

“Enosis Solutions adopted a dynamic end-to-end validation program to help a Business Intelligence solution provider support a Fortune 100 company”

# SUCCESS STORY FOR QA FOR SCIENTIFIC PRICING

## BACKGROUND

The client faced challenges in formulating a strategic direction for Quality Assurance (QA) and measuring QA effectiveness. There was a lack of standardization in QA and an absence of a centralized testing organization. Enosis enabled the client to address its core concerns by setting up an enterprise-wide Quality Assurance & Testing team, which produced tangible benefits in terms of cost savings, process standardization & enhanced productivity.

## THE CLIENT

A US based market leader in the ‘Business Intelligence’ and ‘Data Mining’ solutions space meeting the needs of Global 2000 companies in retail, manufacturing, semiconductor and food service industry.

## THE SOFTWARE

The price recommendations generated by the ‘Scientific Pricing’ application are derived from statistical and econometric models that are being updated continuously using the most recent and historic sales data. The process ensures the capability to construct statistically precise demand profiles from historical information combined with the impact of emerging trends. The derived 40 billion unique customer-product combinations along with optimal price recommendations are to be optimized to yield a maximum increase in revenue, gross profit, and market share.

The application comprises of two key facets:

- **Back-end Modeling & Optimization System:** This module imports customer transaction information on a daily basis and optimizes the econometric demand models
- **Client-Facing Application:** This .NET application provides wide range of functionalities to support the enterprise users engaged in execution of the entire pricing cycle, as efficiently as possible

### Software Screenshots



## CHALLENGES

Enosis SQA team had to overcome many complex challenges in order to fulfill our client’s stringent quality requirements since the application supports a Fortune 100 company to generate optimal sales prices. This ‘Scientific Pricing’ software solution was a completely new concept and due to the exploratory nature of the application, it was very difficult for the developers and QA team to depict the final product at the beginning. The client also faced several challenges in managing Quality Assurance (QA). Historically, QA was being managed at a discrete project level and not coordinated across programs and functions. As a result there was:

- Limited strategic direction for QA at an organization level
- No standardization of tools, processes and test environment
- No centralized reporting or service execution
- A limited view of function level progress and quality

To address these concerns, the client initiated processes of consolidation and outsourcing of their QA and testing requirements. However, while undertaking this QA initiative, Enosis QA team encountered several critical challenges during execution, which includes:

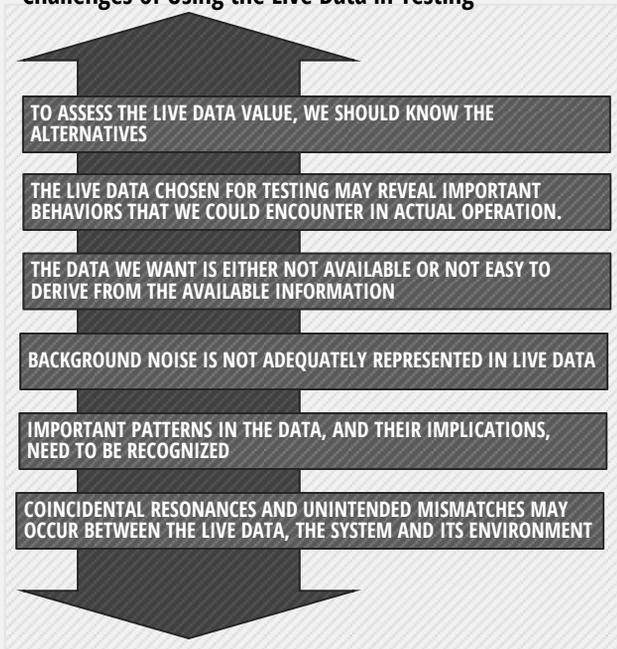
- Knowledge transfer
- Process standardization
- Rapid resource escalation

## CHALLENGES (CONT.)

In details the major challenges that Enosis faced during the execution are:

- **Lack of appropriate Documentation:** Non availability of proper SRS (Software Requirement Specifications) and absence of formal functional documentation demanded close and frequent collaboration with the client and their development team for understanding, verifying and executing the tests. Due to the absence of SRS we had to explore various functionalities of the application to select the most appropriate tools for finding security vulnerabilities.
- **Frequent changes in the application:** Frequent changes in the application in terms of new features and enhancements are commonplace and it required systematic supervision to prioritize and manage the quality assurance tasks under extreme time pressure.
- **Large set of Test Data generation:** ‘Mocking up’ of input test data files is labor intensive as there are a number of factors influencing the selection of live data to be used in testing:

### Challenges of Using the Live Data in Testing



- **Complex Feature workflow understanding:** Understanding the software requirements, analyzing the UCD (Use Case Documents), extracting technical implementation and business logic details by conversing with the Project Manager and client.

- **Preparing independent test environment:** In compliance with client’s requirements, a completely independent test environment was created for every new version released so that our SQA team could test the product from a user’s perspective. For this test environment, Enosis needed to generate a large volume of test data, manually test and analyze the risks associated with large datasets, remove side effects, and test on both test servers and live environment. It also required simulation of a large number of users to perform stress tests and ensure accurate emulation of real life circumstances.
- **Performing Compatibility test on live environment:** Compatibility checks on different software versions, user authentication & reporting services had to be executed before the release of a new version and our SQA team had to ensure that data from the older versions could be processed in the new versions seamlessly.
- **Performing Stress tests on live environment:** Stress tests are performed on live web server to verify that the web server functions under optimum load. These tests find the maximum number of requests/second that the web server can handle and determines the maximum number of concurrent connections web server can handle. These tests also observe the different types of socket Error-Occurrence rate and simulate the limits.
- **Identify and analyze critical bugs:** The SQA team has to reproduce, track and analyze the cause and recommend solutions for the bugs reported by the client’s team.
- **Ensure consistent quality throughout frequent releases:** One of the major challenges confronted by the SQA team was performing a large number of quality assurance tasks for maintaining consistent quality throughout all releases with limited resources and within short release cycles. Our team had to repeatedly check the database queries for monitoring the data integrity and performance issues, preparing RTL (Regression Test Library) for all the modules by ensuring proper documentation, executing the RTL on time and acquiring domain knowledge of the application.

## CHALLENGES (CONT.)

- **Automate to support testing:** Developing test automation scripts and C# applications to facilitate software validation for a wide range of input combinations and functional steps. Develop tools on demand basis to make test cycle faster and support testing ideas.
- **No master plan at program level:** Resulting in frequent shift in timeline, consequently reducing time for verification and validation by a large extent though the requirements and expected quality threshold remained same. This often necessitated extra effort from the quality assurance and testing team.
- **Lack of documentation:** Absence of software documentations for the existing legacy applications was another major area of difficulty.
- **Data integrity:** The price recommendations generated by the ‘Scientific Pricing’ application needed to be validated across several business logics

## APPLICATION USER

The largest food service distributor in North America, distributing frozen foods, various canned and dry foods, imported specialties along with various non-food items to over 400,000 customers with a wide product range of 100,000, employing 51,000 associates and generating USD 37.5 Billion as annual revenue.

## ENOSIS SOLUTIONS’ APPROACH

The Enosis approach presented a consolidated, scalable and robust delivery model and offered several benefits through governance, standardization and reusability. This approach provided a single governance umbrella that leveraged best practices and standardization across different functions resulting in synergies and economies of scale in the QA process characterized by:

- **Knowledge management:** Well-defined knowledge capturing and knowledge management plans were rolled out with customizations for each function. Comprehensive induction and initiation of resources was undertaken prior to reuse of the captured knowledge.
- **Matrix Reports:** The matrix provided the client with an overview of function-level effectiveness and productivity. It also provided details about the applications and enabled QA Manager to track releases, as well as identify and correct issues.
- **Process standardization:** This involves defining the standards that helped in the implementation of best practices such as test traceability matrix, standardized reporting processes across functions and applications, and standardized deliverables that included coverage analysis and test case design.

- **Unified view:** Maintaining unified view of service, providing program status updates (fortnightly and quarterly), billable effort breakdown across applications and functions, utilization reports of teams and matrix scorecards for functions.

Quality is one of the key differentiators between the success and failure of a software product. Client entrusted Enosis’ SQA team for ensuring the stability, performance and desired behavior of their data mining application. We confronted the SQA challenges by rigorously monitoring the quality parameters and orderly executing a number of highly methodical steps by our team of SQA experts.

## SOLUTIONS

### Functional Tests

After analyzing the UCD, we document the tests to be performed on the application in form of ‘Test Scenarios’ to address business requirements validation and other testing criteria. We carry out functional tests to find disagreements between the specifications and the actual implementations of the software systems. This method of verifying the implementation of specifications can help to detect inconsistency and incompleteness in the final application. The test scenarios are executed for validating application functionalities and the reported issues are logged into a collaborative bug tracking tool. Test execution also involves re-testing of application and tracking each issue to closure.

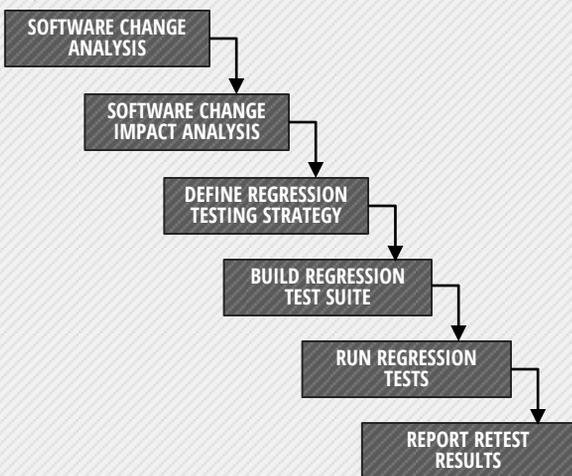
## SOLUTIONS (CONT.)

Functional tests help us to prepare the 'Test Case' documents, identify behaviors expected by the client and ensure maximum test coverage of the functionalities, usability and user interface issues of the application. We represent the functionality and other problems through videos for ensuring clarity and transparency to the client. Conference calls are scheduled twice a week, for the testing team to discuss and workout issues with the client's technical team. Status of the project is also discussed and the status updates are recorded in the Project Management Console module.

### Regression Tests

Diligent planning and execution of Regression tests ensure that new or modified features do not cause current release to regress after incorporating fixes into product. Our regression testing approach buttressed client's confidence and affirmed that they can change the product (or product environment).

#### Regression Tests Workflow



Major testing objectives:

- Retest changed components (or parts)
- Check the affected parts (or components)

Regression testing levels are:

- Unit level
- Re-integration
- Function level
- System level

Enosis gives emphasis on minimizing the re-testing efforts, and achieve the adequate testing coverage.

Regression test strategy usually refers to a rational way to define regression testing scope, coverage, criteria, re-testing sequence (or order) and re-integration orders.

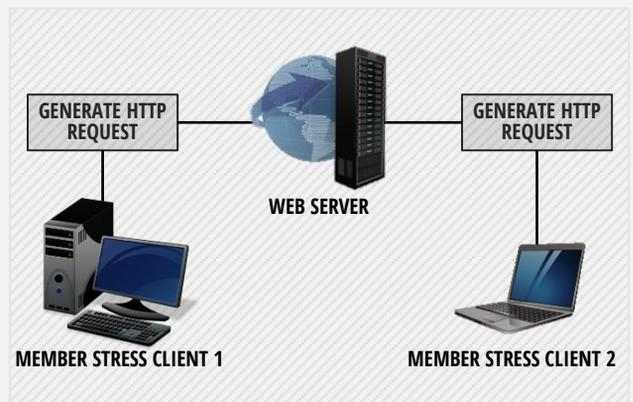
We have software regression test models to support the software regression test strategy, test cases, and coverage criteria.

Our regression test models include:

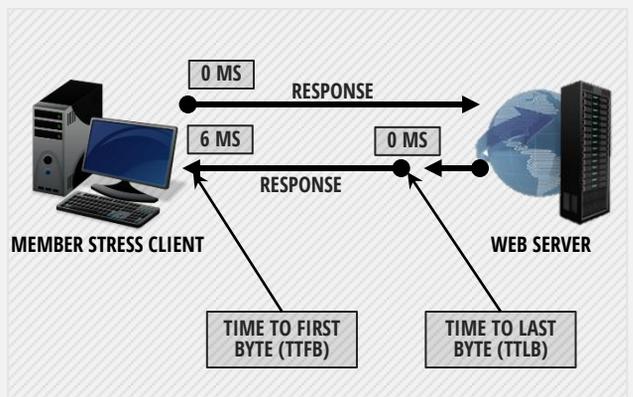
- control flow graph, state-based behavior diagram
- scenario-based model
- component-based Regression model

### Stress Tests

In order to determine the robustness of the software by testing beyond the limits of normal operation, stress tests are performed to evaluate the performance, functionalities and error handling capabilities for large number of users. It validates an applications behavior for higher user load against what would be considered correct behavior under normal user load.



The SQA team has to explore and find out the appropriate tools needed to simulate large users and context specific tools to validate the load capacity. Accuracy of the stress test results are verified and validated by comparing the results generated by different stress testing tools. In case of incongruity between expectations and outcomes, remedial measures are recommended by rigorously analyzing the stress test results.



## SOLUTIONS (CONT.)

### Error Handling Tests

The error handlers are software codes that forestall errors if possible, make the application recover from errors when they occur without terminating the software, or gracefully terminate an affected application and save the error information in a log file. We tested whether our error handlers could successfully confront the errors and demonstrate the desired behavior for different circumstances.

### User Privilege Tests

The software application in discussion possesses nine different user groups, each having different level of access and privileges. The users belonging to different user groups have dissimilar access to each of these modules and features within. We make sure that these usage hierarchy control mechanisms and restrictions to access different features are completely functional and valid.

### Performance Tests

Performance testing refers to the process of understanding how an application and its operating environment respond under different conditions. Our aim is to measure the response time, throughput and resource usage by the application while simulating maximum possible number of concurrent users and executing various software processes like data synchronization. One of the main objectives of performance testing is to ensure low response time, high throughput and low resource usage.

The broader categories of performance tests that have been performed are:

- Code Level
  - Comparison of performance improvement indices across subsequent versions of the application by developing codes and tools
- Database Query Level
  - Checks whether the queries produce results in desired time
  - Checks for table indexes in necessary places
  - Checks and reduces unnecessary joining operations
  - Checks for data integrity

### Release Tests

Release testing is performed before the launching of new versions. Primary goal is to increase the confidence with which the system meets its requirements and to ensure that the deployment scenario will not face any problem. In addition these tests involves testing new features in the release and ensuring that the application functionalities work the way they are intended to.

Release build check Release tests actions are:

- Pre-release checklist execution
- Deployment scenario check
- Fresh PC Installation, version upgrade testing
- Regression Testing
- Bug Tracker status check to confirm that all the major bugs are closed

## THE BENEFITS

- **Process Standardization and Transformation**
  - Leveraged the consolidation of QA services as an outsourced program, which resulted in standardization of tools and processes across the organization
  - QA and change management, which was benchmarked against best practices, led to process transformation and standardization
- **Scalable Management Approach**
  - Scalable team structure, governance mechanisms and reusable processes were replicated for all QA initiatives across the client organization
- **Enhanced Productivity**
  - Reusable artifacts, knowledge assets and processes resulted in improved team productivity
  - Annual improvement was achieved through efficiency gains and internal resource review across functions
- **Flexible Resourcing**
  - Enosis demonstrated skill augmentation model for quick escalation with a fungible resource pool to address the peaks and troughs of the testing cycle
- **Breadth and Depth of Test Coverage**
  - Simplified bug identification process and test workflows, significant decline in the number of functionality failures and usability issues that were reported by the client. Critical bugs are detected at the earlier stages and fixed to minimize the risks.
- **A Greater Level of Quality**
  - At Enosis, we are passionate about quality work. We dedicate a single point of contact to ensure that client have full visibility and control of every testing activity we perform on the product. Our portfolio of testing services combined with our testing methodology and high class level of execution ensures that all activity is planned, monitored and executed in a fashion that exceeds client expectations. All of the actions are geared toward rendering a maximum level of Quality.

## THE BENEFITS (CONT.)

- **Sharp increase in the reliability level**
  - Over a period of time, the client developed a great amount of trust in the SQA certified releases.
  - SQA managed release eradicated the crash/blocker nightmare from the client's mind.

## THE BENEFITS (CONT.)

The Software Quality Assurance was initiated in January 2008. The product has a large life cycle and our quality assurance endeavors will continue with the development phases.

## TOOLS AND TECHNOLOGIES

### TECHNOLOGIES:

**Programming Language:** C#, .NET

**Database:** Greenplum, SQLServer 2008, SQLite

### TOOLS USED:

- Load/Performance Testing- Jmeter
- Web Service testing - Jmeter and SOAPUI tools are used to construct request xml packets and to parse response xml packets.
- User Interface Measurement tool-Meazure
- Concurrency Testing-SOAPUI
- Build Automation-R2Build
- Input data field validation- perlclip
- QA Team has developed some utility tools to support their testing activities