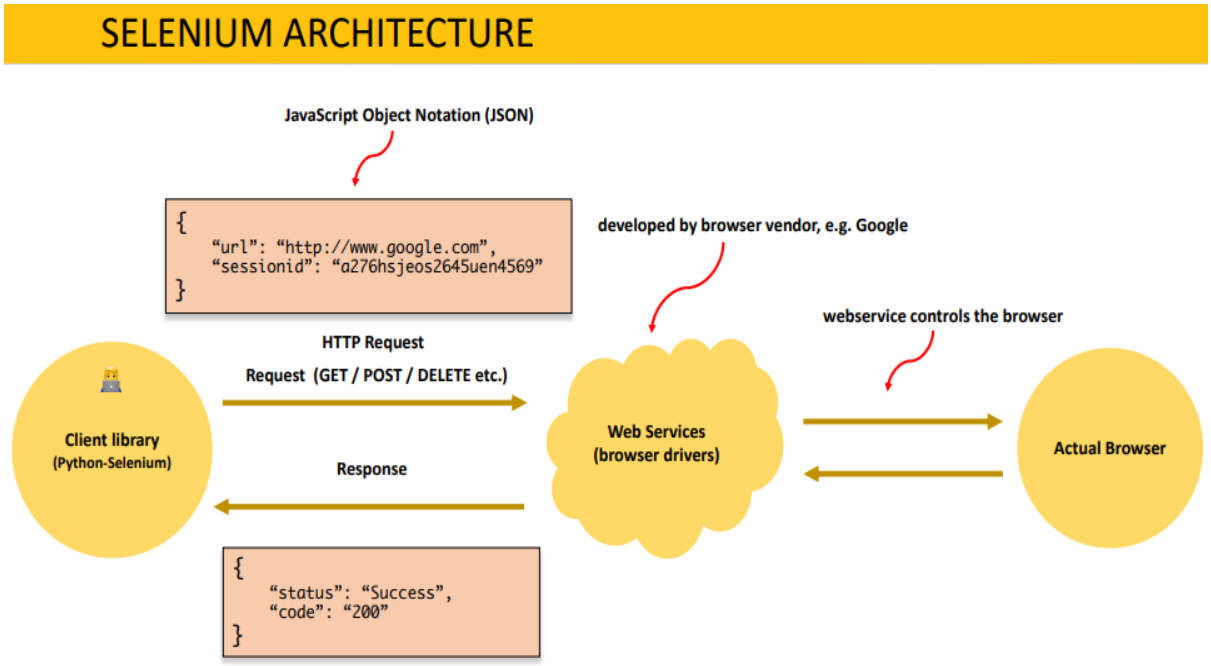
Communication between WebDriver and Browser

When running a Selenium test, WebDriver needs to establish communication with the browser. So, in order to do that the browser and WebDriver have to use a set of rules that they both must share and respect. An analogy would be a conversation between two people. It is necessary that they both know and understand the same language. The same thing happens in automation, they need a common language that both can understand. In this case, the language is called Protocol. Moreover, each browser has its own driver that knows the protocol and makes the communication between WebDriver and the browser possible.

Selenium 3 Architecture



- Selenium 3 architecture supports JSON Wire Protocol, here JSON stands for JavaScript Object Notation. Selenium 4 does not include the JSON Wire Protocol and that's the main difference between selenium 4 and Selenium 3.
- JSON Wire Protocol transfers the information from the client to the server over HTTP, here HTTP stands for Hypertext Transfer Protocol, in this, a selenium request is sent from a selenium client, the request is received by the JSON Wire Protocol over HTTP, and secured by the browser Driver, after that a response returned by the server and received by the client.

CLIENT LIBRARIES / LANGUAGE BINDINGS

- Selenium supports multiple languages such as Python, Java, C#, JavaScript, Ruby.
- Client libraries provide various methods to perform different browser actions. e.g. get, title, find_element.
- As automation developers we call these methods from our development environment. e.g. VSCode
- Once we execute the script, the client libraries convert our code that we have written into a JSON (JavaScript Object Notation) format and sent as a request to Driver over HTTP.

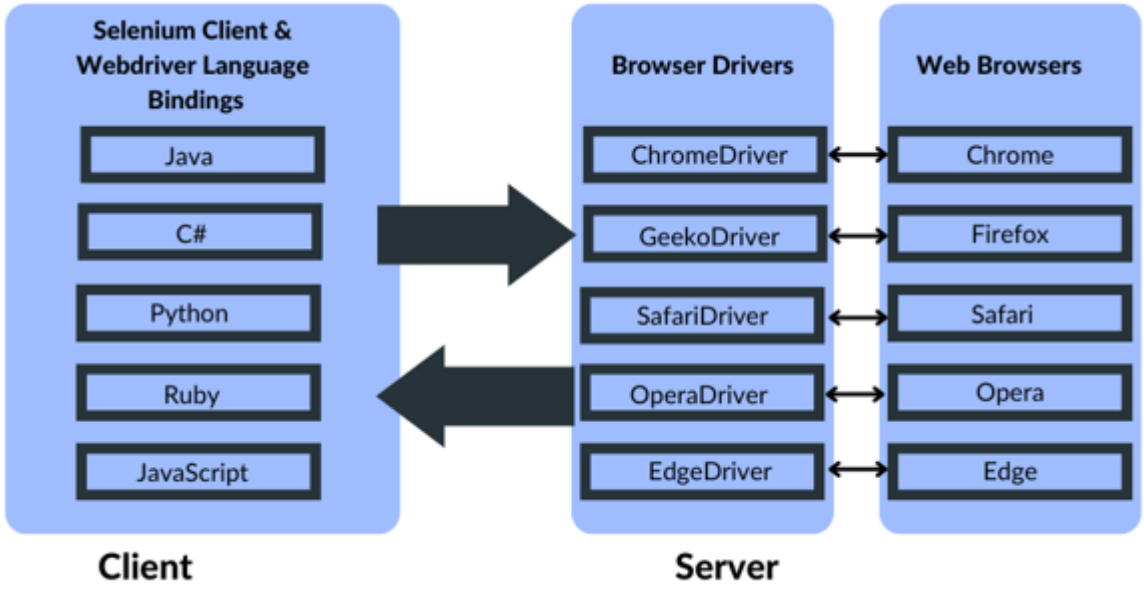
BROWSER DRIVERS

- Each browser has its own implementation of "WebDriver" protocol (mandatory services that needs to be implemented in order for selenium to interact with browser) called drivers.
- The browser drivers are responsible for controlling the actual browsers since the browser implementation details will be known only to the developer of driver.
- Each browser driver will be maintained by respective browser vendor. e.g. Chrome Driver is maintained by Google and Safari Driver is maintained by Apple.
- Each method in the client library is mapped to a specific web-service in the driver.
- The driver interprets the incoming request from the client and controls the actual browser.
- Once the browser operation is complete, the response is sent back to the client/client library by driver in JSON format.
- Client library interprets the JSON response and prints the response in readable format in the editor console.

WebDriver W3C Protocol

The new protocol is called: “WebDriver W3C”. It has received the endorsement of the “World Wide Web Consortium” (W3C). This is an international community that works to develop Web standards. W3C is fractionally different from the original protocol. The major differences are around how you create a new session and how you can do element interactions using the actions API. The most important difference in the actions API is that you can now do multiple actions simultaneously.

Selenium 4 Architecture



- In Selenium 4 there is direct communication between the client and server. In selenium 4 client has 2 parts first is Selenium Client & the other one is WebDriver Language Bindings while Browser Drivers are the server.
- In selenium 4, Selenium Client sends out a request to perform a command. The WebDriver Language Bindings is a code library that is mainly designed to drive actions. Browser Drivers receive the request sent by the client and then return a response after an automation Test Script executes on the Web Browser.
- The Selenium Client and WebDriver Language Bindings are an important part of the architecture where each language has its own unique bindings. Bindings mean that the same commands can be used by different languages. for example, a command written in java language has also been written in other languages like c#, Python, Ruby, etc.
- When we talk about the Browser Drivers and Web Browsers, WebDriver drives each and every browser using the browser’s built-in automation support. A Browser Driver such as Chrome Driver controls the Chrome browser.

Selenium 4 Advantages

There are the following advantages of Selenium 4 over Selenium 3:

1. **Usage of WebDriver Manager**: Selenium 4 has come with the biggest advantage with the use of WebDriver Manager, In the selenium 4 release there is no need to download the latest executable for an individual browser, we can write a single line code that can download the latest version for the specified driver.

2. **Relative or Friendly Locator:** There are different locators available to locate the Web Element on the web, in addition, selenium 4 has come up with new relative locators below are some:
    - toLeftOf(): Find the element to the left of a specified element.
    - toRightOf(): Find the element to the right of the specified element.
    - above(): Find the element above with respect to the specified element.
    - below(): Find the element below with respect to the specified element.
    - near(): Find the element is at most 50 pixels far away from the specified element. The pixel value can be modified.

3. **Capture screenshots of a specific Web Element:** In selenium 3 we can capture screenshots of the entire page but with the help of selenium 4, we can capture screenshots of a specific web element.

4. **Stability:** With the help of Selenium 4 we can achieve stability.