

# Test Automation(Selenium)

## Lecture 3 – Working with Selenium API & Overview of Selenium WebDriver & Working with WebDriver



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# Summary - overall

- Learn the history of Selenium WebDriver
- Architecture
- Run a test with Firefox
  - Working with Firefox profiles
- Run a test with Google Chrome or Chromium
  - Updating the capabilities of the browser
- Run a test with Opera
  - Working with Opera Profiles
- Run a test with Internet Explorer
  - Working with InternetExplorerDriver
- Checking text, attributes and CSS values
- Mouse & Keyboard Events
- Execution of a JavaScript code
- Screenshots
- Automating dropdowns, radio buttons, checkboxes, browser window
- Controlling windows registry with WebDriver



# Learn the history of Selenium WebDriver (part 1)

- Jason Huggins – created Selenium IDE and Selenium RC(Remote Control) – this initially solved the problem of getting the browser to do user interactions.
- Patrick Lightbody and Paul Hammant thought that there must be a better way to drive their tests and in a way that they could use their favorite development language. They created Selenium Remote Control using Java as a web server that would proxy traffic. It would inject Selenium onto the page and then it would be used in a similar manner as to what it was in the three column manner. This also creates more of a procedural style of development.

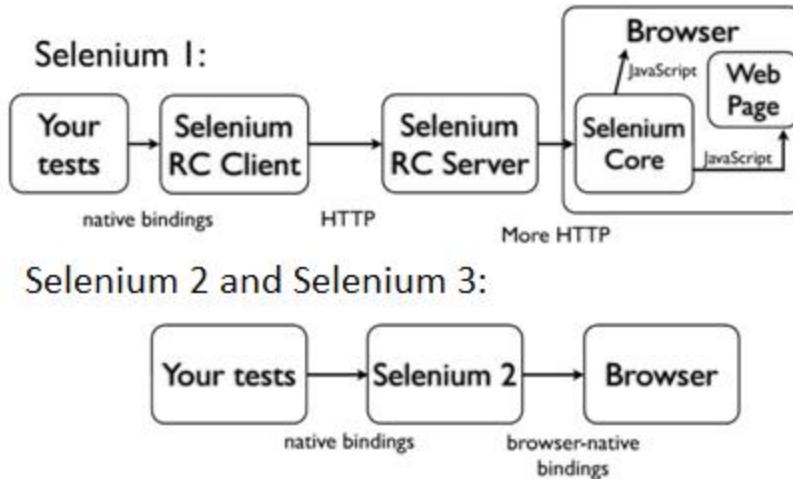


# Learn the history of Selenium WebDriver (part 2)

- Simon Stewart, having hit a number of these issues, wanted to try a different approach to driving the browser. While working for ThoughtWorks, he started working on the WebDriver project. It started originally as a way to drive HTMLUnit and Internet Explorer but having learnt lessons from Selenium RC, Simon was able to design the API to fit in with the way most developers think. Developers have been doing Object Orientated development for a while, so moving away from the procedural style of Selenium RC was a welcome change to developers. For those interested I suggest reading Simon Stewart's article on Selenium design at <http://www.aosabook.org/en/selenium.html>

# Architecture

- The WebDriver architecture does not follow the same approach as Selenium RC, which was written purely in JavaScript for all the browser automation.



- WebDriver on the other hand tries to control the browser from outside the browser. It uses accessibility API to drive the browser



# Working with WebDriver – preliminary points

- IE Driver Executable:  
<http://selenium-release.storage.googleapis.com/index.html>
- Chrome Driver Executable:  
<http://chromedriver.storage.googleapis.com/index.html>
- Opera Driver Executable:  
<https://github.com/operasoftware/operachromiumdriver/releases>
- EdgeDriver Executable:  
<https://developer.microsoft.com/en-us/microsoft-edge/tools/webdriver/>
- Support for Firefox is via Mozilla's geckodriver. You may download this from  
<https://github.com/mozilla/geckodriver/releases>
- Please make sure that you have all the necessary browsers installed respectively for the drivers above.



# More news on version 3.0

- Minimum java version is now 8+
- Firefox is only fully supported at version 47.0.1 or earlier. Support for later versions of firefox is provided by geckodriver, which is based on the evolving W3C WebDriver spec, and uses the wire protocol in that spec, which is liable to change without notice.
- Firefox 47.0.0 is not supported at all.
- **You'll need to start using geckodriver even if you're using Selenium 2 — the change is in the browser, not Selenium.**



# Our First Test Example

```
public class OurFirstTestClass {  
    WebDriver driver;  
  
    @Before  
    public void setUp() {  
        driver = //we will update this part with each section  
        driver.get("http://pragmatic.bg/automation/");  
    }  
  
    @After  
    public void tearDown() {  
        driver.quit();  
    }  
    @Test  
    public void testExample1() {  
        // We will put examples in here  
    }  
  
    @Test  
    public void testExample2() {  
        // We will put examples in here  
    }  
}
```



# JUnit @Annotations

Annotation	Description
@Test public void method()	The annotation <code>@Test</code> identifies that a method is a test method.
@Before public void method()	This method is executed before each test. This method can prepare the test environment (e.g. read input data, initialize the class).
@After public void method()	This method is executed after each test. This method can cleanup the test environment (e.g. delete temporary data, restore defaults). It can also save memory by cleaning up expensive memory structures.
@BeforeClass public static void method()	This method is executed once, before the start of all tests. This can be used to perform time intensive activities, for example to connect to a database. Methods annotated with this annotation need to be defined as <code>static</code> to work with JUnit.
@AfterClass public static void method()	This method is executed once, after all tests have been finished. This can be used to perform clean-up activities, for example to disconnect from a database. Methods annotated with this annotation need to be defined as <code>static</code> to work with JUnit.
@Ignore	Ignores the test method. This is useful when the underlying code has been changed and the test case has not yet been adapted. Or if the execution time of this test is too long to be included.
@Test(expected = Exception.class)	Fails, if the method does not throw the named exception.
@Test(timeout=100)	Fails, if the method takes longer than 100 milliseconds.



# Working with FirefoxDriver (part 1)

- Since Selenium 3 you need to set a property for the geckodriver in order to use Firefox browser like:

1. Update the *setUp()* method to load the

```
System.setProperty("webdriver.gecko.driver",  
"D:\\drivers\\geckodriver.exe");  
WebDriver driver = new FirefoxDriver();
```

2. Now we need to find an element. In this section we will find the one with the ID *nextBid*:

```
WebElement element =  
driver.findElement(By.id("nextBid"));
```

3. Now we need to type into that element:

```
element.sendKeys("100");
```



# Working with FirefoxDriver (part 2)

4. Run your test and it should look like the following:

```
public class OurFirstTestClass {  
    WebDriver driver;  
  
    @Before  
    public void setUp() {  
        System.setProperty("webdriver.gecko.driver",  
                           "D:\\drivers\\geckodriver.exe");  
        driver = new FirefoxDriver();  
        driver.get("http://pragmatic.bg/automation/example4");  
    }  
    @After  
    public void tearDown() {  
        driver.quit();  
    }  
    @Test  
    public void testExamples() {  
        WebElement element = driver.findElement(By.id("nextBid"));  
        element.sendKeys("100");  
    }  
}
```

# Working with FirefoxDriver Profiles (part 1)



- There are times where we need to update the preferences within Firefox.
- <http://www.askvg.com/how-to-access-hidden-secret-advanced-configuration-pages-in-mozilla-firefox-google-chrome-and-opera-web-browsers/>
  - This could be to switch on parts of Firefox that are disabled while they are in development
  - or you want to get more information from the browser while your tests are running

```
FirefoxOptions options = new FirefoxOptions();
FirefoxProfile profile = new FirefoxProfile();
profile.setPreference("browser.startup.homepage",
"http://pragmatic.bg/automation/example4.html");
options.setProfile(profile);
driver = new FirefoxDriver(options);
```

# Working with FirefoxDriver Profiles (part 2)



```
public class OurSecondExampleClass {  
    WebDriver driver;  
    @Before  
    public void setUp() {  
        System.setProperty("webdriver.gecko.driver",  
            "D:\\drivers\\geckodriver.exe");  
        FirefoxOptions options = new FirefoxOptions();  
        FirefoxProfile profile = new FirefoxProfile();  
        profile.setPreference("browser.startup.homepage", "http://  
            pragmatic.bg/automation/example4.html");  
        options.setProfile(profile);  
        driver = new FirefoxDriver(options);  
    }  
    @After  
    public void tearDown() {  
        driver.quit();  
    }  
    @Test  
    public void testExamples() {  
        WebElement element = driver.findElement(By.id("nextBid"));  
        element.sendKeys("100");  
    }  
}
```

# Working with ChromeDriver (part 1)



- Imagine that you wanted to work with Google Chrome to get an attribute of an element on the page. To do this we will need to instantiate a ChromeDriver. Let's see an example.

```
System.setProperty("webdriver.chrome.driver",
    "C:\\\\path\\\\to\\\\chromedriver.exe");
driver = new ChromeDriver();
WebElement element =
    driver.findElement(By.id("selectLoad"));
element.getAttribute("value");
```

# Working with ChromeDriver (part 2)



```
public class ChromeDriverExample {  
    WebDriver driver;  
  
    @Before  
    public void setUp() {  
        System.setProperty("webdriver.chrome.driver",  
"D:\\drivers\\chromedriver.exe");  
        driver = new ChromeDriver();  
        driver.get("http://www.pragmatic.bg/automation/example4");  
    }  
  
    @After  
    public void tearDown() {  
        driver.quit();  
    }  
  
    @Test  
    public void testExamples() {  
        WebElement element = driver.findElement(By.id("selectLoad"));  
        String value = element.getAttribute("value");  
        Assert.assertEquals("Click to load the select below", value);  
    }  
}
```

# ChromeOptions (part 1)

- Google Chrome or Chromium doesn't really have a profile that users can update in the same sense as Firefox. It does however have a mechanism that allows us to set certain options that Chrome will try and use. We can also tell it to install Chromium extensions, which are like Firefox add-ons, into the browser so we can enhance the experience.



# ChromeOptions(part 2)

- Run custom Chrome profile:
  
- ```
ChromeOptions options = new ChromeOptions();  
options.addArguments("user-data-dir=/path/to/your/custom/profile");
```



# ChromeOptions (part 3)

- Refer to **ChromeDriverExample.java**
- We have just seen how we can inject options that we want Chrome or Chromium to start with. If we needed to pass in the arguments that we could start the browser with or if we needed to tell ChromeDriver, we can use **addArguments()**. This allows us to do many things to the browser. We can see a definitive list at
- [http://src.chromium.org/viewvc/chrome/trunk/src/chrome/common/chrome\\_switches.cc?view=markup](http://src.chromium.org/viewvc/chrome/trunk/src/chrome/common/chrome_switches.cc?view=markup)
- <http://www.askvg.com/how-to-access-hidden-secret-advanced-configuration-pages-in-mozilla-firefox-google-chrome-and-opera-web-browsers/>

# Working with OperaDriver (part 1)



- Opera Software, the company that creates Opera, has created their own project to support Selenium WebDriver. Since not every web browser will act the same with the sites that we create, it is a good idea to make sure we can test our applications with OperaDriver.
- Imagine that you want to test your web application that uses geolocation in the browser, when it cannot use geolocation. All location-based applications need to support this if you were to get a user who is worried about privacy on certain machines.



# Working with OperaDriver (part 2)

```
public class OperaDriverExample {  
    Webdriver driver;  
    @Before  
    public void setUp() {  
  
        System.setProperty("webdriver.opera.driver",  
                           "D:\\drivers\\operadriver2.27.exe");  
        OperaOptions options = new OperaOptions();  
        options.setBinary("C:\\Program Files  
                          (x86)\\Opera\\launcher.exe");  
        driver = new OperaDriver(options);  
        driver.get("http://pragmatic.bg/automation/");  
  
    }  
    . . . . . . . . . . . .
```



# Working with InternetExplorerDriver (part 1)

- Internet Explorer is the most used browser in the world followed by Firefox and Google Chrome so getting IEDriver working is going to be a high priority. The current version IEDriver supports IE6 through to IE11 so you will be able to test your websites work on old browsers right up to the latest modern version of the browser.
- Since Selenium 3, IE9+ is officially supported
- IE8, IE7, IE6 - might still work but they are not officially supported and will stop to work at some point



# Working with InternetExplorerDriver (part 2)

```
public class InternetExplorerDriverExample {  
    WebDriver driver;  
  
    @Before  
    public void setUp() {  
        System.setProperty("webdriver.ie.driver",  
                           "C:\\\\path\\\\to\\\\IEDriverServerx32.exe");  
        driver = new InternetExplorerDriver();  
        driver.get("http://pragmatic.bg/automation/example4.html");  
    }  
  
    @After  
    public void tearDown() {  
        driver.quit();  
    }  
  
    @Test  
    public void testExamples() {  
        WebElement element = driver.findElement(By.id("bid"));  
        Assert.assertEquals("50", element.getText());  
    }  
}
```



# Checking an element's text (part 1)

- While testing a web application, we need to verify that elements are displaying correct values or text on the page.
- Sometimes, we need to retrieve text or value from an element into a variable at runtime and later use it at some other place in the test flow.
- Using the WebElement interface' `getText()` method.



# Checking an element's text (part 2)

```
public class ElementTests {  
//Open http://pragmatic.bg/automation/lecture13/DoubleClickDemo.html  
@Test  
public void testElementText()  
{  
    //Get the message Element  
    WebElement message = driver.findElement(By.id("message"));  
  
    //Get the message elements text  
    String messageText = message.getText();  
  
    //Verify message element's text displays "Click on me and my color  
    //will change"  
    assertEquals("Click on me and my color will change", messageText);  
  
    //Get the area Element  
    WebElement area = driver.findElement(By.id("area"));  
  
    //Verify area element's text displays "Div's Text\nSpan's Text"  
    assertEquals("Div's Text\nSpan's Text",area.getText());  
}
```



# Checking an element's text (part 3)

- There is more:
  - `assertTrue(messageText.contains("color"));`
  - `assertTrue(messageText.startsWith("Click on"));`
  - `assertTrue(messageText.endsWith("will change"));`



# Checking an element's attribute values

- Developers configure various attributes of elements displayed on the web page during design or at runtime to control the behavior or style of elements when they are displayed in the browser. For example, the `<input>` element can be set to read-only by setting the *readonly* attribute.

```
@Test //that's in class ElementTests.java
public void testElementAttribute()
{
    //open http://pragmatic.bg/automation/lecture13/DoubleClickDemo.html
    WebElement message = driver.findElement(By.id("message"));
    assertEquals("justify", message.getAttribute("align"));
}
```



# Checking an element's CSS values

- There may be tests that need to verify that correct styles have been applied to the elements. This can be done using WebElement class's *getCSSValue()* method, which returns the value of a specified style attribute.

```
@Test  
public void testElementStyle()  
{  
    //open http://pragmatic.bg/automation/lecture13/DoubleClickDemo.html  
  
    WebElement message = driver.findElement(By.id("message"));  
    String width = message.getCssValue("width");  
    assertEquals("150px", width);  
}
```



# Automating dropdowns and lists (part 1)

- Selenium WebDriver supports testing Dropdown and List controls using a special **Select** class instead of the WebElement class.
- The Select class provides various methods and properties to interact with dropdowns and lists created with the HTML <select> element.



# Automating dropdowns and lists (part 2)

```
@Test
public void testDropdown() {
    //open class SelectTest.java
    Select make = new Select(driver.findElement(By.name("make")));

    assertFalse(make.isMultiple());
    assertEquals(4, make.getOptions().size());

    List<String> exp_options = Arrays.asList(new String[]{"BMW", "Mercedes",
"Audi", "Honda"});
    List<String> act_options = new ArrayList<String>();

    for(WebElement option : make.getOptions())
        act_options.add(option.getText());

    assertArrayEquals(exp_options.toArray(),act_options.toArray());

    make.selectByVisibleText("Honda");
    assertEquals("Honda", make.getFirstSelectedOption().getText());

    make.selectByValue("audi");
    assertEquals("Audi", make.getFirstSelectedOption().getText());

    //or we can select an option in Dropdown using index
    make.selectByIndex(0);
    assertEquals("BMW", make.getFirstSelectedOption().getText());
}
```



# Automating dropdowns and lists (part 3)

- Create another test for a List control which has multi-selection enabled. The test will perform some basic checks and then call methods to select multiple options in a list. The test will verify the selection and then deselect the options by calling various deselection methods, namely by visible text, by value, and by index, respectively.



# Automating dropdowns and lists (part 4)

```
@Test
public void testMultipleSelectList() {
    Select color = new Select(driver.findElement(By.name("color")));
    assertTrue(color.isMultiple());
    assertEquals(5, color.getOptions().size());
    color.selectByVisibleText("Black");
    color.selectByVisibleText("Red");
    color.selectByVisibleText("Silver");
    assertEquals(3,color.getAllSelectedOptions().size());

    List<String> exp_sel_options = Arrays.asList(new String[]{"Black", "Red",
"Silver"});
    List<String> act_sel_options = new ArrayList<String>();

    for(WebElement option : color.getAllSelectedOptions())
        act_sel_options.add(option.getText());

    assertArrayEquals(exp_sel_options.toArray(),act_sel_options.toArray());
    color.deselectByVisibleText("Silver");
    assertEquals(2,color.getAllSelectedOptions().size());
    color.deselectByValue("rd");
    assertEquals(1,color.getAllSelectedOptions().size());
    color.deselectByIndex(0);
    assertEquals(0,color.getAllSelectedOptions().size());
}
```



# Automating radio buttons and radio groups (part 1)

- Selenium WebDriver supports Radio Button and Radio Group controls using the WebElement class. We can select and deselect the radio buttons using the `click()` method of the WebElement class and check whether a radio button is selected or deselected using the `isSelected()` method.



# Automating radio buttons and radio groups (part 2)

```
@Test
public void testRadioButton(){    //Open class RadioButtonTest.java
    WebElement petrol = driver.findElement(By.xpath("//input[@value='Petrol']"));

    //Check if its already selected? Otherwise select the RadioButton by calling click()
    if (!petrol.isSelected())
        petrol.click();
    //Verify Radio Button is selected
    assertTrue(petrol.isSelected());
    //We can also get all the Radio buttons from a Radio Group in a list
    //using findElements() method along with Radio Group identifier
    List<WebElement> fuel_type = driver.findElements(By.name("fuel_type"));
    for (WebElement type : fuel_type)
    {
        //Search for Diesel Radio Button in the Radio Group and select it
        if(type.getAttribute("value").equals("Diesel"))
        {
            if(!type.isSelected())
                type.click();

            assertTrue(type.isSelected());
            break;
        }
    }
}
```

# Automating checkboxes (part 1)



- Selenium WebDriver supports Checkbox control using the WebElement class. We can select or deselect a checkbox using the `click()` method of the WebElement class and check whether a checkbox is selected or deselected using the `isSelected()` method.

# Automating checkboxes (part 2)



```
@Test
public void testCheckBox() {
    //open class CheckBoxTest.java
    //Get the Checkbox as WebElement using it's value attribute
    WebElement airbags =
        driver.findElement(By.xpath("//input[@value='Airbags']"));

    //Check if its already selected? otherwise select the Checkbox
    //by calling click() method
    if (!airbags.isSelected())
        airbags.click();

    //Verify Checkbox is Selected
    assertTrue(airbags.isSelected());

    //Check Checkbox if selected? If yes, deselect it
    //by calling click() method
    if (airbags.isSelected())
        airbags.click();

    //Verify Checkbox is Deselected
    assertFalse(airbags.isSelected());
}
```

# Using Advanced User Interactions API for mouse and keyboard events (part 1)

- The Selenium WebDriver's Advanced User Interactions API allows us to perform operations from keyboard events and simple mouse events to complex events such as dragging-and-dropping, holding a key and then performing mouse operations by using the *Actions* class, and building a complex chain of events exactly like a user doing these manually



# Performing drag-and-drop operations (part 1)

- Selenium WebDriver implements Selenium RC's dragAndDrop command using **Actions** class. As seen in earlier recipes the Actions class supports advanced user interactions such as firing various mouse and keyboard events. We can build simple or complex chains of events using this class.



# Performing drag-and-drop operations (part 2)

```
@Test //open class DragDropTest.java
public void testDragDrop() {
    driver.get("http://pragmatic.bg/automation/lecture13/DragDropDemo
.html");

    WebElement source = driver.findElement(By.id("draggable"));
    WebElement target = driver.findElement(By.id("droppable"));

    Actions builder = new Actions(driver);
    builder.dragAndDrop(source, target).perform();
    try
    {
        assertEquals("Dropped!", target.getText());
    } catch (Error e) {
        verificationErrors.append(e.toString());
    }
}
```



# Executing JavaScript code (part 1)

- Selenium WebDriver API provides the ability to execute JavaScript code with the browser window. This is a very useful feature where tests need to interact with the page using JavaScript. Using this API, client-side JavaScript code can also be tested using Selenium WebDriver. Selenium WebDriver provides a **JavascriptExecutor** interface that can be used to execute arbitrary JavaScript code within the context of the browser.



# Executing JavaScript code (part 2)

```
@Test //open class ExecuteJavaScript.java
public void testJavaScriptCalls() throws Exception
{
    System.setProperty("webdriver.chrome.driver", "C:\\\\path
to\\\\chromedriver.exe");
    WebDriver driver = new ChromeDriver();
    driver.get("http://www.google.com");

    JavascriptExecutor js = (JavascriptExecutor) driver;

    String title = (String) js.executeScript("return
document.title");
    assertEquals("Google", title);

    long links = (Long) js.executeScript("var links =
document.getElementsByTagName('A'); return links.length");
    assertEquals(35, links);

    driver.quit();
}
```

# Capturing screenshots with Selenium WebDriver (part 1)



- Selenium WebDriver provides the *TakesScreenshot* interface for capturing a screenshot of a web page. This helps in test runs, showing exactly happened when an exception or error occurred during execution, and so on. We can also capture screenshots during verification of element state, values displayed, or state after an action is completed.
- Capturing screenshots also helps in verification of layouts, field alignments, and so on where we compare screenshots taken during test execution with baseline images.

# Capturing screenshots with Selenium WebDriver (part 2)



```
@Test //open class ScreenshotTests.java
public void testTakesScreenshot()
{
    try {
        File scrFile =
            ((TakesScreenshot) driver).getScreenshotAs(OutputType.FILE);
        FileUtils.copyFile(scrFile, new File("c:\\tmp\\main_page.png"));
    } catch (Exception e) {
        e.printStackTrace();
    }
}
```

# Capturing screenshots with Selenium WebDriver (part 3)



- Take a screenshot of a specific element (this will require a helper method, cuz it's not supported by default by Selenium TakeScreenshot class)

```
@Test
public void testElementScreenshot() {

    WebElement pmoabsdiv = driver.findElement(By.className("pmoabs"));
    try {
        FileUtils.copyFile(ScreenshotTests.captureElementBitmap(pmoabsdiv),
new File("c:\\tmp\\div.png"));
    } catch (Exception e) {
        e.printStackTrace();
    }
}
```

- The helper captureElementBitmap on the next slide

# Capturing screenshots with Selenium WebDriver (part 4)



```
public static File captureElementBitmap(WebElement element) throws Exception {  
    //Get the WrapsDriver of the WebElement  
    WrapsDriver wrapsDriver = (WrapsDriver) element;  
  
    //Get the entire Screenshot from the driver of passed WebElement  
    File screen = ((TakesScreenshot)  
wheelsDriver.getWrappedDriver()).getScreenshotAs(OutputType.FILE);  
  
    //Create an instance of Buffered Image from captured screenshot  
    BufferedImage img = ImageIO.read(screen);  
  
    // Get the Width and Height of the WebElement using  
    int width = element.getSize().getWidth();  
    int height = element.getSize().getHeight();  
  
    //Create a rectangle using Width and Height  
    Rectangle rect = new Rectangle(width, height);  
  
    //Get the Location of WebElement in a Point. ....  
    //This will provide X & Y co-ordinates of the WebElement  
    Point p = element.getLocation();  
    //Create image by for element using its location and size.  
    //This will give image data specific to the WebElement  
    BufferedImage dest = img.getSubimage(p.getX(), p.getY(), rect.width, rect.height);  
    //Write back the image data for element in File object  
    ImageIO.write(dest, "png", screen);  
    //Return the File object containing image data  
    return screen;  
}
```



# Maximizing the browser window

- Selenium RC's **windowMaximize()** command was missing in Selenium WebDriver. However starting from release 2.21, Selenium WebDriver supports maximizing the browser window.

```
@Test //open class WindowMaximize.java
public void testRowSelectionUsingControlKey() throws Exception {

    WebDriver driver = new FirefoxDriver();

    driver.get("http://www.google.com");
    driver.manage().window().maximize();
    Thread.sleep(1000);
    driver.quit();
}
```

# Questions?

