

## Case Study:

### *Global Banking Company Transforms Testing Approach to Overcome Challenges of Shortening Development Cycles*

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#### Background

One of the world's largest global banking companies, a bank with over 200 million customer accounts and banking operations in over 160 countries and jurisdictions, is continuously looking to leverage new technology and processes wherever possible. With rapid technological changes in the banking industry, there is a need to keep up with the competition by shortening the time to market for new products and creating additional functionality. The bank aspired to increase software test automation levels in its testing process. While test execution automation was an established concept, the ability to automate script generation and reduce product release timelines was a much more indefinite concept, and a goal.

Working with a testing services partner, Conformiq presented its 360° Test Automation approach, which includes model-based testing (MBT) technology, as a way to transform testing in order to greatly improve the bank's current manual test design process. Bank management was skeptical, saying that MBT had previously been seen and tried, but did not prove itself to be valuable and was no longer of interest to them. Conformiq and our services partner explained that not all MBT tools and processes are equal, and convinced the bank to allow us to demonstrate end-to-end automation, leveraging automated test design and integration with their software development life cycle (SDLC) tool chain. Because the bank was under pressure to decide how to move forward and find the best approach to improve its functional testing, the bank agreed to have this project delivered using Conformiq 360° Test Automation as a transformation demonstration by their service provider.

#### Project Deployment of Conformiq 360° Test Automation

Conformiq Creator™ software, part of the Conformiq 360° Test Automation solution, enables an end-to-end automation process that starts with the creation of a model which is a graphical description of the application being developed using the requirements. Directly from the model, all functional test cases, documentation, and executable scripts are automatically generated without user involvement except to select the test design algorithms used.

The project work was done over a period of several weeks with the goal of validating the required target capabilities through automating the design of test cases for execution and integration with the bank's existing SDLC tools infrastructure. The base loan booking operation for a personal loan was selected as being representative of many applications. Automated Clearing House (ACH) functionality for 10 user stories was graphically modeled using Conformiq Creator. A seamless end-to-end automated testing process was demonstrated, starting with system requirements, all the way to interfacing with the bank's hybrid HP/QTP™ automated test execution harness.

One of the bank's testing challenges was the need to speed up testing when application changes were made. There was not enough time to write comprehensive test cases, but high quality was a requirement. So to demonstrate even greater efficiency gains using the Conformiq automated next-generation test process, and to satisfy one of the bank's goals, changes to the loan processes were made, showing how quickly test cases can be regenerated after design changes are made. The model was

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adapted as needed, all test cases were automatically updated, and notifications alerted testers which cases were new and which were no longer valid.

The bank's goals are shown in the following table. Conformiq Creator, with its 360° Test Automation process, validated all goals during project delivery.

Goals for Conformiq 360° Test Automation	Validated
Improve project delivery time and effort	✓
Achieve 100% updated test documentation	✓
Achieve 100% requirements test coverage	✓
Faster test creation and testing when design changes	✓
Automated requirements traceability information	✓
Integration with test management system (HP QC/ALM)	✓
Reduced maintenance effort	✓
Test report customization	✓
Improve test design productivity by 30-40%	✓
Model and process reusability	✓

Figure 1: Goals

The Conformiq Creator modeling software was used to capture the application's operation and system flow from requirements. Inconsistencies between requirements and the model were automatically flagged, so when graphical models were reviewed, logical process errors were easily and quickly identified. Data was included for the automatically generated positive and negative test cases.

Once modeled in part, the Conformiq test generation engine automatically generated an optimal test suite based on the user-selected test design algorithms in order to achieve 100% coverage of requirements. These results were analyzed by reviewing the generated test step reports, message sequence charts, test-to-requirements traceability matrix, and the graphical model coverage diagram. The Conformiq engine automatically split the model across all available computation processors, which speeds up the process of test generation for real world model size and complexity. Once validated, the model was extended for additional features and new Visual Basic (VB) scripts were generated.

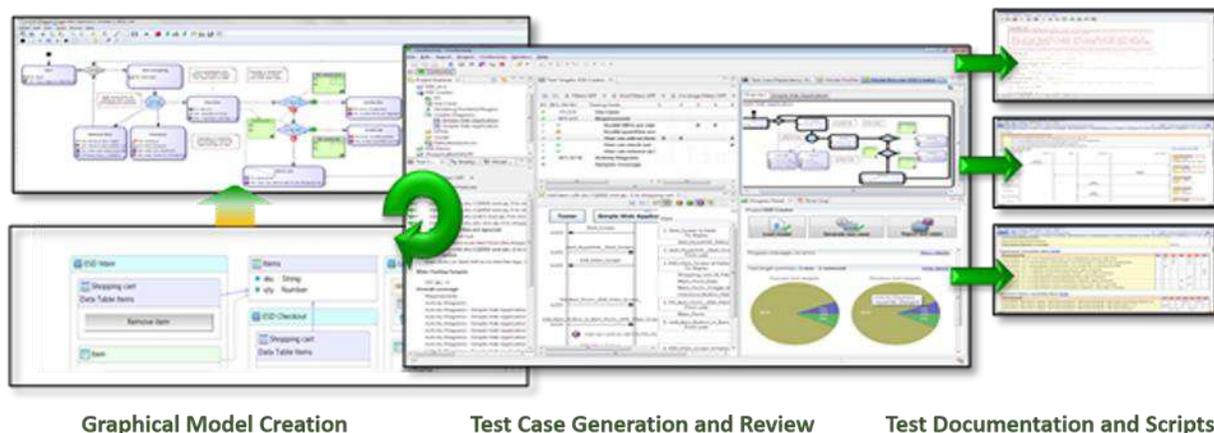


Figure 2: Three Step Process for Test Design

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The three step process shown above shows modeling, generated test case review, and fully automatic test documentation plus test scripts for automated execution, including the expected correct test execution results (test oracle).

The process of incrementally creating models and adding to existing models to test as development progresses supports the incremental creation process in agile development and allows for continuous integration, which is ideal for use with tools like Jenkins. This was not an immediate focus area for the bank during this project, but it did demonstrate an additional benefit of Conformiq's 360° Test Automation approach.

The bank's goals were to create check points to validate the automated test generation work. Previous manual efforts to complete the tasks in the goals were known by the bank and were matched against the results generated by Conformiq. The bank's main goal of automating test design was easily demonstrated by Conformiq's fully automatic generation of the stimuli and the correct test execution results, along with an Excel mapping file with pre-defined mappings to easily link the executable scripts with the HP/QTP libraries. When test data generated from the model was changed, the mapping remained unchanged. Because Creator automatically provides impact analysis after each model change, maintenance was improved by restricting no longer valid test cases from uploading to HP/QC for HP/QTP execution.

The bank also wanted documentation in its own reporting format, so the Conformiq scripiter was easily modified to document what was generated, in the bank's preferred format.

## Project Results Using Conformiq 360° Test Automation

Results for the testing work done for the ACH project were as follows:

Test Case Design and Script Generation	Project Results
Requirements coverage	100%
Regression suite optimization (reduced tests)	40%
Test design cycle time education	40%
Test case design and generation efficiency gain	28%
Total design optimization gain (new + revisions)	48%
Total end-to-end process effort gain (new + revisions)	55%
Efficiency from gains from model reusability	32%

Figure 3: Test Case Design and Script Results

Test cases and traceability matrix were exported to Excel sheets. 126 test cases were generated. Reusability was not particularly considered during initial modeling, but would have resulted in higher efficiency gains if it had been.

Change Management – Model Enhancement	Project Results
Maintenance test suite optimization	>50%
Maintenance effort reduction	>80%

Figure 4: Change Management Results

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Conformiq models were easily updated to incorporate design changes. Updated test suites were automatically regenerated with Automatic Impact Analysis.

Automation of Test Script Generation	Project Results
Effort reduction from scripts & Excel mapping file generation	70%

**Figure 5: Test Script Generation Results**

Test automation was achieved using existing HP/QTP library functions. VB test scripts were generated for HP/QTP automated execution, with successful execution.

The Creator automatically generated test results were compared with the bank’s manual test design methods, as shown below. Check marks indicate the testing process that better solved each key attribute.

Comparative Attributes	Conformiq 360° Test Automation	Previous Manual Approach	Comments
Comprehensive test design and test coverage	✓		Takes longer with manual
Reuse and quick test changes	✓		Major difference
Executable test script creation	✓		Generated automatically with Conformiq
Test design efficiency and optimized test design	✓		Major difference, typically creates fewer test cases for same coverage
Updated documentation, test design and reporting consistency	✓		Manual documentation is seldom kept up to date, manual varies by each tester
User knowledge of application needed		✓	Less knowledge needed for manual test
Understanding of specs, completeness and knowledge transfer	✓		Good visualization and documentation
User cost basis		✓	Lower cost of testers
Tool cost		✓	No tool cost for manual design
Test design headcount needed	✓		Lower expense to company
Reduced overall testing time and costs	✓		Time to market and reduced costs are huge benefits
Technology to help software test	✓		Leadership and innovation for competitive advantage

**Figure 6: Automated vs Manual Results**

*NOTE: Exact overall gains depend on the selected Conformiq licenses, project team size, program duration, tester costs, and especially the frequency of application revisions. The expected Return on*

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*Investment (ROI) for use across this program was calculated to be 3.2X annual ROI. The breakeven point occurs in the fourth month of use. The ROI would have been greater if users had more Conformiq experience and all the interfaces with the bank's tool chain and HP/QTP libraries had been previously created, thus saving a one-time interface effort that was included in the above results. Beyond testing cost savings alone, the demonstrated efficiency gains enable faster application deployment, which has much greater worth. Further, savings to the testing provider improves their EBITA even at lower customer prices.*

## Next Steps

Based on the results from this project, Creator licenses have been deployed. Some of the bank's application is being modeled to create reusable testing assets to ensure that model reusability and fast changes for software needing testing for multiple locations will deliver even greater efficiency gains.

Beyond the initial ACH application, Conformiq products have expanded to a second project. Five other banking groups in multiple locations are now interested in even broader deployment. The results have proven that not all MBT products and processes are equal and Conformiq 360° Test Automation delivers major improvements.

## Summary

The bank more than achieved its initial goal of automating test design. It achieved an end-to-end SDLC integrated process and a reusable testing asset plan that delivers faster time to commercial deployment for their software and lower testing costs, all with known quality and full documentation.

MBT is an umbrella term that can signify many different processes built on the concept of using a model. The differences between MBT tools are very large and, even though they are similar in their high level abstract concept, the details from projects such as the one for this bank, prove that there are major differences in the overall benefits achieved – benefits much greater than just test design. To deliver the highest level of capability, Conformiq delivers an integrated, yet open end-to-end automated testing process, with third-party SDLC tools and/or the customer's own tooling. The software test process gains achieved from deploying the Conformiq automation are significant, yet even larger gains come from earlier commercial deployment of the developed application.

Conformiq's unique 360° Test Automation solution enables the next generation of testing for complex testing environments. Any company looking to improve its current functional testing should consider the benefits that this transformational process will deliver. Conformiq and its testing service partners can help achieve a successful transformation and aid in the faster release of products and applications.

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Conformiq is transforming software testing with Conformiq 360<sup>o</sup> Test Automation™, providing the most sophisticated and comprehensive automated test design solution in the industry. The unique Conformiq 360<sup>o</sup> Test Automation technology enables the next generation of testing: transforming, streamlining and automating even the most complex system-level testing environments. Conformiq 360<sup>o</sup> 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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