Web UI Testing Using Selenium

Selenium Overview

Selenium is not just one tool or API but it composes many tools:

- WebDriver - If you are beginning with desktop website or mobile website test automation, then you are going to be using WebDriver APIs. WebDriver uses browser automation APIs provided by browser vendors to control browser and run tests. This is as if a real user is operating the browser. Since WebDriver does not require its API to be compiled with application code, it is not intrusive.
- IDE - IDE (Integrated Development Environment) is the tool you use to develop your Selenium test cases. It's an easy-to-use Chrome and Firefox extension and is an efficient way to develop test cases. It records the users' actions in the browser for you, using existing Selenium commands, with parameters defined by the context of that element. This is not only a time-saver but also an excellent way of learning Selenium script syntax.

https://www.selenium.dev/documentation/

Selenium Grid

- Grid - Selenium Grid allows you to run test cases in different machines across different platforms. The control of triggering the test cases is on the local end, and when the test cases are triggered, they are automatically executed by the remote end. Generally speaking, there's two reasons why you might want to use Grid:
  - To run your tests against multiple browsers, multiple versions of browser, and browsers running on different operating systems.
  - To reduce the time it takes for the test suite to complete a test pass.
- After the development of the WebDriver tests, you may face the need of running your tests on multiple browser and operating system combinations. This is where Grid comes into the picture.

Selenium Grid - II

- Grid is used to speed up the execution of a test pass by using multiple machines to run tests in parallel. For example, if you have a suite of 100 tests, but you set up Grid to support 4 different machines (VMs or separate physical machines) to run those tests, your test suite will complete in (roughly) one-fourth the time as it would if you ran your tests sequentially on a single machine. For large test suites, and long-running test suite such as those performing large amounts of data-validation, this can be time-saver.
- Grid is also used to support running tests against multiple runtime environments, specifically, against different browsers at the same time – e.g. machine 1 has Internet Explorer 8, machine 2, Internet Explorer 9, machine 3 the latest Chrome, and machine 4 the latest Firefox. When the test suite is run, Selenium-Grid receives each test-browser combination and assigns each test to run against its required browser.

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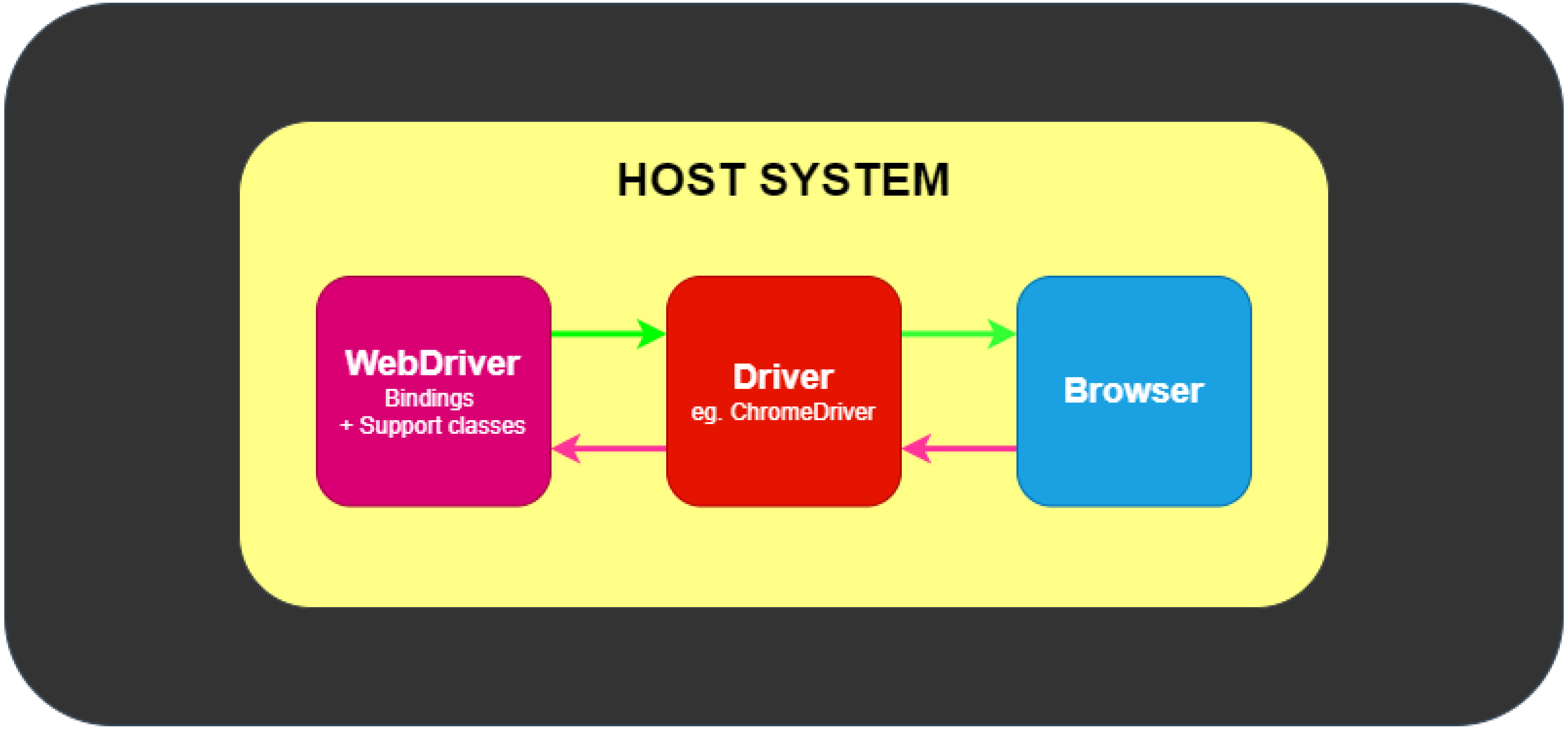
Selenium Grid Advantages

- Central entry point for all tests
- Management and control of the nodes / environment where the browsers run
- Scaling
- Running tests in parallel
- Cross-platform testing
- Load balancing

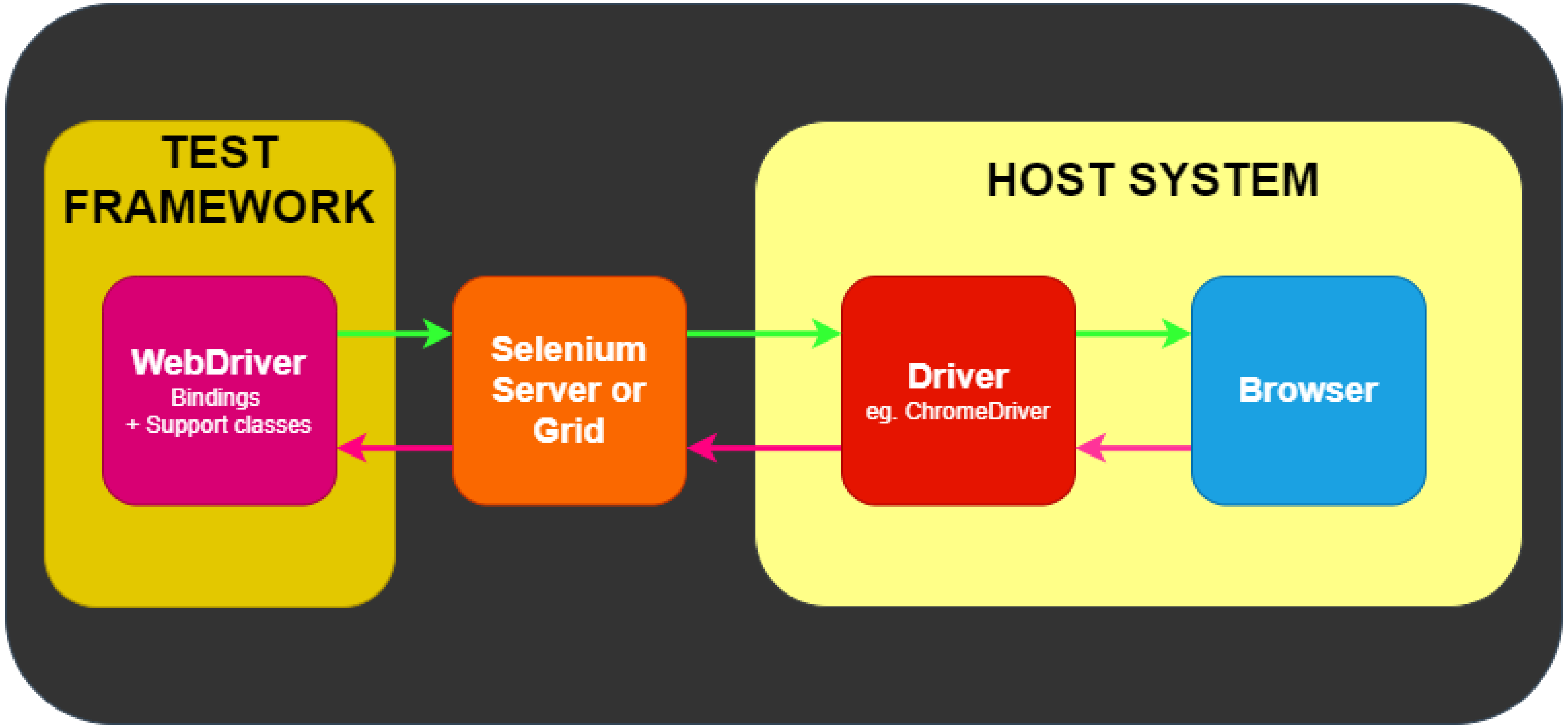
Terminology

- API – a set of “commands” you use to manipulate WebDriver.
- Library - code module which contains the APIs and the code necessary to implement them. Libraries are specific to each language binding, eg .jar files for Java, .dll files for .NET, etc.
- Driver - responsible for controlling the actual browser. Most drivers are created by the browser vendors themselves. Drivers are generally executable modules that run on the system with the browser itself, not on the system executing the test suite. (Although those may be the same system.) NOTE: Some people refer to the drivers as proxies.
- Framework: An additional library used as a support for WebDriver suites. These frameworks may be test frameworks such as JUnit or TestNG.

Selenium Components



Selenium Components - II



WebDriver

- WebDriver drives a browser natively, as a user would, either locally or on a remote machine using the Selenium server, marks a leap forward in terms of browser automation.
- Selenium WebDriver refers to both the language bindings and the implementations of the individual browser controlling code. This is commonly referred to as just WebDriver.
- Selenium WebDriver is a W3C Recommendation
  - WebDriver is designed as a simple and more concise programming interface
  - WebDriver is a compact object-oriented API
  - It drives the browser effectively

Install a Selenium library

```xml
<dependency>
    <groupId>org.seleniumhq.selenium</groupId>
    <artifactId>selenium-java</artifactId>
    <version>4.1.4</version>
</dependency>
<dependency>
    <groupId>io.github.bonigarcia</groupId>
    <artifactId>webdrivermanager</artifactId>
    <version>5.1.1</version>
    <scope>test</scope>
</dependency>
```

Install Browser Drivers

Browser	Supported OS	Maintained by	Download	Issue Tracker
Chromium/Chrome	Windows/macOS/Linux	Google	Downloads	Issues
Firefox	Windows/macOS/Linux	Mozilla	Downloads	Issues
Edge	Windows/macOS	Microsoft	Downloads	Issues
Internet Explorer	Windows	Selenium Project	Downloads	Issues
Safari	macOS High Sierra and newer	Apple	Built in	Issues

Example

```
@Test public void chromeSession() {
	System.setProperty("webdriver.chrome.driver",
"D:\\CourseJavaQA\\chromedriver_win32\\chromedriver.exe");
	ChromeOptions options = new ChromeOptions();
	WebDriver driver = new ChromeDriver(options);

	// Exercise
	driver.get("https://bonigarcia.dev/selenium-webdriver-java/");
	String title = driver.getTitle();

	// Verify
	assertThat(title).contains("Selenium WebDriver");
	driver.quit();
}
```

https://www.selenium.dev/documentation/

Example with WebdriverManager - I

```
public class WebdriverManagerTest {
    WebDriver driver;
    @BeforeAll
    static void setupClass() {
        WebDriverManager.chromedriver().setup();
    }
    @BeforeEach
    void setupTest() {
        driver = new ChromeDriver();
    }
    @AfterEach
    void teardown() {
        driver.quit();
    }
```

Example with WebdriverManager - II

```
public class WebdriverManagerTest {

    @Test
    void test() {
        // Exercise
        driver.get("https://bonigarcia.dev/selenium-webdriver-java/");
        String title = driver.getTitle();

        // Verify
        assertThat(title).contains("Selenium WebDriver");
    }

}
```

Selenium Commands

- Actions – Help manipulate or change the state of applications (e.g. click on some link or select an option from a page).
- Accessors – Enable verification and storage of the application state (e.g. consider command "storeTextPresent" – if the text is found on the page, then it stores True else stores false).
- Assertions – Help compare expected and actual results. They act like checkpoints and if both the values are equal, only then the test case passes or else it fails. Thus, Assertions help verify whether the state of the application after executing the test case conforms to the desired state (e.g. VerifyText, waitForPageToLoad). Assertions have three modes:
  - Assert
  - Verify
  - WaitFor

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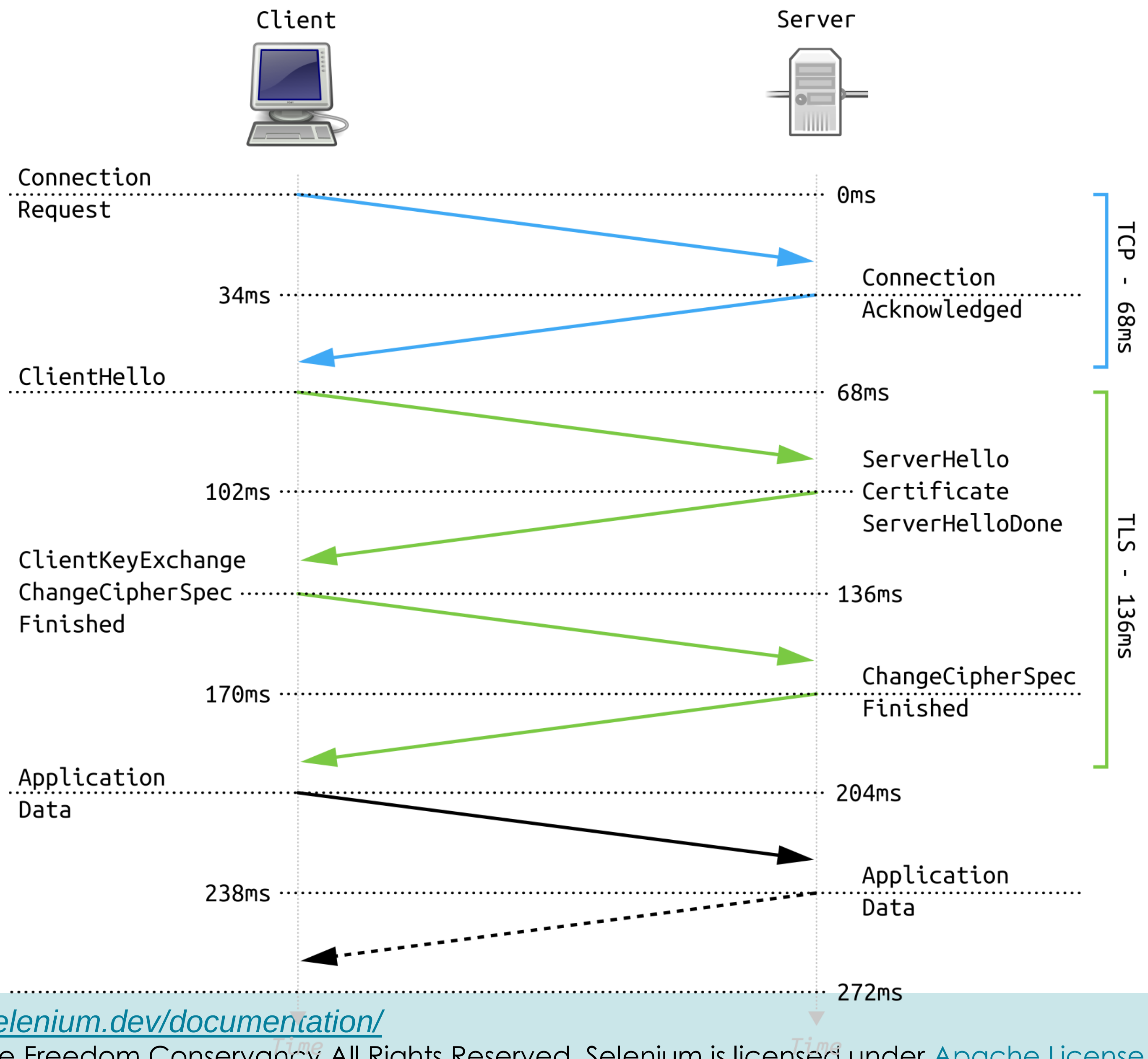
Web Elements

- **Locator strategies** - Ways to identify one or more specific elements in the DOM.
- **Finding web elements** - Locating the elements based on the provided locator values.
- **Interacting with web elements** - A high-level instruction set for manipulating form controls.
- **Information about web elements** - What you can learn about an element.
- **Working with select list elements** - Select lists have special behaviors compared to other elements.

Transport Layer Security (TLS)

- Transport Layer Security (TLS) is a cryptographic protocol designed to provide communications security over a computer network. The protocol is widely used in applications such as email, instant messaging, and voice over IP, but its use in securing HTTPS remains the most publicly visible.
- The TLS protocol aims primarily to provide cryptography, including privacy (confidentiality), integrity, and authenticity through the use of certificates, between two or more communicating computer applications. It runs in the application layer and is itself composed of two layers: the TLS record and the TLS handshake protocols.
- TLS is a proposed Internet Engineering Task Force (IETF) standard, first defined in 1999, and the current version is TLS 1.3, defined in August 2018.
- TLS is the successor of the now-deprecated Secure Sockets Layer (SSL).

Simplified TLS 1.2 Handshake



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Using Self-Signed Certificates

- keytool -genkeypair -alias springboot -keyalg RSA -keysize 4096 -storetype JKS -keystore springboot.jks -validity 3650 -storepass changeit
- keytool -genkeypair -alias springboot -keyalg RSA -keysize 4096 -storetype PKCS12 -keystore springboot.p12 -validity 3650 -storepass changeit
- keytool -list -v -keystore springboot.jks
- keytool -list -v -keystore springboot.p12
- keytool -importkeystore -srckeystore springboot.jks -destkeystore springboot.p12 -deststoretype pkcs12
- keytool -import -alias springboot -file myCertificate.crt -keystore springboot.p12 -storepass password
- keytool -export -keystore springboot.p12 -alias springboot -file myCertificate.crt

Spring Boot SSL Configuration

```
server.ssl.key-store: classpath:springboot.p12
server.ssl.key-store-password: changeit
server.ssl.key-store-type: pkcs12
server.ssl.key-alias: springboot
server.ssl.key-password: changeit

server.port=8443
```

Selenium IDE

- Provides you the capability of automatically recording your test cases based upon the interactions with the browser
- Gives developers greater flexibility in executing the test cases - developer can run the entire test suite or execute a single test case
- Operates on the basis of the rich set of Selenese commands, which helps the IDE understand what needs to be done
- Allows the test developers to set breakpoints for the purpose of debugging Test cases can be re-used using the run command. (e.g. allowing you to re-use the logic of login or reload on multiple places in the entire suite)
- Use of multiple-locators for each element in the IDE ensures successful execution

Thank’s for Your Attention!

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