**Unit Testing Tools and Their Features**

A unit can be considered as the smallest testable part of an application. Unit testing is a software testing method by which individual units of source code, together with associated control data, usage procedures, and operating procedures, are tested to ensure that code meets its design and behaves as intended. Unit testing frameworks can also be used by programmers to test any specific functionality in application and libraries. Each test case is independent from the others and substitutes such as method stubs, mock objects, fakes, and test harnesses are also used to assist testing a module in isolation.

## How to Choose Unit Testing Tools

Automated unit testing helps in improving quality, decreasing costs and reducing time required for testing. However, all this is possible only with use of appropriate testing tool. Following are various parameters critical to selection of appropriate tool:

**1. Minimum implementation time:** This is possible when users are already familiar with technology (language, method of working, integration constraints) used by the testing tool. Additionally, extensive documentation and support available help in reducing implementation time.

**2. Minimum ownership and running costs.** An open source tool which is free to access may be less efficient and have higher operating costs. On the other hand, a commercial tool available may require initial investment but due to its better features might make testing efficient and cost effective in the long run.

**3. Flexibility:** Every project is unique in a certain way and has its own peculiar needs. Thus an efficient testing tool while offering most required features should also provide option of code modification. Further for swift debugging, the framework should make test code readable.

### Popular Automated Unit Testing Tools and Their Features

#### 1. xUnit.net

* Free, open source, community-focused unit testing tool for the .NET Framework.
* These frameworks derive their structure and functionality from Smalltalk’s SUnit. Following its introduction in Smalltalk, the framework was ported to Java and it gained wide popularity,
* Works with CodeRush, TestDriven.NET, ReSharper and Xamarin.
* It is part of the ASP.NET Open Source Gallery under the Outercurve Foundation, and is licensed under Apache 2 (an OSI approved license).

#### 2. NUnit

* Unit-testing framework for all .NET languages.
* It is one of many programs in the xUnit family, written entirely in C# and serves the same purpose as JUnit does in the Java world.
* NUnit is Open Source software, NUnit 2.6.4 is released under the NUnit license while NUnit 3.0 uses the MIT license. NUnit 3.0 which is a complete rewrite, is currently under development. However, a beta release, with new infrastructure and features is currently available.

#### 3.  JUnit

* It is an instance of the xUnit architecture’s unit testing framework for the Java programming language. It is a simple framework to write repeatable tests.
* JUnit features include assertions for testing expected results, test fixtures for sharing common test data and test runners for running tests.
* JUnit is Open Source Software, released under the Eclipse Public License Version 1.0 and hosted on SourceForge.

#### 4. TestNG

* It is a testing framework for the Java programming language inspired by JUnit and NUnit.
* It includes support for annotation, parameterized, data-driven testing and multiple instances of the same test class.
* It is designed to cover all categories of tests: unit, functional, end-to-end, integration.
* Offers flexible execution model and can be run either by Ant via build.xml or by an IDE plugin with visual results.

#### 5. PHPUnit

* It is an instance of the xUnit architecture’s unit testing framework for the PHP programming language. It is based on the “JUnit” framework for Java.
* PHPUnit can output test results in a number of different formats, including JUnit XML, Test Anything Protocol, JSON, and TestDox.
* It can be executed on cross-platform operating systems and its development is hosted on GitHub.

#### 6. Symfony Lime

* Symfony Lime is a unit testing and functional testing framework built specifically for the Symfony web application framework which is based on the Test::More Perl library.
* The framework is designed to have readable output from tests, including color formatting, by following the Test Anything Protocol which also allows for easy integration with other tools.

#### 7. Test Unit:

* It is an xUnit family unit testing framework for Ruby. It allows writing tests, checking results and automated testing in Ruby.
* This software is distributed under the same terms as Ruby.
* Test::Unit 1.2.3 is the original Test::Unit, taken straight from the Ruby distribution. It is being distributed as a gem to allow tool builders to use it as a stand-alone package.

#### 8. RSpec

* It is a behavior-driven development (BDD) framework for the Ruby programming language, inspired by JBehave.
* It contains its own mocking framework that is fully integrated into the framework based upon JMock. The framework can be considered a domain-specific language (DSL) and resembles a natural language specification.
* RSpec 3 was released in 2014 and provides verifying doubles, composable matchers and a new syntax that allows RSpec to be used with no monkey patching.

In conclusion, unit tests isolate each part of the program and check that the individual parts are correct. Unit testing finds problems early in the development cycle and hence facilitates changes required in code. Testing the parts of a program first and then testing the sum, allows faster integration testing and progressive documentation which are critical to the success of the unit. However, considering the variety of testing tools available and their variable features, it becomes essential that features of each testing tool are analyzed in detail before any selection and use.