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A Conformiq White Paper

Next Generation Testing: Transforming Software Test

Software complexity is increasing exponentially. Yet even today, an uncomfortably large part of testing in the industry is carried out entirely manually.

- Test design is done manually.
- Test execution is done manually.
- Management of test assets is done manually.

What about "automated test," as it is historically understood?

- When typical automation is introduced to manual testing practices, it almost exclusively focuses on either test management or test execution, leaving out all the other aspects of testing.
- Even worse, the focus is really only on automating regression testing, so manual test design and test execution are still the prevailing approaches to testing new functionality.

Conformiq 360° Test Automation is transforming the testing process from the inside, using unprecedented state-of-the-art technology. With Conformiq next-generation testing solutions, test design and testing efforts are significantly reduced, while testing quality is increased.

The next generation of testing is not just about automating test design, or any other single part of the testing process. Instead, it's about automating how the tests are derived and designed in the first place, as well as how tests are managed and executed. It's about transparency, visibility and control. It's about speed and turnaround time. It's about seamless integrations; bringing tools and processes together.

The following sections explore the real-world implications of next generation testing:

- Automate testing without manual involvement
- Thoroughly test complex systems with a minimum of test cases
- Gain knowledge of what has and has not been tested
- Easily see what tests were generated, what they cover, and why they're needed
- Tightly integrate with systems development life cycle (SDLC) tools and processes, and directly link to automated execution frameworks
- Reuse existing assets including models, manual test cases, and record and playback tests
- Parallelize testing on premise, or in the cloud

Automate Testing without Manual Involvement

Traditional manual test process quality assurance is a huge bottleneck. Many software projects fail to meet their objectives, and suffer significant schedule and budget slippage because defects are discovered too late. The pressure to develop and change applications faster than ever before only exacerbates the limitations of manual approaches.

Automation is the key to answer current shortcomings, to accelerate productivity, decrease turnaround time, and improve quality. We all know that we should automate our testing. But we are not doing that. Or it is not paying off. Why? One reason is that existing automated test approaches are considered so expensive to create, and especially to maintain, that they are most often written months or even years later than the actual software feature was implemented, if even then.

Historical attempts to "fix" these problems by elevating the abstraction level of the test cases may include, for example, keyword-driven testing. However, the tests themselves are still designed and crafted manually, which introduces great risks. This is time-consuming and hardly reproducible, and the test coverage with respect to requirements and traceability still needs to be done manually as well.

In order to take the testing really to the next level, it is crucial to automate all the aspects of testing and not to focus only on some parts of it. It is crucial that the automation covers the ways:

- Tests are created and derived in the first place.
- Tests are executed in order to shorten the turnaround time and to make the process repeatable.
- Tests are managed and maintained.

This is where Conformiq solutions supporting NextGen testing come in.

Conformiq solutions automate not only test execution and test management, but also test design. Test design concerns decisions such as what to test and what not to test; how to stimulate the system, and with what data values; and how the system should react and respond to the stimuli. This is a separate task from test execution, and is done before executing the tests against the system.

The Conformiq 360° Test Automation approach to test design is fully automated, driven by models describing the expected behavior of the system under test (SUT), not the tests themselves. With Conformiq, engineers create simple, high-level formal models of the SUT, which are then used in fully automatic test case generation.

Automated test design technology is an effective and complementary way of addressing shortcomings of existing test automation. First, it automates the design of functional test cases, reducing the design cost and increasing quality. Second, it reduces the maintenance costs of the tests. Third, it automatically generates coverage reports and traceability information from requirements to the tests, and back.

Thoroughly Test Complex Systems with a Minimum of Test Cases

To keep your customers happy, and ultimately your business successful, comprehensive product testing is needed. One of the main reasons for testing is to assure a level of product quality: to manage thorough test first and foremost.

Ironically, this has been one of the weakest links of existing, historical manual and so-called "automated" approaches to automation. If the real quality of your tests is low, it really does not matter how fancy your testing processes are, or how cool the tools you are using for test execution are.

To address this huge shortcoming and elevate the quality of test assets, one needs to broaden the concept of "test automation" to cover automation of test design. Why? Because the automated test design approach lowers the risk of having incorrect, missed and redundant tests. For example, an engineer can accidentally miss a test case that is dictated by the requirements, perhaps for an error handling case, a limit value of a data parameter, or an expiration of a rarely activated timer. The Conformiq algorithmic approach to test design eliminates randomly incorrect tests. There are fewer missing tests, because the algorithm does not accidentally miss corner cases. And there are fewer redundant test cases, because the resulting test sets are optimized rigorously for coverage, non-redundancy and test efficiency. This guarantees that you test your system thoroughly with the most compact set of tests possible.

Gain Knowledge of What Has and What Has Not Been Tested

The imperative for code quality brings us directly to the next important aspect that next generation testing provides, namely, providing the knowledge of what has been tested and what has not. With manual and semi-automated approaches, there is no systematic way to estimate functional coverage. Therefore it is very difficult to judge the progress of testing or the quality of the produced test cases.

The Conformiq combined automated testing solution provides coverage reports with valuable information about how well the test cases cover the system behavior being tested. Understanding the following items are critical. First, how well the test cases cover the system specification, i.e. how complete test cases are with respect to the specification. You need to understand the quality and completeness of the test suite and clearly identify parts of the specification that are not well tested and covered. Second, you need to understand that how well the test cases cover the actual application. A large discrepancy between these two figures (i.e. coverage of the specification versus coverage of application) should trigger an alarm because of the disproportionate amounts of code in the system that are unused or dead code, or are related to unspecified functionality. Without having a direct link from the test assets to both the specification and the implementation

you have very limited ways of arguing about the correctness of the application functionality.

In addition to coverage aspects, tests (especially automatically generated tests) need to be understandable and easy to review. You should not take it at face value that existing tools just magically create good quality tests, and that you should not spend any time on reviewing them - just the opposite. Everything starts from "simple things" like having understandable and meaningful names and high level descriptions for test cases. Tools should generate understandable, detailed analysis of each and every test case so you can walk thru the test case step by step, and simulate it against the specification to gain full understanding of the tests, if deemed needed. Conformiq solves this challenge.

Easily See What Tests Were Generated, What They Cover, and Why They're Needed

Coverage reports give valuable information about how well test cases cover the system behavior, while test traceability is the ability to relate tests to the specification and requirements.

Requirements traceability means tracing your functional requirements through your system design and test. From the test design perspective, this means that you should be able to explain how your test cases and individual test steps are related to functional requirements that have been articulated.

Implementing requirements traceability with Conformiq has many benefits:

1. Ensuring that none of the functional requirements has been ignored in test case design.
2. Helping to explain tests and rationales for why tests were generated. Requirement traceability helps in understanding tests, as the tests are linked to the requirements they are supposed to test.
3. In post-execution analysis of tests, pinpointing any feature which is actually malfunctioning.

Tightly Integrate with Systems Development Life Cycle (SDLC) Tools and Processes

Conformiq 360° Test Automation integrates with virtually all major testing SDLC tools, both commercial and open source, for a complete and integrated testing process. Conformiq allows customers to select best of breed tools, and integrate them into an end-to-end system, delivering improved quality, increased confidence through known coverage, and the ability to test at the speed of development. Conformiq

solutions also directly link to automated execution frameworks.

No single point of automation in the chain is best used as a standalone capability. For example, having only "automated" test execution serves a limited value. The real benefit of next generation testing derives from having all the aspects of testing automated and integrated in to one end-to-end system.
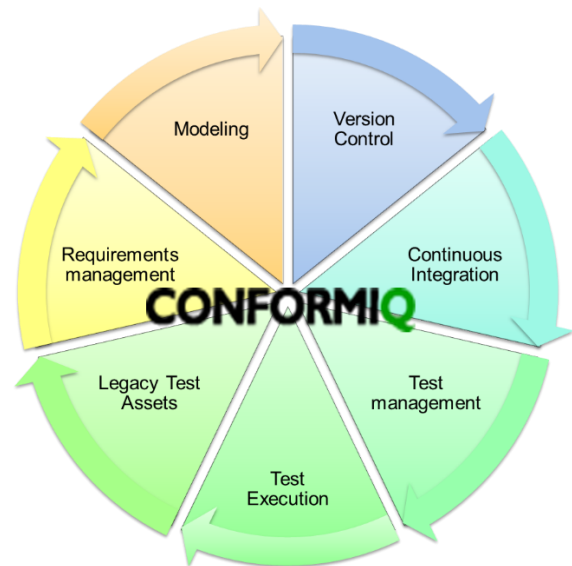
This true value comes from the ability to integrate existing and popular tools and solutions seamlessly. Take test execution again as an example; many of the adopters of advanced test automation approaches have already invested in test execution infrastructure prior to moving to include for example automating the test design. Therefore, instead of replacing your existing test execution system when deploying a more advanced test automation process, you should look for a tool and solution that integrates with your existing infrastructure. This same approach applies if manual test execution is employed; you look for a tool that integrates your ways of working.

Again, test execution infrastructure is just one piece of the overall integrated solution including tools like requirement management, test management systems, version control systems, etc.
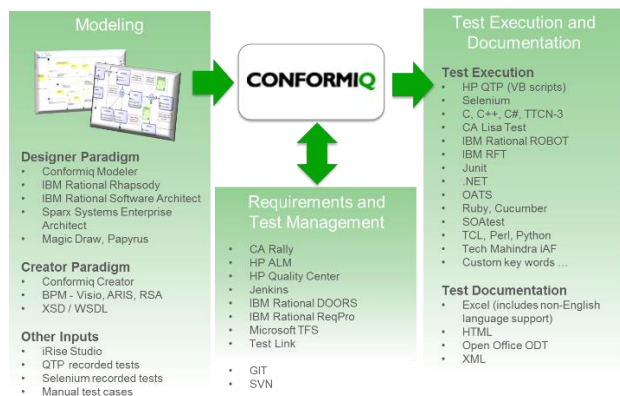
If in the case that there is no out-of-the-box integration with your particular tool, the platform offers integration APIs so you can easily integrate with your tool. (Investing in a tool that does not have proper integration APIs can be risky, limiting your freedom to upgrade your testing infrastructure in the future to support multiple test execution platforms.)

Reuse Existing Assets Including Models, Manual Test Cases, and Record and Playback Tests

Migrating to a fully automatic next generation testing platform provides numerous benefits and takes your testing to a whole new level of productivity, accelerated schedule, and code quality. Migrating to a next generation testing platform, you must of course consider your existing assets and whether they can be leveraged moving forward. No platform is really complete without a capability of such a migration path. Without it, this migration can be a very tedious and cumbersome process, and in practice this is one of the biggest stumbling blocks in migration projects.

The Conformiq platform allows you to reuse existing legacy testing assets that have been developed over the years: assets you previously created can be migrated to the new platform without starting from scratch. Conformiq can also reuse models created using a different notation and formalism to kick start the migration process, as well as using existing test cases (either hand-crafted or created using a simple record and playback tool).

Parallelize Testing On-premise or in the Cloud

Performance is critical, and one of the core innovations of Conformiq technology is to parallelize the testing in a distributed environment, in a computer cluster, on premises or in the public cloud, with superior performance. The Conformiq 360° Test Automation solution enables a cloud capability.

Test design automation and test generation from system models (models that describe the system operations instead of test cases or testing strategies) is computationally an intensive task. The more complex the system and test heuristics used, the more computing resources needed. Conformiq has invested a significant amount of effort over the years to deliver the test generation core engine performance level to manage real industrial problems.

Conclusion

Conformiq is driving the transformation of software testing, pioneering the next generation of testing technology, streamlining and automating even the most complex system-level testing environments.

The Conformiq 360° Test Automation approach provides the most sophisticated and comprehensive automated test design solution in the industry based on unique state-of-the-art technology, significantly reducing test design and testing efforts, while increasing test quality.

Conformiq is the only company to provide 360° Test Automation, system-level testing environments, for the benefit of testing teams, test architects, QA teams, development and test managers, 3rd party testing organizations and CIOs.

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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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