# Guide to Test Automation Tools 2017 - 2018



WHITEPAPER QATestlab 2017

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### Summary

This whitepaper aims at providing the comprehensive data on the most popular test automation tools in 2017 - 2018 including the description of their parameters which can be considered when selecting a tool / framework for test automation. The document also provides the comparison of the leading test automation tools highlighting both advantages and disadvantages, and also main objectives, technical characteristics and the information about a provider.

The whitepaper is aimed to assist in selecting a proper test automation tool avoiding time and money losses. Besides, it includes the recommendations on the most effective test automation tools, information about their effectiveness and maintainability, which were prepared by QATestLab on the ground of successful execution of 50 test automation projects. The conclusions are drawn including the tendencies of 2017 - 2018 and are based on real experience.

#### Disclaimer

The second part of the Guide includes the objective assessment of the test automation tools used on the real projects by QATestLab engineers. All comments are acceptable. In case of any questions or suggestions, please contact us.

#### Introduction

The main goal of the Guide is to provide information about the test automation tools which are most demanded and widespread in 2017.

The whitepaper consists of two sections. The first one analyses test automation tools including their functional features, system restrictions and perspectives of further development. It includes the following tools: Selenium WebDriver Framework, Appium Framework, Robotium Framework, Serenity Framework, Robot Framework, Galen Framework, HP Unified Functional Testing (UFT), Ranorex Studio, TestComplete, Telerik Test Studio and Applitools Eyes.

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The second section of the document is based on QATestLab expert's opinion and experience in using particular test tools on real projects. It gives the estimate for selected tools and brings hints and tips on the best tools.

### 1. Test Automation Tools. Market review

The industry trend of digital business transformation leads to the increase of software solutions competition. In order to keep high compatibility and strong market position, the companies in various industries are trying to ensure fast production of top-quality solutions at a reasonable price. Both software testing and development have own solutions to provide a quick workflow. At the stage of software development, the agile methodology is applied. For quality verification, test automation tools and frameworks are used to accelerate the testing activities.

New vendors of test automation tools, technologies and frameworks appear at the market of test automation software because of the appearance of new technologies, e.g., cloud and IoT solutions, modification of development approaches and methodologies, e.g., Agile, DevOps, and changing of business strategies. Some of the tools are opensource and multi-purpose, providing wide functionality, while others are commercial and possess limited functions. So, the choice of a proper test automation tool should be well-grounded and based on the analysis of its characteristics and development perspectives.

According to the Magic Quadrant for Software Test Automation provided by Gartner Inc., the research and advisory company, the leaders of test automation software are Hewlett Packard Enterprise (HPE), IBM and Tricentis. The high market position is among the prerequisites for the further development and enhancement of testing tools as the companies possess enough financial, technical and human resources to continue the tool / framework updating.

The market is dynamic and its needs and requirements are also constantly changing. In order to match the latest market trends, the

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vendors of test automation tools are focused on creating new fieldspecific solutions and maintaining the ready-made ones. Automation tools can be designed for unit, integration, UI, regression, continuous, security and performance testing. Besides, there are automation tools for mobile software verification.

Among the variety of available tools for test automation we have selected and analyzed the most popular and widely used ones. The tools to be considered:

- Selenium WebDriver Framework
- Appium Framework
- Robotium Framework
- Serenity Framework
- Robot Framework
- Galen Framework
- HP Unified Functional Testing (UFT)
- Ranorex Studio
- TestComplete
- Telerik Test Studio
- Applitools Eyes

### 1.1. Selenium WebDriver Framework

Selenium WebDriver also known as WebDriver is a software library for browser management. It is the main framework developed within the Selenium toolkit.

Selenium 2 / Webdriver



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### Selenium webdriver architecture



Despite being called a browser driver, WebDriver is actually a family of drivers for different browsers including a set of client libraries in various languages that enable the work with these browsers.

### Advantages

The framework enables the design of automated test scripts in Java, C#, Ruby, Python, Javascript and others. Due to the support of different languages, test engineers are able to automate testing of web applications developed on various platforms, connect any additional frameworks for tests execution, logging and automation of conducted test scripts.

Selenium WebDriver provides the automation of any modern browser, e.g., Chrome, FireFox, IE, Edge, Safari, and mobile ones, e.g., iOS, Android. Being supported by different software vendors, WebDriver enables the test automation of Windows applications including UWP (Universal Windows Platform) and Win32 developed on Windows 10 OS. Besides, the automation of hybrid desktop web applications developed using the platforms similar to OpenFin and Electron is also available.

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In order to write automated test scripts using Selenium WebDriver, the engineer should possess the programming skills and be aware of the principles of manual testing. Thus, the engineer will be able to develop various scripts of different complexity.

### Disadvantages

Despite all advantages, the framework has several limitations. The proper automation of such containers as Flash or Silverlight is impossible. Also, the automation of HTML5 and operations with system windows of the browser are limited. The test engineer faces the restrictions while changing the browser setting through system windows, interacting with a file manager, working with other applications launched at PC.

# 1.2. Appium Framework

Appium Framework is an open source test automation framework written in JavaScript and designed for test automation of mobile applications of various types. As the sphere of mobile test automation is at the very start of its progress and development, the framework does not provide a wide functionality and capacities.

As Appium Framework supports different programming languages including Java, C#, Ruby. PHP, a number of auto script developers are able to use it.



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### What to automate

Using Appium, test engineers can automate testing of mobile applications of the following types:

- Native applications developed using Android, iOS or Windows SDKs (System Development Kit)
- Mobile web applications available through mobile browsers, e.g., Safari on iOS, Chrome or built-in browser on Android.
- Hybrid applications possessing a native controller to ensure the interaction with web content.

Appium architecture



Apple instruments for iOS Google UIAutomator for Android API level 16 or higher Selendroid for Android API level 15 or less

#### Advantages

Being a cross-platform framework, Appium enables the automation of tests for different platforms, e.g., iOS, Android, Windows, Firefox OS. On the basis of the same API the same code can be reused between various platforms. The framework is suitable for iOS and FireFox simulators, Android emulators and iOS, Android, Windows and Firefox OS devices. But the test automation engineer should take into account the OS version as the framework has some restrictions. For example, it support OS 9.3+ versions.

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### Disadvantages

Using Appium, it is impossible to automate testing of certain applications, e.g., mobile games. But the framework developers are working on the improvement of its capacities and functionality. For instance, it is planned to implement the capacity to automate Unity3d that enables the game testing automation. Accelerating the testing procedure, Appium is suitable for mobile testing of large and complex projects. The automation process with Appium requires much time and means but the results it provides even after automating the first series of test cases will justify all spendings.

### 1.3. Robotium Framework

Being designed for Android test automation of Android based applications, the framework can be used for automation of native and hybrid applications. Using the framework, the test automation engineer is able to prepare UI tests for Android application applying black-box approach. So, he / she should not possess a deep knowledge of application architecture and profound programming skills.

### Android Automated Testing using Robotium



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### Advantages

By designing system, functional and user acceptance scenarios with Robotium, test engineers are able to coverage of wide range of Android activities. The procedure of test case writing requires minimum time and the quality of such tests will not be low. Besides, Robotium provides a quick test execution and readability of test cases.

In general, Robotium performs the same tasks as Appium in terms of mobile test automation. But in comparison to Appium, it is less popular because the framework is suitable only for Android applications. Usually, the test automation engineers use Robotium to check the applications with available source code and ones with the access only to APK file. Also, it is applicable for continuous integration due to its ability to support the integration with Gradle, Maven and Ant.

### Disadvantages

But the functionality and capacities of Robotium have several limitations. Using the framework, it is impossible to handle several applications simultaneously. Robotium does not support Web or Flash components. The simulation of clicking a soft keyboard is not available. To conduct simulation, the test engineer should use 'enterText()'.

In case of testing on outdated mobile device, Robotium may operate rather low. Besides, the framework does not support the interaction with Status Bar Notifications.

### 1.4. Serenity Framework

The framework designed to automate acceptance tests and generate the reports on autotests execution. It has in-build features for automatic generation of reports on test execution. The framework supports each test with screenshots, execution time, narrative and error messages. The framework is suitable for BDD development including reporting and organization of the procedure.

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# Serenity BDD architecture



Serenity is an open source library that supports the integration with Selenium WebDriver. But it should not be compared with Selenium as Serenity focuses not on the process automation but on the organization of test scenarios writing. Beside that, it is not a common framework for leading logs as it includes the implemented functionality for automation.



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### Advantages

The framework ensures easy and flexible maintenance of designed test cases. Besides, it possess the ready-to-use functional patterns that the test automation engineers are able to use. This ensure the acceleration of automation procedure.

Due to its architecture, Serenity is rather flexible. It consists of two branches that represent pages and tests. The framework includes the following parts: basic page class, basic test class, page classes and test classes.

### Disadvantages

But Serenity is not suitable for complex projects as it is difficult to extend its functionality. To prepare the software for testing requires high man power. It does not ensure a wide test coverage - a lot of areas of the product under test left uncovered. The proper operation of Serenity framework requires high investments. Test automation engineer should take a correspondent training.

### 1.5. Robot Framework

Robot Framework is open source as well as the majority of available libraries and tools. It was developed by Nokia Networks but now is sponsored by Robot Framework Foundation. It was released under Apache License 2.0.

The framework is designed for automation of acceptance testing and ATDD (Acceptance Test-Driven Development). Being hosted on GitHub, it is supported with enough documentation to ensure smooth workflow. The operation of the framework is based on the keyword-driven testing approach using convenient easy-to-use tabular test data syntax.

By implementing test libraries with Python or Java, the test automation engineer is able to extend the framework capacities. Based on existing keywords, the tester can design new ones of a higher level using the same syntax. Robotium supports Jython (JVM) and IronPython (.NET).

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### Advantages

The framework possesses high integrability capacity that ensures the interaction with different applications and tools for editing, running and writing tests. Some of such tools are created as separate projects. In-built tools:

- Rebot for log and report generation and outputs combining
- Libdoc for keyword documentation creation
- Testdoc for generating HTML documentation based on test cases
- Tidy for changing the format of test data files

Robotium Framework includes a number of editors including RIDE, Atom and Eclipse plugins, Gedit, TestMate bundle, RED, Notepad++ and others. Besides, there is Ant task for launching tests, Jenkins plugin for collecting and publishing test results in Jenkins and Maven plugin for utilizing the framework. The availability of a number of plugins and tools ensures integration with different systems under tests.



Appium

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Comparison of Technical Aspects

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2.1. Selenium WebDriver

Tools and Frameworks:



# High level architecture



The framework includes the libraries for automation of web applications, databases, activities with the file system, SSH (Secure Shell), Swing, Windows GUIs, SWT (Standard Widget Toolkit) and others.

### Disadvantages

The test automation engineers who do not possess profound programming skills are able to use Robotium Framework. Besides, a number of available tools for editing tests and scenarios is available. But in comparison to other test automation frameworks similar to Selenium, Robot Framework is not so flexible.

# 1.6. Galen Framework

Galen Framework is released under Apache License 2 and available on Github. The main aim of the framework is to automate the testing of websites with responsive design. The automatic mode enables checking of elements arrangement and refractions as well as their CSS properties.

The markup language is the basis for Galen Framework. In comparison to CSS, the framework and Galen Specs language operate the page objects but not classes. The arrangement of each object on the page is tested and described regarding other elements of the same page.

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# Galen Spec Language

# Galen Spec Language

Object definition

HTML	GALEN
<body>   <body>   <br <="" th=""/><th>@objects search-panel id search-bar search-panel-button css #search-bar a menu-item-* css #menu li</th></body></body>	@objects search-panel id search-bar search-panel-button css #search-bar a menu-item-* css #menu li

### Advantages

Galen Framework enables the testing of responsive websites on different mobile devices due to its capacity to run tests in a cloud. Besides, for testing of a website layout in various browsers the framework integrates with Selenium Grid as it is based on Selenium. It utilizes WebDriver for launching certain pages in the required browser, collecting information about the page elements and making screenshots.

As the framework does not require deep programming skills and abilities, it is a very convenient tool for verifying the design of web solutions. In order to use the framework effectively and work with different objects, a test automation engineer should possess only basic knowledge of CSS and be aware of core algorithms descriptions. It ensures fast writing and maintaining of tests.

### Disadvantages

Galen Framework is not suitable for automated checking of interface functionality. To perform this task, the automation engineer has to overcome the restrictions in library functionality. But it can be combined with other frameworks, e.g., TestNG, to ensure automated checking of both design and functionality

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# 1.7. HP Unified Functional Testing (UFT)

Unified Functional Testing (UFT) earlier known as Quick Test Professional (QTP) is designed to automate functional and regression tests for different software products and environments through UI including native or web GUI. It also can be used for enterprise QA. The software is developed by Hewlett Packard enterprise Software that now is a part of Micro Focus.

The basis of HP UFT is Visual Basic Scripting Edition (VBScript) that ensures work with objects and controls of the software under test. But test automation engineer faces difficulties, that if a product has complex and customized UI objects, the tool may not recognize them.



### **Advantages**

HP UFT provides automated testing of web, API, packaged and mobile applications. It is suitable for REST and SOA services, CRM (Customer Relationship), ERP (Enterprise Resource Planning) applications. It supports cross-browser testing including product verification on Firefox, IE, Chrome and Safari. Also, different add-ins ensure the support to Web, .Net, Delphi and Java.

Due to the LeanFT (Lean Functional Testing) plugin, it is possible to create tests in Eclipse / Java and Visual Studio / C#. The tool supports continuous testing and works with such software as Jenkins. The integration with

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Jenkins the test execution can be a part of regular build process.

### Disadvantages

As the Test Execution engine goes in combination with the GUI Test Code development IDE, it is impossible to launch tests separately from HPE. Also, the price for tool license is rather high. Mostly large companies that work on complex projects utilize HP UFT. It is more suitable for the team that includes both developers and testers. Besides, the software has some limitations in supporting different OS and browsers. So HP UFT is used for those projects where the browser type and version used for automation does not matter.

### 1.8. Ranorex Studio

Ranorex is designed for GUI testing automation of desktop, web and mobile applications. Also, it is suitable for functional testing of different solutions. The framework is developed by Ranorex GmbH. It is a set of separate tools that possess own specific features integrated in the framework. It includes:

- Ranorex Studio test development environment Appium Framework
- Ranorex Recorder object-based capture / replay feature
- Ranorex Spy GUI object recognition Galen Framework
- Ranorex Test Suite Runner Ranorex Studio



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The test automation engineer is able to design tests using Ranorex Recorder but for more complex needs, it is possible to create own scripts separately from the tool. This enables the execution of the same code for different test cases. And the code can be managed with Subversion and Team Foundation Server. Due to Ranorex UI items repository, the test logic is separated from the UI display. Thus, the same tests can be used even if the interface was changed. Due to the feature of GUI object recognition, the maintenance of tests requires less expenses.

The framework is used for automated testing of applications developed on Winforms, C#, VB.NET, WPF, Silverlight, SAP, Oracle Forms, Flash / Flex, MS Dynamics, Java. It is cross-browser tool that supports IE, Firefox, Chrome and Safari. Ranorex Studio ensures test automation on iOS and Android based applications. Also, it is used for data- and keyword-driven testing.

Two editions of Ranorex Studio are available. Using the runtime edition, the test automation engineer is able to perform a standalone test execution. But the premium version consists of node locked license added to the host name and the floating one shared between machines. The price depends on the license version.

Despite the tool intuitive UI, test automation engineers should learn the available documentation in order to ensure the effective usage of all Ranorex feature and all its advantages.

#### Disadvantages

The tool is suitable for middle size projects where it is necessary to perform and run test automation quickly. Test automation engineer should possess the basic programming skills and know how to work with XPath for editing and correcting written scripts. The usage of Ranorex for test automation of large projects will be ineffective because of the need to edit a big number of tests. It is cost and time-consuming.

The introduction of a new feature into the application under test causes crashes because of Ranorex poor compatibility with the applications. In case of crash, the closed application will not be launched automatically.

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The framework does not support some touch gesture / drag&drop operations.

### 1.9. TestComplete

TestComplete is a platform developed by SmartBear for automated functional and UI testing. It supports the automation of UI tests for different desktop and package applications, web and mobile solutions. TestComplete has three modules - each designed for testing particular application types. The tools ensure the verification of applications on physical and virtual machines.

Using the tool, test automation engineers are able to check various types of applications including Web, Windows, Android, iOS, WPF, HTML5, Flash, Flex, Silverlight, .NET, VCL and Java. TestComplete tests can be easily recorded and scripted. Besides, the testers are able to write them manually using keyword-driven operations. The tests are suitable for issues logging and automated playback.



TestCompete enables the automation of the following software testing types:

- UI testing
- Cross-browser testing
- Regression testing
- Data-driven testing
- Functional testing
- Parallel testing
- Keyword-driven testing
- Agile testing

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Also, the platform is suitable for test automation of HTML5 web applications including their checking in Firefox, Opera, Chrome and Edge. Due to the feature of GUI object recognition, the maintenance of tests requires less expenses.

#### **Advantages**

TestComplete includes the package of pre-installed extensions and provides the opportunity to create own customized ones. Pre-installed script extensions includes the Atlassian JIRA, QAComplete and Bugzilla script extensions used for error logging and extensions for creating manual checkpoints. The tool is very easy-to-use and convenient especially for those who do not possess programming skills or are new to test automation. TestComplete is a proper tool for simulating user actions during smoke testing or when it is necessary to execute the drag&drop function a number of times.

#### Disadvantages

The licence cost is rather high. The software does not support Descriptive Programming. As TestComplete has only global and centralized Object Repository, you cannot create non-centralized object repository. In case of dynamic web applications, object recognition may fail. You cannot switch to debug mode if the exception appears. The software does not have the option of saving all variables used in test cases. Only Script Editor supports the customization.

### 1.10. Telerik Test Studio

Test Studio is a test automation tool developed by Telerik. It is used for automation of GUI, mobile, load, performance and API testing activities. Having point-and-click interface, the tool ensures a convenient way of task management and fast task execution. The interface is extended using Telerik-exclusive features such as 3D element selection. Three versions of Test Studio are available:

- UI testing
- Cross-browser testing

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• Runtime for test execution and integration

The test automation engineers use Telerik Test Studio for verification of web and desktop applications developed on Silverlight, WPF, AJAX, HTML, WPF, iOS, Android, Ruby, PHP, Angular and MVC. Besides, in order to provide in-built control translators, the tool supports the integration with Telerik controls.

#### Advantages

With the usage of Test Studio, test automation procedure requires less scripts for checking of SilverLight applications. Test Studio provides central object repository due to the Element Explorer that is a central location for test elements used for different tests can be stored, shared and referenced from.

For mobile application testing, Telerik offers Test Studio Mobile. Designing test scripts once, the automation engineers can run them on different devices with various OS types and versions. There is a separate Test Studio for iOS verification that supports testing on iPhone, iPad and iPod devices. The test automation engineers can perform testing of native, web and hybrid iOS applications. Test Studio for iOS supports such development platforms as Xcode, PhoneGap, MonoTouch.

### How We Do It



Test Studio functionality resembles Ranorex Studio. It can be used for small and middle-size projects. In the recorder mode, the test engineer is able to record automatically the scenarios. Besides, the option of writing scripts manually is also available. But the usage of Test Studio does not require programming skills.

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### Disadvantages

As it is a commercial framework, you should pay license fees. Online support is available only with licence renewal. To use Telerik, you should set up the add-in for source control. The use of relative object properties can cause difficulties. In case of a big number of tests for automation, it is better to use the framework with more functional capacities that provides opportunity to design more flexible scripts manually.

# 1.11. Applitools Eyes

Applitools Eyes is a cloud-based automated solution for UI testing developed by Applitools. It supports checking of different visual effects of web, mobile and desktop applications. Special visual technology enables to verify an application is displayed in various browsers and devices.



The tool supports integration with TeamCity, Jenkins, Bamboo, TFS, Slack, HP Quality Center, Travis CI, JIRA and Circleci. Besides, it can be integrated with other test automation frameworks such as Appium, Selenium, HP UFT, MS CodedUI, Protractor for AngularJS. The functionality of Applitools Eyes may be extended by the integration with device and browser testing frameworks including BrowserStack, Sauce Labs, Perfecto Labs and HP Mobile Center.

The Applitools Eyes tests can be based on manual checking of application functionality and UI that includes testing of product content, CSS and layout. In such a case the tool ensures an instant verification of UI

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elements and front-end functioning checking whether they are broken and notifying about every critical issues. At the same time it does not alert about insignificant modifications that will not affect user's experience.

Even a manual tester can use the tool for checking of application design. There is a special plugin for visual testing. It enables creation of simple and easy-to-use scripts without programming skills and requiring no coding at all.

#### Advantages

In comparison to other frameworks, Applitools Eyes enables extension of available functionality of an automation project adding visual checkings. Also, the tool has the libraries that can be implemented to a project. Due to this feature test automation engineers are able to add application design checking to test scripts using the screenshots.

### Disadvantages

The tool can be used only as a part of test automation project, it will not provide a wide test coverage. It resembles the Galen framework but does not have so wide capacities during checking on screens with different resolutions. Applitools Eyes operation is based on actions that should be performed by the main test automation framework on the projects.

# 1.12. Test Automation Tools and Frameworks: Comparison of Technical Aspects

Having specific features and system characteristics, every test automation tool and framework provides a certain scope of options. The specifics of the system under test requires the test automation framework to satisfy all the requirements. The effectiveness of test automation depends on the right choice of test automation tool. To make the selection of a proper tool for test automation, we prepared the comparison of main technical characteristics of the most popular tools and framework for test automation.

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#### Test Automation Tools and Frameworks

	Selenium WebDriver	Serenity	Robot	UFT	TestComplete
Testing types	Different types	Acceptance testing	acceptance testing and ATDD	Functional testing	Functional testing
Supported languages	Java, C#, Ruby, Python, Javascript	Java	Python, Java	VBScript	JavaScript, Python, VBScript, JScript, DelphiScript, C++Script, and C#Script
AUT	Web apps	Web apps	distributed, heterogeneous apps	Windows desktop, web, mobile apps	Windows desktop, web, mobile apps
Programming skills	High	Medium	Beginner	Medium	Medium
Product Support	Open source community	Open source community	Open source community	Dedicated staff, community	Dedicated staff, community
Cost	Free	Free	Free	License and maintenance fees	License and maintenance fees

#### Test Automation of Mobile Applications

	Appium	Robotium	TestComplete	Robot	Telerik Test Studio	Ranorex Studio
Testing type	Mobile testing	Android UI testing	Functional testing	acceptance testing and ATDD	GUI, performanc e, load and API	GUI testing
Supported languages	Java, C#, Ruby. PHP, JavaScript, Python	Java	JavaScript, Python, VBScript, JScript, DelphiScript, C++Script, and C#Script	Python, Java	HTML5, Angular, AJAX, JavaScript, Silverlight, WPF, MVC, Ruby and PHP,	C#, VB.Net and Python

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AUT	iOS, Android and Windows apps, native and hybrid apps	native and hybrid Android apps	Windows desktop, web, mobile apps	distributed, heterogene ous apps	mobile, web and desktop apps	desktop, web and mobile apps
Programming skills	Beginner	Beginner	Medium	Beginner	Medium	Medium
Product Support	Open source community	Dedicated staff, community	Dedicated staff, community	Open source community	Dedicated staff, community	Dedicated staff, community
Cost	Free	License and maintenan ce fees	License and maintenanc e fees	Free	License and maintenanc e fees	License and maintenanc e fees

#### **GUI and Visual Test Automation**

	Galen	Ranorex Studio	Telerik Test Studio	Applitools Eyes
Testing type	Layout and functional testing of websites	nd GUI testing GUI, al performance, f load and API		Visual testing
Supported languages	Java, JavaScript	C#, VB.Net and Python	HTML5, Angular, AJAX, JavaScript, Silverlight, WPF, MVC, Ruby and PHP,	Java, JavaScript, C#, PHP, Python, Ruby, Swift
AUT	responsive websites	desktop, web and mobile apps	mobile, web and desktop apps	web, mobile and desktop apps
Programming skills	Beginner	Medium	Medium	Beginner
Product Support	Open source community	Dedicated staff, community	Dedicated staff, community	Dedicated staff, community
Cost	Free	License and maintenance fees	License and maintenance fees	License and maintenance fees

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# 2. Test Automation Tools Approved by

# QATestLab

The Whitepaper is prepared by QATestLab, an independent provider of QA and testing services. Based on 12-year experience in software testing and realizing more than 1000 projects for different industries, the company is ready to share the obtained experience.

The team of test automation engineers consists of 10 specialists that have already realized more than 40 projects. Due to the diversity of projects, the team uses different test automation tools and frameworks to provide effective testing.

In order to minimize time and expenses related risks, our test automation team analyzed several most popular tools and frameworks used on real projects and prepared the recommendation on tools and frameworks usage. We recommend the following test automation tools and frameworks: Selenium WebDriver, Appium, TestComplete, Ranorex Studio.

# 2.1. Selenium WebDriver

According to "Magic Quadrant for Software Test Automation" by Gartner Inc, the research and advisory company, by 2020 Selenium WebDriver will become a standard tool for automation of functional tests.

### Advantages

- Free framework
- Wide support from different software developers including Google, Microsoft
- System operation on a regular basis, patches for new browser versions
- Independence from platform, browser and its version
- Enabled automation of different programming languages
- Integration with other frameworks
- Support of parallel testing

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- Scripts execution on remote machines and services
- Tests launching on schedule on CI systems and so on
- Opportunity to automate hybrid applications developed on the basis of OpenFin or Electron

### Disadvantages

But using Selenium WebDriver for test automation projects, QATestLab team faces several disadvantages that limit the tool functionality and complicate the testing activities:

- The automation of such container technologies as flash is impossible.
- Test automation engineer should possess programming skills as the scripts for automated tests should be written manually.
- It's impossible to execute validation and reporting in one library. They should be set separately. And this requires additional means.
- The library may contain bugs that are difficult or sometimes impossible to remove. This is a free open-source project that does not have a separate team responsible for bug fixing in the current library versions.

#### **Recommendations on usage**

In order to avoid Selenium WebDriver disadvantages and fully use the tool functionality and capacity, the test automation team at QATestLab has prepared recommendations.

- Selenium WebDriver is suitable for automation of application functionality. For design verification, manual testing is more suitable.
- Test automation team should avoid a big number of repeated tests as they enlarge the code amount.
- Test automation engineers should possess knowledge of the programming languages a product is created in.
- It is better to execute the tests in different browsers in parallel with the accordingly planed structure of automated tests and project.
- For multi-browser testing, the usage of specialized services such as BrowserStack or Sauce Labs is more preferable.

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They provide ready solutions for a remote run of automated tests in the cloud. No necessity to waste time and effort to support infrastructure.

### 2.2. Appium

For test automation of mobile applications including native, hybrid and mobile web ones, the test automation team in QATestLab uses Appium in the majority of cases.

### Advantages

- Simultaneous development of automated scripts for iOS and Android. No need to support several automation projects in parallel
- An active development of the framework together with its functionality
- Independency from the used platform
- Support of several programming languages
- Wide community support
- Automation of a number of device configurations without any additional settings

### Disadvantages

Apart from that, the test automation engineers defined several limitations in the framework functionality.

- Development of autotests and connection of additional libraries should be done manually for adding tests to scripts and generating reports.
- During the automation of some applications, the interaction between the framework and UI may cause some problems. Also, test automation engineer can face the difficulties while using the customized interface elements.
- Appium has a slow operation speed in comparison to other tools that support mobile automation.
- The automation of mobile games is impossible as the framework does not support the interaction with Unity3d and similar technologies.

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### **Recommendations on usage**

The automation team at QATestLab prepared several recommendations that will help to use the framework capacities fully and ensure effective quality verification.

- The framework is suitable for test automation of the application on several platforms.
- Appium is impossible to use for automation of game applications, only native or hybrid ones.
- It is effective to automate the application testing simultaneously on devices with different configurations
- Appium is suitable for managing the autotests execution process, adding own functionality to report running, performing additional checking activities, e.g., API, databases.

# 2.3. TestComplete

For functional tests automation QATestLab testers usually use TestComplete that assists in providing an effective quality assessment of different applications.

### **Advantages**

- The tool simplifies the procedure of exploring UI elements markup.
   Test automation engineer gets the information about a certain UI element by clicking it.
- It has an objects repository that stores ID rules of UI elements. Each rule has an alias based on a parent-child relationship between UI elements. Being used instead of direct locator's usage, the aliases ensure the independence of test scripts from UI markup.
- TestComplete provides a rich support of logging procedure including the features of customizing logs, attaching screenshots, assigning priorities and defining logging events interceptors.

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### Disadvantages

Using the framework during functional test automation, the QA team faced several disadvantages that may reduce the effectiveness of testing activities.

- For writing scripts, TestComplete suggests several scripting dialects that have much in common.
- The behavior of some feature is not documented. For example, a tester cannot hover the UI element by mouse and in some cases it is impossible to convert the returned objects to array.
- IDE (Independent Development Environment) has own bugs, e.g., after saving script changes manually IDE may freeze.
- TestComplete provides a limited test flow handling, e.g., no opportunity set handlers for start / finish events of the test suite.
- The functionality of IDE script editor is limited. It does not provide such features as a smart renaming of code entities, quick navigation, autocompleting of the name of objects' properties.

### **Recommendations on usage**

The tips that will assist in increasing the productivity of checking procedure using TestComplete:

- The framework can be used for automation of large projects where desktop application automation or simultaneous automation of desktop / web / mobile applications is required.
- Due to the option of recording, the specialists with basic programming skills can used TestComplete for not complicated projects.
- The interception of log errors caused by script failures is not recommended.
- As the code editor of TestComplete provides rather limited functionality, it is better to use another one, for example, VSCode, Atom that can be extended by plugins.

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### 2.4. Ranorex Studio

Being designed for automation of GUI testing, Ranorex Studio ensures a smooth workflow and effective checking.

### Advantages

- Support of function "script recording" if it is unnecessary to write the code manually
- In-build functionality for report generation and script run
- Using program interface, it is possible to set the receiving of test data from the external file / spreadsheet or database
- Capacity to record the scripts for web and desktop applications, mobile programs.
- Does not require high programming skills for development of autotests.

### Disadvantages

Using Ranorex Studio for automated GUI testing, the QA team usually faces the following disadvantages that reduce the reduce the effectiveness of testing activities.

- In some cases, the automated script recording may work improperly and require manual code adjustment.
- The framework supports the programs only on Windows platform.
- Ranorex Studio is a commercial test automation framework.
- In comparison to free alternatives, the framework is not supported with enough documentation on usage issues and ways of their solving.
- It is rather difficult to connect additional functionality to the automation project as the tool is oriented only on the provided functional, e.g., script run and reports receiving.
- In the majority of cases, it is impossible to automate customized elements of application interface as the tool does not recognize them.

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### **Recommendations on usage**

In order to ensure an effective test automation with Ranorex Studio, the test automation engineers at QATestLab always keep the following tips that they single out on the basis of their own experience.

- It is better to use recorder for not large projects where major changes are not expected.
- For small projects, the usage of the tool may be too expensive in comparison to other analogues presented at the market.
- It is impossible to execute scripts on a large set of device and browser configurations. Ranorex Studio is not suitable for multi-browser testing.

# 3. Summary

Due to the increasing requirements to software quality and reduction of release timeframes, the growth and development of test automation market are inevitable as test automation tools / frameworks ensure fast quality verification of complex systems.

In order to simplify the choice of proper tool for test automation among the variety of ones already available in the market, we tried to prepare the guide dedicated to the analysis of most popular tools in 2017.

For everyone involved in software testing to make the right choice, we have reviewed the tools not according to their price but according to the sphere and goals of implementation and their functional capacities and limitations. Based on our own experience on real automation projects, we singled out several recommendations on usage of the test automation tools / framework that are widely used by QATestLab.

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