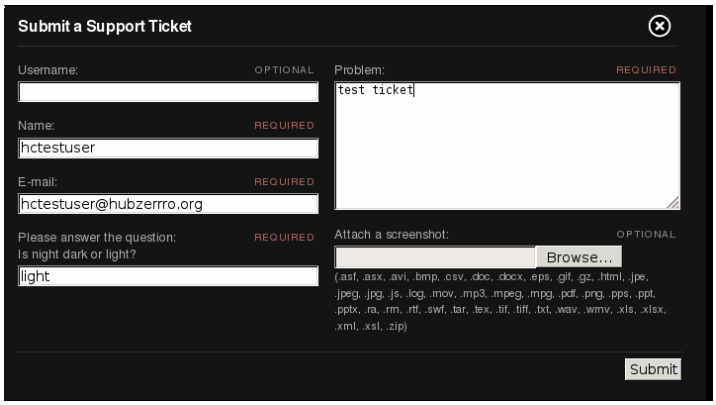
Explicit waits:

```
from selenium import webdriver
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC

url = 'https://hubzero.org/login'

browser = webdriver.Firefox()
browser.get(url)

wait = WebDriverWait(browser, 10)
wait.until(EC.visibility_of_element_located(
                (By.CSS_SELECTOR,'#username'))))

e = browser.find_element_by_css_selector("input[id='username']")
e.clear()
e.send_keys('hctest')

browser.quit()
```

In this case, we can use one of the provided conditions from the expected condition class to check for the visibility of an element. If the element is visible on the page, we are ready to move on and locate the element.

Note there are some conditions that check visibility vs existence of an element. An element can exist on the web page without being visible.

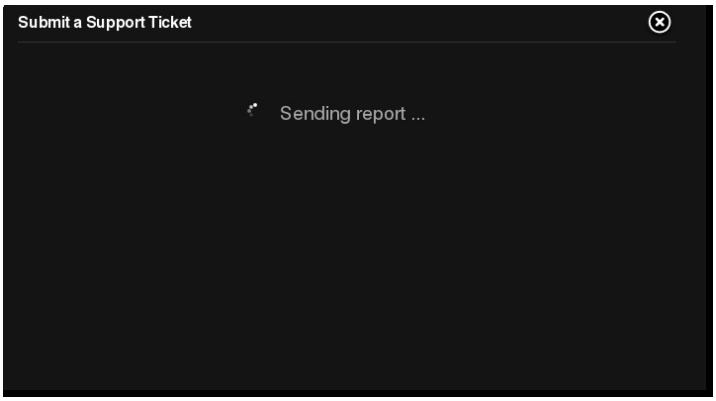
Dealing with AJAX:



One place I've used explicit waits is when dealing with dynamic Javascript from our website's support ticket mechanism.

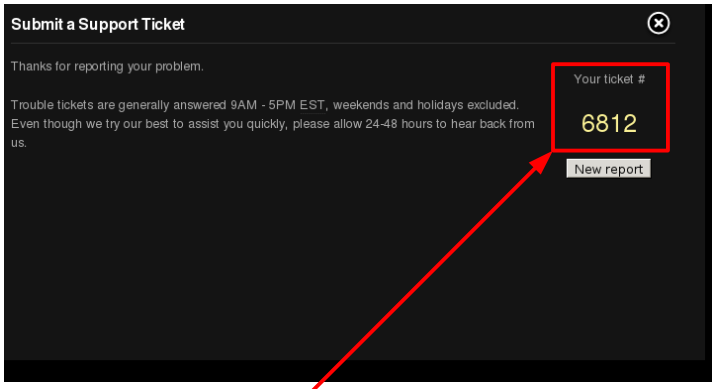
After you fill out a support ticket,

Dealing with AJAX:



You get a spinner like this while the web site stores your support ticket and generates a ticket number for you.

Dealing with AJAX:




```
<div id="trSuccess">
   <div>
      <p>Your ticket #
         <span>
            <a title="View ticket" href="/support/ticket/6812">6812</a>
         </span>
      </p>
   </div>
</div>
```

Then you get a web page like this, where the support ticket number is inside this trSuccess div. Without some kind of waiting, this can be a hard problem to solve.

Dealing with AJAX:

```
…

submit_ticket()

# wait for the page to refresh
wait = WebDriverWait(browser, 60)
e = wait.until(lambda browser :
                browser.find_element_by_id("trSuccess").is_displayed())

ticket_number = e.find_element_by_css_selector('a').text()
...
```

```
<div id="trSuccess">
   <div>
      <p>Your ticket #
         <span>
            <a title="View ticket" href="/support/ticket/6812">6812</a>
         </span>
      </p>
   </div>
</div>
```

With explicit waits, I don't need to increase my implicit wait, which affects all failing element lookups. I can keep my implicit wait timeout low and use the explicit wait with a longer timeout here.

For my condition, I write my own lambda function which returns true or false as to whether the trSuccess div is displayed in the web page.

Once it is displayed, I jump out of my explicit wait, and grab the ticket number.

QUESTIONS?
MOVIES?
MORE?