Coveros Develops Custom Test Automation Framework

for an Embedded Medical Device in a Regulated Environment

CASE STUDY

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CHALLENGES

- Timing issues due to missed deadlines
- Excessive documentation
- Manual testing
- Need for traceability

SOLUTIONS

- Streamline test case management
- Test automation
- Documentation tool
- DevOps and continuous deployment

ABIOMED

Abiomed is a biomedical device company that developed the first artificial heart. The company now focuses on creating devices that provide circulatory support to the heart in surgical and emergency situations. Abiomed was founded in 1981 and is headquartered in Danvers, Massachusetts, with an office in Aachen, Germany.

CHALLENGES

- The development team consistently missed their deadlines, reducing the time available to the test team for verifying a release
- The test team was managing test cases using Word documents that were hundreds of pages long, causing more time to be spent on managing documentation than was spent on actually executing tests
- Test cases were almost always manually executed
- Abiomed was working in an FDA-regulated environment, which required them to provide traceability from requirements to test cases

Abiomed's testing team was struggling to test all the features developers were producing before the release deadline. Developers would routinely miss their deadlines and provide new features to the test team a few days before a release, which meant that testers needed to work long hours in an attempt to finish all the testing in time. This already difficult situation was made even more challenging because most testing was performed manually and a large amount of time was spent managing hundreds of pages of test documentation. To further complicate the situation, any solution to the test execution and test management problem needed to provide the traceability from requirements to test cases that is required by the FDA.

SOLUTION

Coveros performed an agile assessment for one of Abiomed's product development and testing teams. After Abiomed decided to implement our recommendations, we were hired to perform an agile transformation. The team started using Scrum and working within two-week sprints, but because of the manual and documentation-heavy process that Abiomed's testing team was using, they were unable to test all the features developers were producing within the same sprint in which they were developed.

The first step that Coveros took to improve the testing team's ability to finish testing features within a sprint was to modify their documentation-heavy process. Instead of maintaining the large Word documents, we had the team start managing their test cases in Zephyr, a test case management tool. We chose Zephyr because it allowed the team to manage their manually executed test cases and because it integrates with Jira. This integration later allowed the test team to produce

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the traceability matrices required by the FDA when preparing to release new features to customers.

After we streamlined the management of existing manual test cases, our next steps were to start automating tests so they could be executed more quickly and in a repeatable fashion, and to free up tester effort to focus on tests that are not easy to automate. We created a test automation framework that enabled interaction with a console that controls a heart pump. Based on discussions we had with the testing team, we decided to implement the framework in Python because the test team had the most experience with that language.

In addition to allowing test cases to interact with the console, the test automation framework took screenshots after every test step was performed and put those screenshots, along with other information about each test step, into a test execution report. We wrote tests that utilize this framework using behave, a behavior-driven development (BDD) framework for Python. Because BDD tests are written in a pseudo-natural language, nontechnical stakeholders, like business analysts, were able to help specify software behavior.

During the remainder of our engagement with Abiomed, we continued enhancing the capabilities of the test automation framework, including:

- Writing test execution results to Zephyr instead of to a separate HTML file so that these results could be directly linked to the test case they are associated with
- Automating verification of test results by taking screenshots of the console and comparing selected portions of those screenshots to "golden standard" screenshots
- Storing the "natural language" definition of a test case in only Zephyr instead of in both Zephyr and a feature file so that test case definitions only need to be updated in one place

Finally, we built a tool that produced the necessary documentation when submitting information about a new release to the FDA. This tool gathered information on stories, requirements, and test cases from Jira and put it into a Word document that could then be reviewed and cleaned up before submission. This supported our goal of only producing heavy documentation when needed: when it was time to release the software.

TECHNOLOGY SOLUTIONS

Test Automation

- Created custom UI testing framework invoked using the BDD framework behave

Test Management

- Used Zephyr for Jira to manage test cases and store test execution results

Continuous Integration

- Integrated execution of fully automated tests into the CI pipeline

"The custom test automation framework and sample test cases that Coveros created jump-started our agile testing efforts."

—Chris Dunigan, Product Verification Manager, Abiomed

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BUSINESS VALUE

Coveros was able to help Abiomed successfully implement test automation, DevOps, and specialized continuous deployment services for its embedded biomedical devices, which improved software quality and better aligned software development and test practices. This increased the productivity of the development and test teams, enabling Abiomed to deliver functionality more rapidly and respond to critical customer needs.

Abiomed's testing team was empowered to verify new features within the sprint in which they were developed. This provided business value by eliminating the problem of the test team delaying the release, which had plagued the organization for years. Automating tests allowed them to be executed in a repeatable fashion, which reduced risk during each sprint as well as over the course of releases, as it allowed the regression test suite to be executed and verify that new features did not break existing functionality. Roughly a hundred test cases were automated either totally or partially, and although 100 percent automation was not achieved, the test team still realized enormous benefits and created a good foundation on which to continue their automation efforts.

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