INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 3 - V7I3-1507)
Available online at: https://www.ijariit.com

Research on Functional Test Automation Tools for API, Web and Mobile application

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ABSTRACT

Industry 4.0 is reshaping every aspect of production. This modern industry necessitates a faster-than-ever evolution of all aspects of the networks. In this case, validation and verification occur as critical phases in the life cycle of software projects. A software failure could have devastating effects, so it is critical that all applications function correctly in development. Without automation, testing cannot be effective in today's world. We need automation to minimize repetitive work and to ensure that the time from development to production is shortened while maintaining high quality. As a result, automated testing is critical in the software testing phase. This study aims at exploring and comparison of few popular tools in the realm of Web UI automation, API automation, mobile app test automation.

Keywords— *QTP- Quick Test Professional, UI- User Interface, CI- Continuous Integration, CD- Continuous Deployment*

1. INTRODUCTION

Software has become an inseparable part of our lives, altering how we perform routine chores. Customers have grown accustomed to regular updates and the introduction of new features, and they have begun to anticipate them. Development lifecycle now has to be reduced to meet the rapidly changing needs and expectations as well as the demand for higher quality products which can be challenging at times. Agile development and DevOps practices are now widely used by enterprises to address these challenges. Test automation strategy is necessary to assure the quality of often required software releases while limiting the time effort spent on each release. To deliver high-quality product or software, a suitable testing framework has to be chosen, considering factors such as execution time, results publishing, browser or platform compatibility, easiness of learning, and also the cost of tools. In this paper, the main objective is to make a comparative study of few automation testing tools to determine their serviceability, maintenance, andeffectiveness.

The flow chart figure below shows the generic procedure steps involved in the test automation of APIs, Web application and mobile application, makes use of web interface or graphical user interface (GUI) to carry out the functional and regression testing. The scripting language known as VBScript is used to specify the test procedure as well asmanipulate and control the application objects during testing [2]. The important functionality provided by QTP is UI testing, but it may be employed to test non- UI applications such as web service testing,database, file system functionality. QTP is used to test applications, Java Applets, multi-media objects and also Windows apps, as well as Visual Basic & .NET framework applications. Some of the characteristics Quick Test Professional (QTP) is as enumerated below:

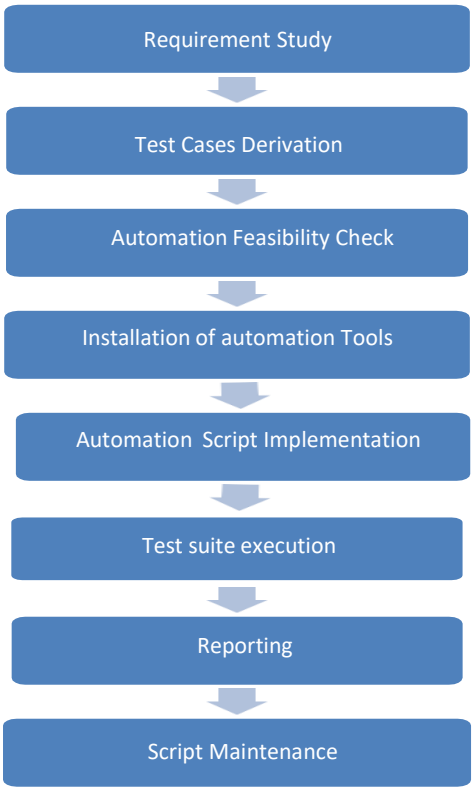

Fig 1. Generic Test Automation Procedure

In this paper, we will discuss about the few of the popular functional test automation tools for API test automation, Web UI automation and mobile automation. Also compare and contrast thetools available in each category.

2. WEB AUTOMATION TOOLS

2.1 Quick-Test Professional

It is a popular automation tool for regression and functional testing [1].

- Capable of handling test cases such as detecting user activities such as a mouse event.
- It extends some plug-ins for various technologies.
- Provides record & playback feature.
- Supports keyword driven and data-driven testing features.
- Better error handling mechanism.
- Also supports Mobile application testing
- Can be integrated with open source CI systems like Jenkins.

2.2 Selenium

Selenium is a web application testing framework that is open source. Selenium IDE enables testers to develop tests without having to learn a scripting language, providing record/playback function[3]. It supports a wide range of programming languages such as Java, C#, Groovy, Ruby, PHP, Perl, Python and Scala. Most web browsers are capable of running these tests. It supports operating systems such as Linux, Windows, and Mac OS X. Seleniumis a browser automation library that is oftenused for end-to-end web application testing. In little time, QA may write their test cases quickly and efficiently. It is a framework that is adaptable, robust, andscalable.

3. API AUTOMATION TOOLS

3.1 Karate

It is a Java library for testing SOAP and REST web services[4]. It is built on top of the Cucumber- JVM. It offers libraries for web API testing, mocking and performancetesting. It now also supports standalone executable for teams using non-Java languages to write language neutral automation script for XML, HTTP or JSON[5]. Some of the characteristics of Karate is as enumerated below:

- Supports Domain Specific Language.
- It provides, embedded user interface for debugging and replaying steps when editing.
- Supports XML and JSON.
- Easily readable tests.
- It has built-in support to switch between multiple environments.
- It has built-in test reports generation mechanism and also one has the option of using any third-party reporting tools instead.
- For API calls it provides Mock server that manages CRUD over several calls.
- Allows for the reuse of test suites for Gatling performance testing, that checks the server for OK responses.

3.2 Rest Assured

It is a Java library is used to test REST web services [6]. It allows us to make extremely customized HTTP requests that is sent to a RESTful web service. It includes tools for working with JSON andXML, as well as handling assertions with Ham crest expressions. Some of the characteristics of REST Assured is as enumerated as below:

- Supports Domain Specific Language.
- Supports XML and JSON.
- It has the capability to serialize- deserialize request-response to and from Plain Old Java Objects.
- Reusability of response validation using
- ResponseSpecBuilder.
- Provides support for testing Spring controllers as it has Spring Mock MVC module.
- It has the feature to test asynchronous Restful services.

4. MOBILE AUTOMATION TOOLS

4.1 Appium

Appium is a mobile app test automation tool having following characteristics:

(a) It can be used to test native, Web, and hybrid mobile apps. Apps developed by using iOS or Android SDK are referred to as mobile native applications [7]. Mobile Web apps are those that can be viewed through mobile browsers. Hybrid applications are the ones, where native code encapsulates web views as well as there is an integration with Web contents.

(b) Supports cross-platform testing that allows to test mobile apps on iOS, Android etc.

(c) Automation scripts can be written in Python, Java, C#, Ruby, Objective-C JavaScript etc.

4.2 Robotium

Renas developed Robotium, an Android automation testing system, in 2010. Robotium was developed by a committed developer group [8]. It's an open-source mobile test automation framework used in automating grey box testing of Android applications.

4.3 UI Automator

It's owned by Google Inc. and whichis included in the Android SDK. It can onlybe used in native applications but not in hybrid applications [9]. It's the only API- enabled automation testing framework on the Android SDK. Owing to its structure and support from different areas of Android GUI testing it's very simple to use. The automation script is written in Java and its code, based on Android version 2.0 instrumentation, which helps in calling the prevalent methods in the Android instrumentation class.

5. COMPARISON OF TOOLS

The following tables compares the tools ineach category:

Table 1. Comparison of HP-QTP vs Selenium

Features	Selenium	HP-QTP
Licensing	No license required. It is open source. Apache 2.0 license	Proprietary or commercial tool.
Operating system	Cross platform	Microsoft Windows only
Programming languagesupport	Java, JavaScript, Python , C#, PHP etc.	Only VBScript & JavaScript.
Browser support	Chrome, Safari, Firefox, Internet explorer etc... All major browsers are supported.	Google Chrome, IE, Firefox etc..

Main Function	Web application UI test automation framework.	Test automation tool
Report Generation	Doesn't have inbuilt report generation mechanism. Requiresthird party software support like TestNG , ExtentReport.	It has inbuilt dashboard support.
File uploading feature	Not available	It is supported.
Script writing time	High	Low
Usability	Requires high expertise.	Easy to use.
IDE Compatibility	IntelliJ, Eclipse, Visual Studio	Not supported
Record and playback	Yes. Selenium IDE supports it.	Yes
Technical support	Doesn't have official technical support. But has huge developercommunity support online.	It has good official technical support.

Table 2. Comparison of Appium vs Robotium vs UI Automator

Features	Appium	Robotium	UI Automator
Opening external applicationwhen an AUT is active	Yes	No	No
Touch event simulation	Yes	Yes	Yes
Access to 3 main buttons Home. Recent and Back in android	Yes	Partly	Yes
Access to keyboard	Yes	Yes	Yes
Uninstall an application	Yes	No	No
Take Screenshot	Yes	Yes	Yes
Performing test when SMS or an incoming call	Yes	Partly	Yes
Design and generate test case	No	No	No
Perform test when the alarm ison	No	No	Yes
Testing the APK file	Yes	Yes	Yes
Perform test when memory is low	Yes	Yes	Yes
Switch on GPS	No	No	No
Testing when battery is low	Yes	Yes	Yes
Testing in the real device	Yes	Yes	Yes
Support for Mobile OS platform	No dependency on mobile OS. Supports Android,iOS.	Android only	Android only
Type of application supportedfor testing	Native, hybrid and mobile web apps	Native and hybrid apps only.	Native apps only.
Programming language support	Java, JavaScript,PHP,Ruby ,Python , C#,Objective-C etc.	Java	Java, Kotlin
Setup	Hard	Easy	Easy
Test execution time	Slow	Fast	Medium

Table 3. Comparison of Rest Assured vs Karate

Feature	Rest Assured	Karate
Prerequisite environment	Java Virtual Machine	Java Virtual Machine
Implemented in	Java & Groovy	Java
SOAP Support	No	Yes
License	Open source . Apache 2.0	Open source. MIT License
Scripting language	Java	Cucumber , Gherkin and Java
Scripts to be compiled	Yes	No need to compile the scripts.
Test Runner	TestNG , JUnit	TestNG , Junit
Built-in Tags	No , can use TestNG tags orother	Yes
Ignore specific fields values inpayload	No	Yes
Validate payload values	No built-in support for deepequals comparison	Supports deep equalscomparison
Built-in Data type	No	Yes
Built-in conditional logic	No	Yes
Built-in regular expressionvalidation	No	Yes
Performance Testing	No	Yes, with support of Gatling
Web UI Automation	No	Yes, from Karate 0.9.5
Distributed testing	No	Yes, from Karate 0.9.5
Built-in test report support	No	Yes
Data driven testing support	No . Have to use test runnerlike TestNG with Rest Assured	Yes, it can be achieved through dynamic JSON or CSV.

6. CONCLUSION

In the software development life cycle, software testing is the most important phase. The manual software testing at times is less accurate and also consumes quite a lot of time which is not desirable in projects where agile methodology is practiced. Hence automation becomes inevitable. In the paper we have explored, compared and contrasted few popular tools available for API testing, Web UI automation and mobile automation.

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