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A Conformiq White Paper

How to Succeed at Multi-Platform Testing

It should come as no surprise that the numbers of platforms and device types are more varied now than ever before. Customers continue to demand the latest devices, features and functionality, as well as increased mobility and accessibility. With the proliferation of mobile and portable device platforms and the Internet of Things, the workload of developers, and especially testers, has greatly increased. As traditional testing practices prove unable to keep up with the demand, businesses of all types are experiencing significant product delivery delays and, in some cases, costly product defects. Naturally, there is a growing demand for more efficient and cost-effective testing across all platforms.

With the Internet of Things and more devices of all types, it is critical for development teams to build products that interoperate and function consistently across multiple platforms and devices. Regardless of the industry, multi-platform testing capability is now mandatory.

Due to fragmentation and differentiation of devices, displays, and inputs, the traditional manual approach to testing suffers many drawbacks and limitations. Among other things, it is extremely time-consuming and prone to missed coverage. This not only promotes lower product quality, but also leads to cost escalation. Testing is even more difficult because features do not function in the same way across all platforms. This requires developers to implement custom code for different platforms, which, in turn, requires more testing. Adding to the testing complexity is the vast number of APIs (application programming interfaces) that connect all these devices.

Introducing Cross-Platform Test Automation

In order to improve product quality across all platforms, it is necessary to have known test coverage. In parallel, it is important to ensure greater efficiency throughout the testing process and reduce testing turnaround time in order to speed time-to-market. The industry agrees that implementing cross-platform test automation is really the only effective way to scale. This requires businesses to make an investment in implementing and deploying a test execution infrastructure that works across platforms such as Appium, Calabash, Perfecto, Selendroid, and Telerik. At the same time, for other platforms and legacy applications, automating execution utilizing existing tools like HP QTP/UFT and Selenium might also be needed. When combined, these infrastructures allow tests to be executed on a variety of devices without the core structure having to be re-engineered, but supporting them all can make automated testing very complex. Thus it becomes critical to use a testing process that can easily support all needed execution frameworks.

However, while the industry has identified the importance of automating test with cross-platform testing, most traditional test automation focuses only on regression testing. When testing new functionality, traditional manual test design and manual test execution are still the prevailing approaches, even though "state-of-the-art" cross-platform test automation is now available.

Manually created test cases typically focus on "happy paths". They target the most common states and activities within the application, not corner or negative cases where defects often occur. This focus on happy-path testing carries over even when regression tests are automated (scripted). There are numerous reasons for this, but the most common one is because traditional test scripting is a complex activity that requires a lot of time and effort. Manually, it is often too labor intensive to design tests and their expected results for this remaining functionality.

Unfortunately, because of this focus on happy-path regression testing, state-of-the-art test automation suffers from numerous shortcomings associated with the manual test design approach, including incorrect, missed and redundant tests, ad-hoc coverage, and manual traceability. As often happens when only the testing of happy paths is automated, all the remaining functionality (i.e., the less-used functionality and usage scenarios where bugs typically lie) are still tested using completely manual ad-hoc approaches, which are neither accurate nor repeatable. Even worse, these bugs may only be found by product users.

Since the core purpose of testing is to find all flaws as efficiently and cost-effectively as possible, automating test design is the obvious solution. In this way, the effort of testing across multiple platforms can be significantly reduced, while simultaneously increasing the quality of the testing performed.

Manual Test Design Limitations

As described above, one of the most fundamental problems with current state-of-the-art multi-platform testing is that test design remains a manual activity. Test design involves making decisions on:

- What to test and what not to test
- How to stimulate the system and with what data values
- How the system should react and respond to the stimuli (test oracle)

Test design is a separate task from test execution, and is done before executing the tests against the system.

So what is the problem with doing test design manually?

First of all, manual test design cannot guarantee systematic, known, and repeatable coverage of the system behavior. This already presents a huge risk. With manual test design, it is difficult to assess the quality of your testing efforts, which often leads one to evaluate the quality and progress of the manual test design process using spurious metrics such as the number of test cases or the number of hours spent testing. Neither of these metrics directly correlates with application test coverage and test quality.

Additionally, manual test design is a very expensive and time consuming process, especially when there are changes in the requirements. In practice, test engineers are forced to manually analyze each of the test cases individually in order to see which test cases need to be updated and reworked; which need to be removed: and which need to be added to fill the coverage gap when there are changes in the requirements. The manually written test scripts need to be updated both when the requirements change and also when some implementation details change. All this erodes productivity and is

extremely error-prone, especially when release dates dictate very short testing times.

By automating test design, testing efforts can be significantly reduced, while at the same time, the quality of the testing can be increased.

Introducing Conformiq° 360 Test Automation

The most effective way to automate test design is from the top down. Conformiq provides the most sophisticated and comprehensive automated test design solution in the industry. Its unique Conformiq 360° Test Automation technology enables the next generation of testing for complex, system-level testing environments.

It includes a model-based testing (MBT) approach, driven by system models. System-model driven, next-generation MBT solutions, such as Conformiq Designer™ and Conformiq Creator™, do not compete with existing test automation solutions, instead they are complementary. Conformiq tools can directly leverage existing investments in test automation and directly integrate with cross-platform test execution infrastructures, meaning that test cases generated by Conformiq can be directly executed against multiple different devices and platforms without additional manual efforts. Conformiq 360° Test Automation also makes it possible to perform testing either on the actual target device and/or in a simulated environment.

Automating test design using Conformiq tools has numerous benefits, some of which are listed below.

Improved quality and fault detection – An automated approach to test design lowers the risk of having incorrect, missed, and redundant tests. An engineer can, for example, accidentally miss a test case that is dictated by the requirements for an error handling case, a limit value of a data parameter, or an expiration of a rarely activated timer. An algorithmic approach to test design eliminates randomly incorrect tests. This yields fewer missing tests because the algorithm does not accidentally miss corner cases. There are fewer redundant test cases because the resulting test sets are rigorously optimized by a computer and checked for relevance. Tests are always related to the requirements, the quality of the generated test suite is always measurable, and the entire process is systematic and repeatable.

Reduced time and cost – Creating a system model for Conformiq software is straightforward and less error prone than describing the tests themselves. One model can be used to generate multiple test suites for different purposes, including the expected results of execution (test oracle), saving both time and money.

Improved traceability – Using Conformiq software helps ensure that none of the functional requirements have been ignored in test case design, gives a rationale on why all tests were generated, helps in understanding tests, and assists in post-execution analysis of tests to pinpoint which feature(s) were actually malfunctioning.

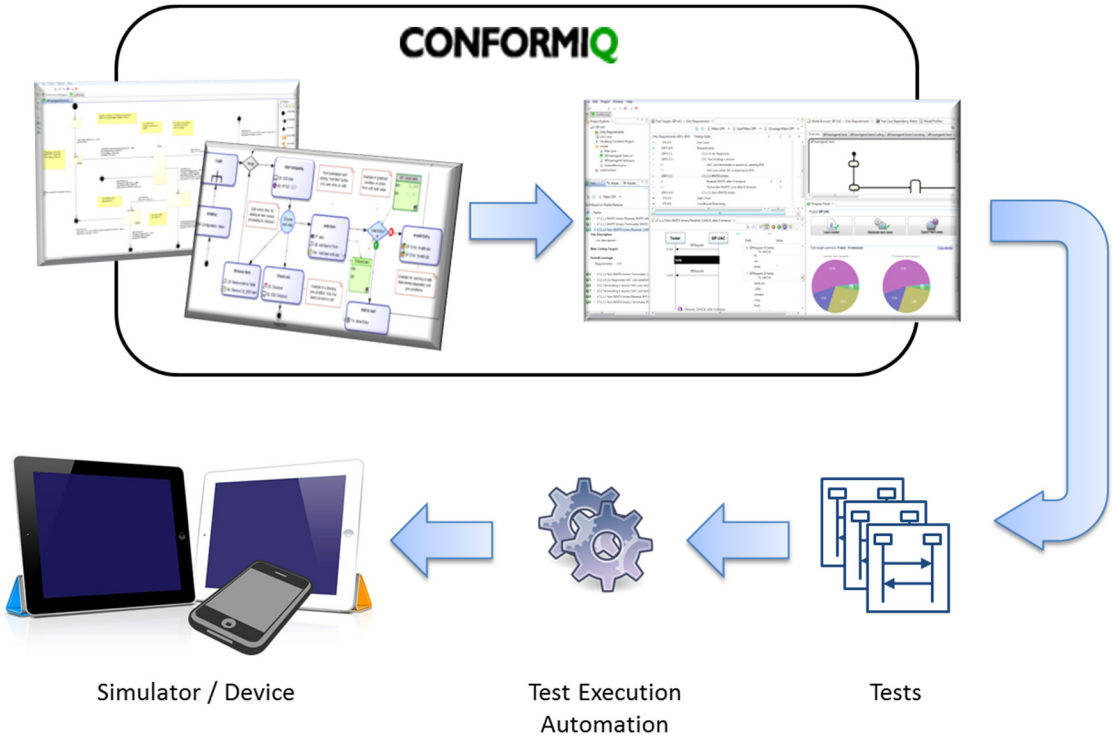
Improved maintenance – The maintenance effort for Conformiq models are significantly reduced compared to a traditional test case approach. For changes, once the tests are regenerated, the Conformiq tools generate an impact analysis with incremental traceability. The tools directly report which of the test cases were removed, which were added, and which became redundant. In this way, the regression test suite is optimized because it no longer includes useless test cases. This can eliminate up to 40% of regression test cases that, over time, have been added but never eliminated when design changes made them no longer relevant. With automated test design, testers know why they have each test case and what each one covers.

Conformiq 360° Test Automation Setup

With Conformiq tools, instead of manually designing test cases, a test engineer or test architect creates an abstract model of the system under test (SUT). He or she essentially takes the specification or requirement document and encodes it into a computer readable graphical model. A Visio model is an example of a graphical representation of a specification. Before generating test cases, the test engineer states his or her goals with regard to what the test generation tool *should* produce for the test suite. Next, he or she defines and configures the test selection heuristics such as requirements, paths, pair-wise, boundary value, and others. Then these test cases can be automatically generated without human involvement.

The output of the test generation is a collection of test cases, a coverage report, a message sequence chart of the test steps, graphical coverage of each test case for the model, and a traceability matrix, plus executable scripts for automation. The coverage report gives valuable information on how well the generated test cases cover the model with respect to coverage criteria, and gives information on the quality of the test suite. The traceability matrix gives the linkage between the model and the requirements. The test cases list all steps and data in the user's format and language.

Conformiq tools directly integrate with test execution infrastructures, meaning that Conformiq generated test cases can be readily executed against multiple devices and platforms via the cross-platform test execution automation infrastructure of your choice.



Conclusion

The only efficient and scalable way to approach cross-platform application testing and keep up with the rapid proliferation of devices is to invest in test automation by implementing and deploying an automated test execution infrastructure.

However, most allegedly cross platform test automation typically relies on manual test design, which introduces great risks. It is time-consuming and not reproducible or scalable.

Conformiq 360° Test Automation, which includes next-generation system model driven MBT, is an effective way of addressing the shortcomings of the existing cross-platform testing.

First, it automates the design of functional test cases to reduce test design cost and increase quality. Second, it reduces the maintenance costs of the tests. And third, it automatically generates coverage reports and traceability information from requirements to tests and back, so you know what has been tested, by what test case, and importantly, what has NOT been tested.

Conformiq 360° Test Automation with system model driven MBT offers significant benefits on top of existing test automation in terms of improved quality, improved SUT fault detection, improved traceability, improved maintenance, improved reuse, improved requirements, and reduced cost and time.

Conformiq solutions directly leverage existing investments in test automation and directly integrate with cross-platform test execution infrastructures, meaning that Conformiq MBT generated test cases can be directly executed against different devices and multiple platforms without additional manual effort.

Author Kimmo Nupponen is the Chief Scientist at Conformiq, and has been developing automated test design software for over ten years.

Conformiq is transforming software testing with Conformiq 360° Test Automation™, providing the most sophisticated and comprehensive automated test design solution in the industry. The unique Conformiq 360° Test Automation technology enables the next generation of testing: transforming, streamlining and automating even the most complex system-level testing environments. Conformiq 360° Test Automation improves efficiency with a 40% faster test case development cycle; enables delivery of higher quality code with 50% more defects found; increases manageability with 50% better collaboration: and reduces costs with a 400% return on investment. Conformiq serves enterprise IT, communications and embedded software markets worldwide. Privately-held Conformiq is headquartered in San Jose, California, with a worldwide delivery and support organization including offices in Finland, Germany, Sweden, and India.

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