The automated testing of a website can be built by creating behavior-driven development Cucumber feature files and associated unit tests (JUnit) that reference Java page objects representing the web application using the Selenium WebDriver and a headless environment such as PhantomJS Driver, and then porting the solution into a continuous integration environment (Jenkins).

Below are the Maven dependencies to execute an automated testing solution using Cucumber, Selenium WebDriver, PhatomJS Driver, JUnit, Spring, Log4j, and Sauce Labs.

|  |  |
| --- | --- |
| Description | Maven Dependency |
| Cucumber | <dependency>  <groupId>info.cukes</groupId>  <artifactId>cucumber-java</artifactId>  <version>1.2.4</version>  </dependency>  <dependency>  <groupId>info.cukes</groupId>  <artifactId>cucumber-picocontainer</artifactId>  <version>1.2.4</version>  </dependency>  <dependency>  <groupId>info.cukes</groupId>  <artifactId>cucumber-junit</artifactId>  <version>1.2.4</version>  </dependency> |
| Selenium WebDriver | <dependency> <groupId>org.seleniumhq.selenium</groupId>  <artifactId>selenium-java</artifactId>  <version>2.53.0</version>  </dependency>  <dependency> <groupId>org.seleniumhq.selenium</groupId>  <artifactId>selenium-server</artifactId>  <version>2.44.0</version>  </dependency>  <dependency> <groupId>org.seleniumhq.selenium</groupId>  <artifactId>htmlunit-driver</artifactId>  <version>2.21</version>  </dependency> |
| PhatomJSDriver (Ghost Driver) | <dependency>  <groupId>com.github.detro</groupId> <artifactId>phantomjsdriver</artifactId>  <version>1.2.0</version>  </dependency> |
| JUnit | <dependency>  <groupId>junit</groupId>  <artifactId>junit</artifactId>  <version>4.11</version>  </dependency> |
| Spring | <dependency> <groupId>org.springframework</groupId>  <artifactId>spring-context</artifactId>  <version>4.3.3.RELEASE</version>  </dependency> |
| Log4j | <dependency>  <groupId>org.apache.logging.log4j</groupId>  <artifactId>log4j-api</artifactId>  <version>2.7</version>  </dependency>  <dependency>  <groupId>org.apache.logging.log4j</groupId>  <artifactId>log4j-core</artifactId>  <version>2.7</version>  </dependency> |
| Sauce Labs | <dependency>  <groupId>com.saucelabs</groupId>  <artifactId>sauce\_junit</artifactId>  <version>2.1.21</version>  <scope>test</scope>  </dependency> |

The steps to install PhantomJS below are to be executed on the server where Jenkins is hosted.

|  |  |
| --- | --- |
| Install PhantomJS | As Referenced from <https://gist.github.com/julionc/7476620>.  Version: 2.1.1  Platform: x86\_64  First, install or update to the latest system software.  sudo apt-get update  sudo apt-get install build-essential chrpath libssl-dev libxft-dev  Install these packages needed by PhantomJS to work correctly.  sudo apt-get install libfreetype6 libfreetype6-dev  sudo apt-get install libfontconfig1 libfontconfig1-dev  Get it from the [PhantomJS website](http://phantomjs.org/).  cd ~  export PHANTOM\_JS="phantomjs-2.1.1-linux-x86\_64"  wget https://bitbucket.org/ariya/phantomjs/downloads/$PHANTOM\_JS.tar.bz2 sudo tar xvjf $PHANTOM\_JS.tar.bz2  Once downloaded, move Phantomjs folder to /usr/local/share/ and create a symlink:  sudo mv $PHANTOM\_JS /usr/local/share  sudo ln -sf /usr/local/share/$PHANTOM\_JS/bin/phantomjs /usr/local/bin  Now, It should have PhantomJS properly on your system.  phantomjs –version |

Cucumber uses feature files to specify use cases that describe a specific function of the software being tested. The feature files use the Gherkin language to define the test cases. The Gherkin syntax is designed to be non-technical and human readable in effort to promote business driven development practices across an entire development team. A feature file is separated into three parts: Features, Scenarios, and Steps. The Features describe specific function of the software being tested. Each feature is made of a collection of scenarios and each Scenario is defined by a sequence of Steps. Using java annotations, the Cucumber Steps associate with JUnit tests.

Below is the defined feature file for this application: angularjsWebsite.feature.

Feature: To test the AngularJS website home page.

Background:

Given I am on the AngularJS website home page.

@angularJSWebsite

Scenario: Test basic components on the AngularJS home page.

When I confirm I am on the AngularJS website home page.

| Field | Value |

| DownLoad Angular JS One Button | Download AngularJS 1\n\n (1.6.0-rc.1 / 1.5.8 / 1.2.32) |

Then I click on the Download AngularJS One button.

And I check the properties of the Download AngularJS One page.

| Field | Value |

| Title Label | Download AngularJS |

| Branch | 1.5.x (stable) |

| Build Minified | Minified |

| Build Zip | Zip |

| Build Uncompressed | Uncompressed |

| Cdn | angular.min.js |

| Bower | bower |

| Npm | npm |

| Extras | Browse additional modules |

| Previous Versions | Previous Versions |

| Download Button | angular.min.js |

| Close Button | × |

Then I click on the Close button of the Download AngularJS One page.

@angularJSWebsiteTestTheBasics

Scenario: Test The Basics.

When I fill in the name.

| Field | Value |

| Name | Greg |

Then I confirm the message.

| Field | Value |

| Name Message | Hello Greg! |

@angularJSWebsiteTestAddSomeControl

Scenario: Test Add Some Control.

When I confirm the labels of the current todo items.

| Field | Value |

| First Todo Checkbox | learn angular |

| Second Todo Checkbox | build an angular app |

Then I confirm the todo checkboxes that are selected.

| Field | Value |

| First Todo Checkbox | learn angular |

And I confirm the todo checkboxes that are not selected.

| Field | Value |

| Second Todo Checkbox | build an angular app |

Then I add a new todo item.

| Field | Value |

| New Todo List Item | Go to the dentist |

And I check the values of the todo items.

| Field | Value |

| First Todo Checkbox | learn angular |

| Second Todo Checkbox | build an angular app |

| New Todo List Item | Go to the dentist |

Then I select the check box of the new todo item.

| Field | Value |

| New Todo List Item | Go to the dentist |

And I recheck the value of the todo items.

| Field | Value |

| First Todo Checkbox | learn angular |

| New Todo List Item | Go to the dentist |

@angularJSWebsiteTestWireUpABackend

Scenario: Test Wire Up A Backend.

When I confirm the labels of the current JavaScript Projects.

| Field | Value |

| Angular 2 | Angular 2 |

| AngularJS | AngularJS |

| Backbone | Backbone |

| Cappucino | Cappucino |

| Ember | Ember |

| GWT | GWT |

| jQuery | jQuery |

| Knockout | Knockout |

| Polymer | Polymer |

| React | React |

| Spine | Spine |

| SproutCore | SproutCore |

Then I confirm the labels of the current JavaScript Project Descriptions.

| Field | Value |

| Angular 2 | One framework. Mobile and desktop. |

| AngularJS | HTML enhanced for web apps! |

| Backbone | Models for your apps. |

| Cappucino | Objective-J. |

| Ember | Ambitious web apps. |

| GWT | JS in Java. |

| jQuery | Write less, do more. |

| Knockout | MVVM pattern. |

| Polymer | Reusable components for the modern web. |

| React | A JavaScript library for building user interfaces. |

| Spine | Awesome MVC Apps. |

| SproutCore | A Framework for Innovative web-apps. |

Then Search for, update, and confirm a project values.

| Field | Value |

| GWT\_Current\_Name | GWT |

| GWT\_Current\_Website | http://www.gwtproject.org/ |

| GWT\_Current\_Description | JS in Java. |

| GWT\_Updated\_Name | GWT\_Updated |

| GWT\_Updated\_Website | http://www.gwtproject\_updated.org/ |

| GWT\_Updated\_Description | JS in Java.\_Updated |

@angularJSWebsiteTestCreateComponents

Scenario: Test Wire Create Components.

When I confirm the locales.

| Field | Value |

| United States | US |

| Slovakia | SK |

Then I confirm the localization values for United States.

| Field | Value |

| US\_Date | Date: Sunday, April 1, 2012 |

| US\_Currency | Currency: $123,456.00 |

| US\_Number | Number: 98,765.432 |

And I confirm the pluralization values for United States.

| Field | Value |

| no beers | no beers |

| 1 beer | 1 beer |

| 2 beer | 2 beer |

| 3 beer | 3 beer |

| 4 beer | 4 beer |

| 5 beer | 5 beer |

| 6 beer | 6 beer |

| 7 beer | 7 beer |

Then I confirm the localization values for Slovakia.

| Field | Value |

| SK\_Date | Date: nedeľa, 1. apríla 2012 |

| SK\_Currency | Currency: 123 456,00 € |

| SK\_Number | Number: 98 765,432 |

And I confirm the pluralization values for Slovakia.

| Field | Value |

| žiadne pivo | žiadne pivo |

| 1 pivo | 1 pivo |

| 2 pivá | 2 pivá |

| 3 pivá | 3 pivá |

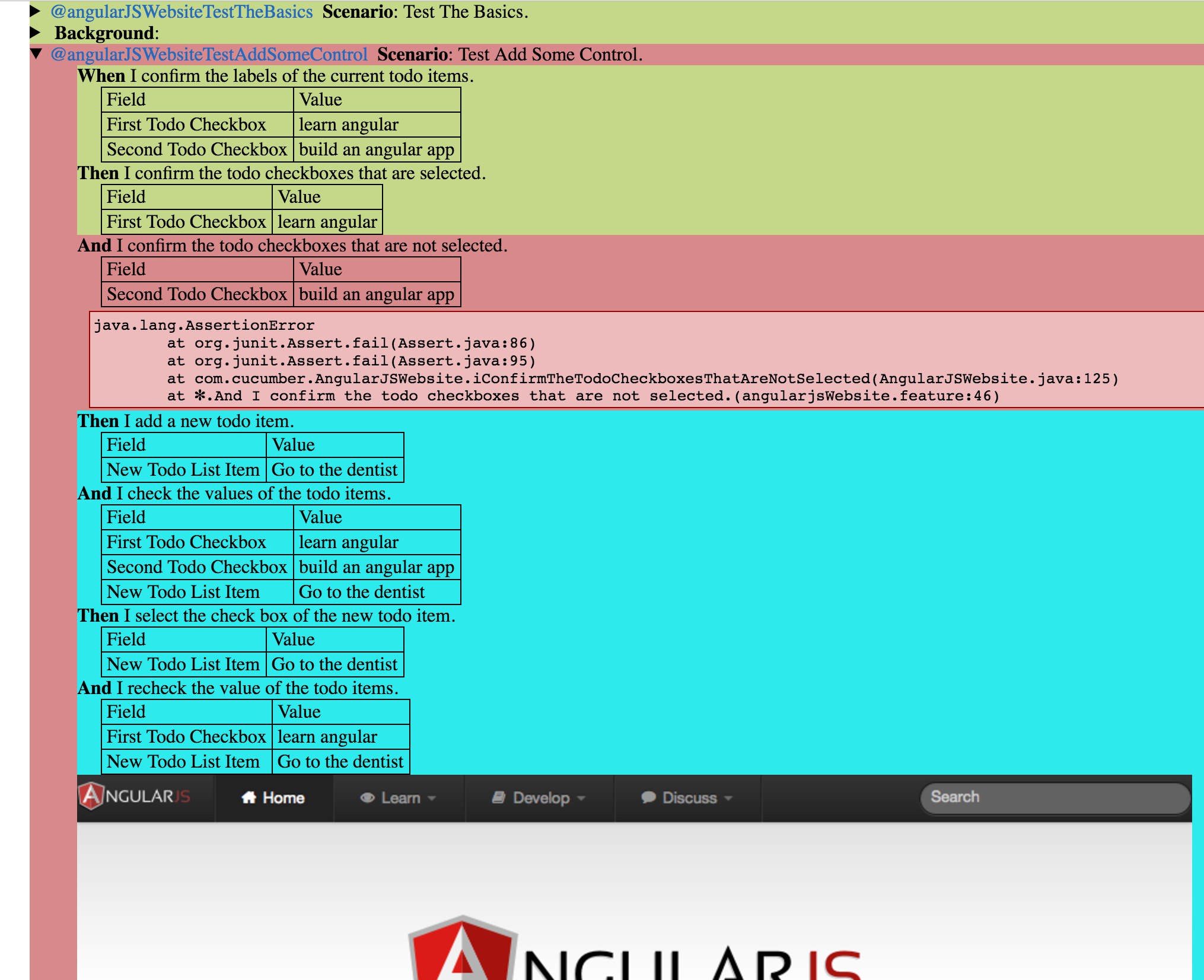
| 4 pivá | 4 pivá |

| 5 pív | 5 pív |

| 6 pív | 6 pív |

| 7 beer | 7 beer |

As specified in RunnerTest.java, the Cucumber test results are found in the target folder. The results are specified as both an html (index.html) and json (output.json) file. The html test results are color coded according to status of the execution. For instance, green specifies passed steps, red specifies failed steps, and blue specifies skip steps. After a failed step, Cucumber skips the rest of the steps of the scenario. A screen shot is taken of the failed step. Below is an example of a Cucumber html report displaying a failed test.



Below is the code snippet from a Cucumber json report that displays the failed test.

{

"result": {

"duration": 224821,

"error\_message": "java.lang.AssertionError\n\tat org.junit.Assert.fail(Assert.java:86)\n\tat org.junit.Assert.fail(Assert.java:95)\n\tat com.cucumber.AngularJSWebsite.iConfirmTheTodoCheckboxesThatAreNotSelected(AngularJSWebsite.java:125)\n\tat ✽.And I confirm the todo checkboxes that are not selected.(angularjsWebsite.feature:46)\n",

"status": "failed"

},

"line": 46,

"name": "I confirm the todo checkboxes that are not selected.",

"match": {

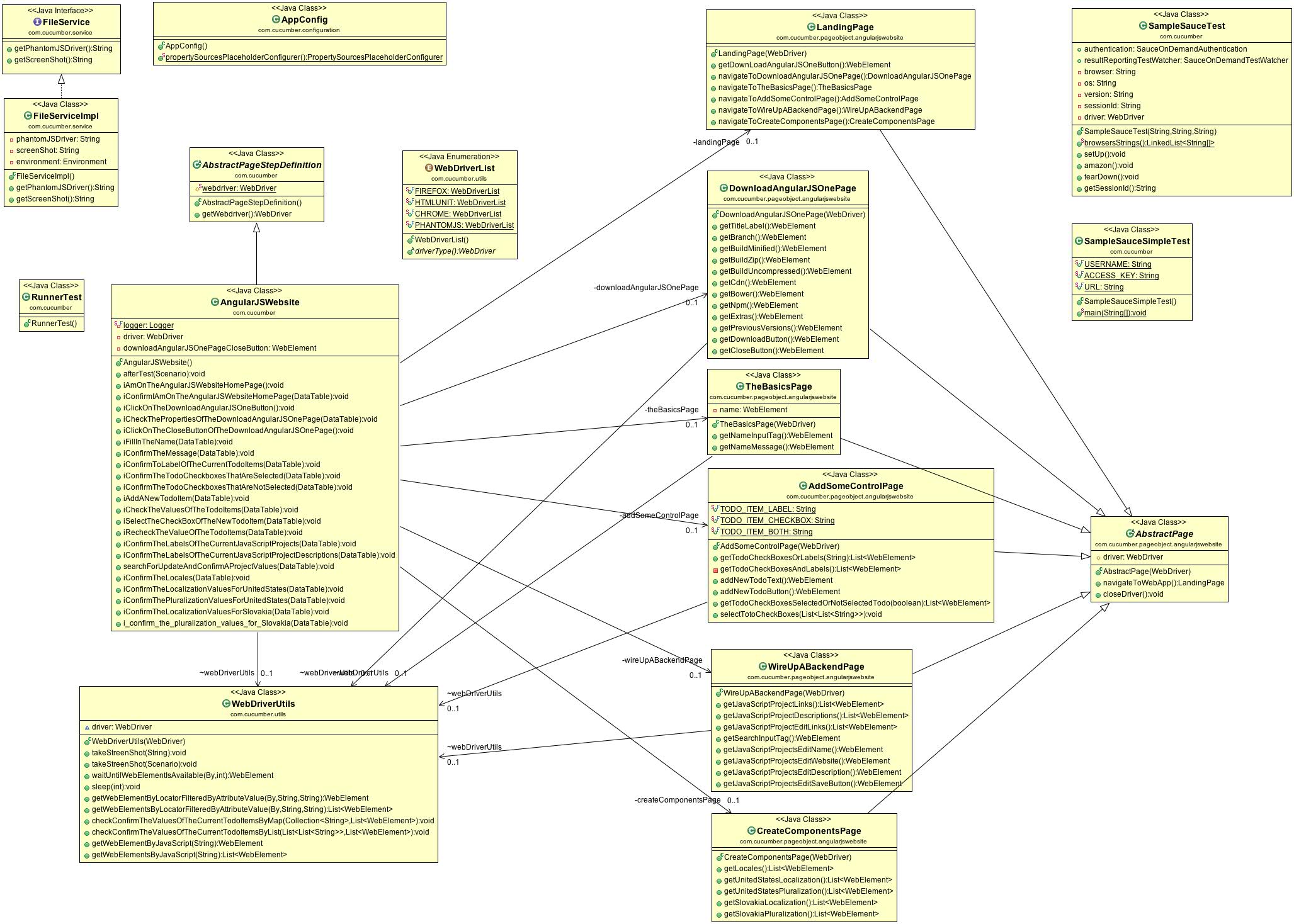
"location": "AngularJSWebsite.iConfirmTheTodoCheckboxesThatAreNotSelected(DataTable)"

},

Selenium WebDriver (Selenium 2.0) makes calls to a web browser’s native support for automation using a browser-specific browser driver. Selenium documentation lists the available [Selenium Drivers](http://www.seleniumhq.org/docs/03_webdriver.jsp#selenium-webdriver-s-drivers). Firefox Driver, ChromeDriver, and HtmlUnit Driver are an example of a few Selenium Drivers. The example project uses the PhantomJS Driver. The PhantomJS Driver utilizes Ghost Driver, a Remote WebDriver that uses PhantomJS as back-end (github.com/detro/ghostdriver). The HtmlUnit Driver has been installed, but is not currently be used. HtmlUnit is a java-based implementation of a WebBrowser without a GUI. I found the HtmlUnit Driver did not consistently represent the target WebBrowser, especially in regards to emulating JavaScript events, and I switched to the PhantomJS Driver for a similar headless environment.

Below are highlights of some functionality as demonstrated in the [AngularJSWebsiteTestBySeleniumWebDriver](https://github.com/gdombchik/AngularJSWebsiteTestBySeleniumWebDriver) GitHub repository. The Cucumber feature files are located in the src/test/resources source folder. The application.properties file is located in the src/main/resources source folder. The JUnit files can be located in the com.cucumber package.

|  |  |  |
| --- | --- | --- |
| Functionality | Description | Java Files |
| CucumberOptions | CucumberOptions specifies JUnit configuration items such as location of Cucumber feature files, Cucumber reporting, and Cucumber test suites. | RunnerTest.java |
| Selenium WebDriver | Specify the Selenium WebDriver implementation. The example uses PhantomJSDriver and returns the WebDriver interface. | AbstractPageStepDefinition.java  WebDriverList.java |
| Properties File | The main functionality is to specify the PhantomJS binary package located on my machine versus the location on the AWS Ubuntu server. | AppConfig.java  FileService.java  FileServiceImpl.java |
| Page Object Design Pattern | As specified in the Selenium documentation:  “Page Object is a Design Pattern which has become popular in test automation for enhancing test maintenance and reducing code duplication.  The Page Object Design Pattern provides the following advantages  1. There is a clean separation between test code and page specific code such as locators (or their use if you’re using a UI Map) and layout.  2. There is a single repository for the services or operations offered by the page rather than having these services scattered throughout the tests.” | *Cucumber Feature File:*  angularjsWebsite.feature  *Test File:*  AngularJSWebsite.java  *Page Objects:*  AbstractPage.java  LandingPage.java  DownloadAngularJSOnePage.java  TheBasicsPage.java  AddSomeControlPage.java  WireUpABackendPage.java  CreateComponentsPage.java  *Web Driver Utility:*  WebDriverUtils.java |

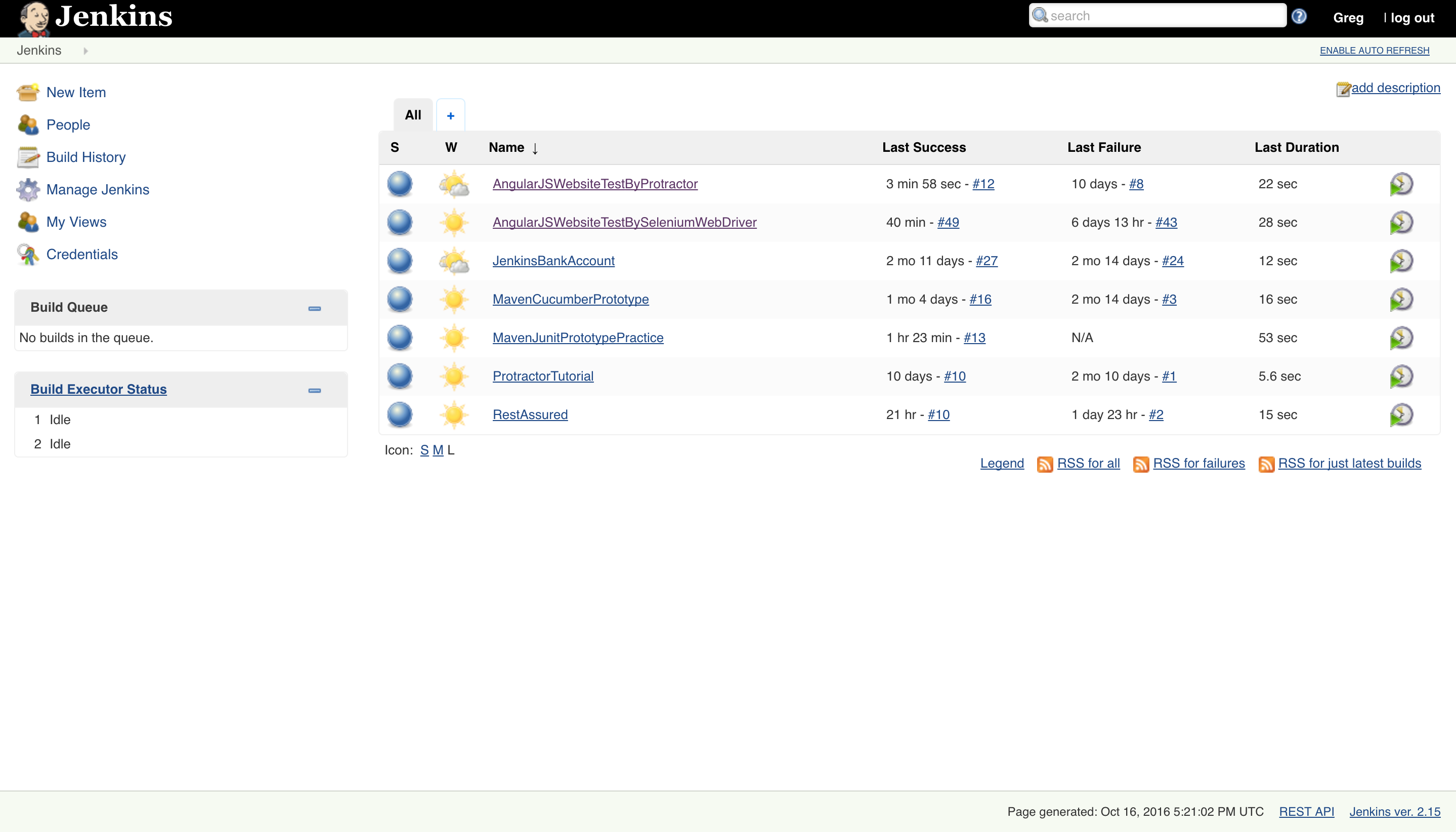


In reviewing how to run the Java tests using a continuous integration (ci) tool such as Jenkins, an option is to use Maven to run the Selenium tests using a headless environment using tools such as PhantomJS.

The steps to install Jenkins, Java, Maven, and Git on AWS E2 Ubuntu server: <https://gist.github.com/jsuwo/9038610>.

The Jenkins project setup for a Java project in GitHub. This example Jenkins has been installed on an AWS E2 Ubuntu server.

|  |  |
| --- | --- |
| Description | Command |
| *AWS E2 Ubuntu server* | |
| Switch to the Jenkins user. | $ sudo su – jenkins |
| Create public private key pair. | $ cd .ssh  $ ssh-keygen -t dsa |
| Cat the public key and copy the results. | $ cat AngularJSWebsiteTestBySeleniumWebDriver.pub |
| *GitHub* | |
| Add and paste deploy key in GitHub project. | <https://github.com/gdombchik/AngularJSWebsiteTestBySeleniumWebDriver/settings/keys> |
| *Manage Jenkins – Configure System* | |
| Jenkins Location | Scroll to the “Jenkins Location” section.  Jenkins URL:  <http://ec2-52-25-64-69.us-west-2.compute.amazonaws.com/>  System Admin e-mail address:  [greg@gregorydombchik.com](mailto:greg@gregorydombchik.com) |
| E-mail Notification | Scroll to the “E-mail Notification” section.  SMTP server:  mail.gregorydombchik.com |
| *Jenkins Server – Global Tool Configuration* | |
| Maven Installation | Scroll to the “Maven” section.  Select “Maven installation…” button.  Name:  Apache Maven 3.0.5  MAVEN\_HOME:  /usr/share/maven/ |
| JDK Installation | Scroll to the “JDK” section.  Select “JDK installation…” button.  Name:  Oracle JDK 1.7  JAVA\_HOME:  /usr/lib/jvm/java-7-oracle/ |
| *Jenkins Server – New Project* | |
| Add A Jenkins Project for a Java project. | Select New Item.  Enter an item name.  Select Freestyle project.  Select Ok. |
| Specify the URL of the remote GitHub repository. | Scroll to the “Source Code Management” section.  Select the “Git” option.  Repository URL:  <https://github.com/gdombchik/AngularJSWebsiteTestBySeleniumWebDriver.git> |
| Update the Poll SCM. | Scroll to the “Build Triggers” section.  Select the “Poll SCM” option.  Enter the following in the “Schedule” text box:  H \*/3 \* \* \* |
| Update the Build. | Scroll to the “Build” section.  Select from the “Add build step” and select the “Invoke top-level Maven targets” option.  Maven Version:  (Default)  Goals:  clean install  POM:  pom.xml |
| Update E-mail Notification. | Scroll to the Post-build Actions.  Select from the “Add post-build action” and select the “E-mail Notification” option.  Enter email address in the “Recipients” text box:  [greg@gregorydombchik.com](mailto:greg@gregorydombchik.com) |
| *GitHub* | |
| Add Jenkins GitHub Plugin you can automatically trigger build jobs when  pushes are made to GitHub. | <https://github.com/gdombchik/AngularJSWebsiteTestBySeleniumWebDriver/settings/installations>  Select from the “Add service” and select the “Jenkin’s (Git plugin)” option. (NOT GITHUB PLUGIN. This service does not appear to work).  Enter the following in the “Jenkins url” text box:  <http://ec2-52-25-64-69.us-west-2.compute.amazonaws.com/> |



An alternative to executing the unit tests on a server using the PhantomJS driver is to use a cloud testing solution such as Sauce Labs. Sauce Labs provides the ability to run the tests on hundreds different browser types, browser version, and operating system combinations. I have installed the Sauce Labs java helper library and a couple sample test files in the AngularJSWebsiteTestBySeleniumWebDriver GitHub repository. The Sauce Labs account credentials and specified browser/operating system combination(s) are specified in the unit test. When the Jenkins server runs the Sauce Labs specified tests, the tests will be executed on the Sauce Labs cloud testing environment. A Sauce Labs unit test result is displayed in both the Jenkins and Sauce Labs dashboard.

