***Avnet QRT***

**Performance Test Plan**

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DOCUMENT CONTROL

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Quote Replacement Tool (QRT)

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# Introduction

This document serves as the Performance Test Plan for the Quote Replacement Tool (QRT) Phase 1 Application, also known as Release 1. This test plan document defines the detailed work activities for the management and execution of the QRT Phase 1application performance testing.

As part of the QRT program, the performance testing will include validation against normal 100% and peak 125% loads and will include comparison to pre-defined acceptable performance milestones in order to ensure that QRT and its related systems will perform adequately at expected operating loads post-production.

## Document Purpose

The purpose of the Performance Test Plan is to document the performance test strategy, process, methodology, environment, and work activities associated with Release 1.

## Scope

The QRT application Critical Business Processes (CBPs) were analyzed and assessed for highest usage. The business processes were chosen as the CBPs to be tested for the application performance testing based on historical use cases.

## Overview

Performance and stability of Release 1 under expected normal and peak transaction volumes are considered critical. Therefore, the performance testing and its outcome are particularly important as a decision point of the program. However, performance testing is not a comprehensive test of each and every application scenario (which is covered instead in the system integration testing and user acceptance testing phases of the program). This performance testing plan focuses on high-yield scenarios that have potential impact to the system performance in the production realm. The nineteen CBPs are the key focus area for performance testing. We will test the ability of the system to perform these key business processes with certain volumes of transactions within a pre­scribed time. These nineteen CBPs account for 95% of projected production QRT transactional volume. Please see Table 4 for the complete list of the CBPs.

## Test Objective

The goal of the application performance test is to determine if the application can meet the performance criteria required by Avnet to operate efficiently with the increased volume of transactions and users. Application performance testing has very specific objectives. They are:

* Measuring load against specific configuration (production specifications)
* Defining a limited set of transactions for representative workload
* Using test scenarios based on specific parameters – user counts, transaction volumes, etc.
* Creating a method to understand and explain how workload characteristics affect performance (creating a plan for future capacity planning)

QRT performance testing is not functional testing. It aims to simulate a production-like workload on pre-determined transactions that have significant throughput or load considerations in the post-production realm.

# Performance Testing Details

## Performance Verification Test Approach

The Performance Verification Test (PVT) approach is used to validate and verify test objectives according to the performance non-functional requirements (NFRs). The approach in this case is to execute tests with a known key number of transactions per hour with a set number of users performing key business functions that will generate a normal Load and Peak workload similar to usage patterns observed in the legacy production system. If all performance NFRs are met at the completion of the testing, then the performance testing is successful and considered complete. If bottlenecks are identified and corrected, performance testing resumes.

In Release 1, performance testing of QRT will concentrate on the CBPs to ensure that the system can handle the projected load. In order to test these functions, nineteen CBPs have been identified for this release. Each of these business scenarios will be run standalone in order to establish a response time baseline. In the single user baseline test, the basic elements of the original performance design can be verified by:

* Quantifying the best possible response time with a standalone business process
* Measuring the system resources with single business process
* Identifying any obvious bottlenecks in the business process path or within the system.

## Baseline Executions

**Single User Baselines**

Initially, each of the CBPs will be run individually against the nearly completed application in order to establish the first response time baseline. This baseline will represent the best achievable response time for each scenario and the test would consist of one virtual user running ten transactions/ iterations in a serial manner for each of the nineteen CBPs included in the performance testing.

## Workload Executions

Subsequent to the baseline runs, the load will be gradually increased from the initial workload of 25% to up to 100% (normal workload) and 125% (peak workload) or until throughput, response time and/ or machine resources begin to degrade (stress or breaking point). The objective for this testing is to monitor and assess the performance of the system as load increases over time.

When testing, a standard execution time of 60 minutes (at targeted volume) will be used. This 60-minute period does not include ramp-up and ramp-down time. Arrival rates for the transactions during the execution will be designed to distribute the load evenly and maintain repeatability between measured runs. Test scripts will have error handling, text and/ or image checks incorporated to ensure that the application is running correctly during simulation time. During measured testing, any load balancing mechanisms or systems must perform in a production-like manner. If needed, IP spoofing or other methods to force the load testing tools to invoke load balancing will be used.

As an additional effort and if permitted by the schedule, endurance tests will be executed in the performance environment. These tests will run for at least 8 hours and simulate an entire business day of time and of load.

Load Test Procedures:

* Data collection or metrics scripts are kicked-off prior to the start of the test to collect CPU, I/O, and Network stats.
* All users are ramped up.
* Steady state is reached after all users have logged onto the system.
* Test is run for 60 minutes.
* After the test has been completed, metrics are collated, and the test results are saved, published in a standard format and archived.

As bottlenecks are identified, analysis is completed, bottlenecks are fixed, and testing continues. Bottleneck resolution will be addressed through the performance development process, including system design, enhancement design, implementation, and testing. This process will be repeated until the performance non-functional requirements (NFRs) have been achieved.

## Performance Executions (NFR-specific)

Detailed in Table 1 are the performance tests along with pass/ fail (response times, etc) criteria to satisfy specific performance non-functional requirements.

### Table 1. Non-Functional Requirements

|  |  |
| --- | --- |
| NFR-4 | The average single line create quote end-user transaction will be less than three seconds when measured under 100% load in the quote system load model. The create quote transaction is defined as user keystroke to response (end-to-end) for all branches connected via Avnet’s private LAN/ WAN.  The create quote scenarios used to measure the system performance will only include the quotes with the following common attributes:   * The quote is an RFQ type of quote * Only required fields are populated for Quote Header * A single line item has been specified with only Part, Manufacturer Code, Quantity and Target Resale (USD) populated * Part selected is not registerable, programmable, and is not a BOM part * VPN supported facilities, or remote user response times may vary. |
| Load Test  Performance Test | The LoadRunner tool will be utilized to simulate 759 users for a minimum duration of one hour to ensure the system will operate at its load capacity without interruption or systems performance degradation.  The performance team will execute one-hour load testing with concurrent Vusers (LoadRunner Virtual Users) to achieve a load rate of 72,000 transactions per hour (TPH). The average single line create quote end-user transaction will be less than three seconds when measured under 100% load in the quote system load model.  Pass Criteria:  1. Average response time per scenario during the one-hour load test achieves the expected average response time (NFR-4 and throughput as outlined in Table 2 below) *OPTIONAL:*  2. A separate analysis and associated recommendation may be made in case any system component exceeds 80% capacity, which may require additional tuning or hardware. No system components show consistent loads in excess of 80% utilization during the one-hour load test.  Fail Criteria:  1. Average response time per scenario during the one-hour load test does not achieve the expected average response time (Table 2) OR  2. Excessive error rate. A small volume of error responses are expected due to limitations of either the test data or of the script technology. A threshold of 5% error transactions will be used to determine whether a test can be considered valid for inclusion in the analysis and conclusions. |

### Table 2. Expected Average Response Time

|  |  |  |
| --- | --- | --- |
| **Business Process Name** | **Executed Test Steps** | **CBP average response time performance NFR** |
| **Create Quote** | 1. **Login into QRT Application** 2. **Click on Create Quote** 3. **Enter Quote Data**   (a) Customer Name  (b) Ship To Account  (c) Part Number  (d) Manufacturer Code  (e) Quantity  (f) Target Resale  **= = = = = = = = = = = = =**   1. **Click submit quote** 2. **Validate Quote Summary Page**   **= = = = = = = = = = = = =**   1. **Logout of QRT Application** | **Test Setup functions\***  **= = = = = = = = = = = = =**  **3.0 seconds**  **= = = = = = = = = = = = =**  **Test End function\*** |

***\*Above not included in 3 second NFR***

*Assumptions: network response time is within budget, optional data not required for every step.*

## Test Execution Checklist and Notification Procedure

Before each test execution a sequence of steps will take place to ensure successful execution and consistent results.

* Provide one-day (preferably 24-hour) notification to the Execution Distribution (see end of this section for constituents)
* Repeat this notification two hours before test execution start
* Validate the LoadRunner controller and generator availability at least one hour before test execution start. Reboot any LoadRunner machines as necessary
* Verify scenario and run-time settings.
* Verify data parameter files at each generator location.
* About 30 minutes before test execution start, begin systems monitoring, for example, CPU, memory, disk. Check for any anomalous readings.
* Ensure all performance environment functions are operational by processing, either manually or via the LoadRunner Virtual User Generator (VuGen), executing one or two records and verifying their successful processing.
* Ensure that no or minimal activity is observed in these system readings leading up to test execution start.
* Start test execution. Monitor LoadRunner real-time output (for example, response timings and error count) as well as system metrics throughout the execution.
* After test ramp-down is complete, send out the completion notification to the same Execution Distribution.
* After results are compiled into the standard format, send out the execution report to the Results Distribution.

1. **Execution Distribution List** (via Avnet email)

to: Patel, Dharmesh; Middents, Mark; Johnson, Michael; Luu, Brian; Vail, Scott; Taha, Ayman; Kim, Charles; Wilson, Gary; Karnik, Kedar

cc: Mukerjee, Surya; Haefner, Benjamin; Bramania, Suraj; Frank, Nathan; Worden, Steven; Potter, Joseph; Penrose, Kyle; McMullen, Beth; Mattson, Ed; Blecher, Marc

1. **Results Distribution List** (via Avnet email)

to: Patel, Dharmesh; Penrose, Kyle; Blecher, Marc; Johnson, Michael; Mukerjee, Surya; Haefner, Benjamin; Bramania, Suraj; Vuong, Jennifer; Taha, Ayman; Middents, Mark; McMullen, Beth; Karnik, Kedar; Scheer, Beth

## Performance Metrics

**Standard Metrics.** The type of data that will be captured/ monitored during the performance verification test will include:

* Response Times (Mean and 90th percentile)
* Transactions per hour
* Errors

**Optional Metrics.** For testing that requires additional analysis, the following metrics may also be captured as needed:

* Server Resources (CPU, Memory, Disk I/O)
* Web Resources (Connections, Threads)
* Application Resources (Threads, JVM, Queues and Pools)
* Database Resources (Cursors, Waits, Sorts)

## Performance Test Data

Performance test data extraction will come from representative production datasets and recent timeframes. Data modeling against production profiles was used to produce valid test data, both quantitatively and qualitatively. All of the performance test data has been broken down for the seven included locations and for the nineteen CBPs. Data to reflect at least 90 calendar days of production volume will be included in the performance database, and the test data will be archived.

### Table 3. Test Data Types

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Dataset** | **Data Field** | **Referenced in CBP #** |
| 1 | Customer | Customer Name | ALL |
| 2 | Customer | Ship To Account | ALL |
| 3 | Part | Part Number | ALL |
| 4 | Part | Manufacturer Code | ALL |
| 5 | Part | Part Class | ALL |
| 6 | Part | Customer Part Number | ALL |
| 7 | Part | Design WIN Flag | ALL |
| 8 | Part | Program Flag | ALL |
| 9 | Location | Branch Number | ALL |
| 10 | Quote | Quote Number | 3,4,5,7,8,9,13 |
| 11 | Quote | Line Item | 3,4,5,7,8,9,13 |
| 12 | Quote | Customer Dock Date | 3,4,12,13 |
| 13 | Quote | Follow-up Date | 3,4,12,13 |
| 14 | Registration | Registration ID Field | 14,16,19 |

## Script Naming

LoadRunner script names should define the function or functions exercised. Generally, test function relates to the object of the test. Variables such as environment may or may not be included in the test script name, as environment can be parameterized in a script. However, scripts which access the Production environment should be separate from scripts for test environments and should begin with the string “PROD”. For example: “Get\_Quote” and “PROD\_Get\_Quote”.

## Transaction Naming

Names of transactions within scripts should also follow a standard naming convention. Common transactions that recur more than once per script should use the same name (spelled identically). All transactions should begin with a sequential alphabetical character so that transactions display in their sequential order on the native LoadRunner reports. Transactions should also indicate the user action taking place. For Example, “A\_Login” and “B\_Navigate\_Home\_Page”.

Transaction wrappers (the start and end transaction LR functions around each scripted transaction) should surround only the actual system calls that represent the elapsed time of the function being measured. Non-related items like think times, cookies, and navigational steps, should not be included within the transaction wrappers.

## Scripting Standards

#### Sections (Run Logic)

All functions related to user authentication, including cookies (only necessary cookies should be included), login and password, and a standard 3-second think time after the login transaction, should take place in the initialization (Vuser\_init) section of each script. All functions related to the application functions under test, excluding user authentication, should take place in the Action section of each script. If applicable, any functions related to logout or application closure, should take place in the Vuser\_end section of each script. The run logic during execution usually includes multiple executions of the action section but only one iteration of Vuser\_init and of Vuser\_end per test.

#### Think Time

The default think time setting, which can be configured in Recording Options, should reflect 3 seconds think time after every named transaction. Think times must never be included within transaction wrappers. During replay, think time may be manipulated (or eliminated completely) in the Runtime settings, depending on the objective of the test.

#### Text Checks

Text checks should be included for every page where the server returns data. One text check, as long as it is designed to validate unique text on the returned page, will suffice.

## Runtime Settings

Runtime settings must be verified at the script level when scripts are smoke-tested using VuGen. They also must be verified, each and every time, at the scenario level when scenarios (and the related, uploaded scripts) are performance-tested using Controller.

#### Recommended runtime settings (applicable Protocol: LoadRunner Web)

* Run Logic – Use default settings. Exceptions: when smoke-testing in VuGen, manually override the number of iterations here (not required in Controller). If multiple action sections are to be executed in sequence (unlikely, but possible if multiple scripts are combined), this would be the setting to modify.
* Pacing: Use the second option, “after the previous iteration ends, with a \_random\_ delay between two numbers (in seconds). These two numbers should reflect the previously defined pacing level needed to achieve the desired throughput.
* Logging: Disable for Controller executions. For VuGen smoke-testing and debugging, logging is useful, at the level required to get the server response level necessary for a successful debug.
* Think Time: (See also scripting standards above, as related to inclusion of think time after transactions). Enable for scripts where user interface behavior is simulated. In which case, use recorded think time multiplied by a random percentage between 50% and 150%. Think time may be disabled at the scenario level as appropriate.
* Miscellaneous: Only checked item should be Run Vuser as a Thread, which enables multithreading to allow more Vusers per load generator machine.
* Speed Simulation: Use maximum bandwidth
* Browser Emulation: Simulate browser cache including “cache URLs for HTML content” should both be checked. This instructs VuGen to cache only the URLs that require the HTML content. For user interface-like (end-user timings) testing, download non-HTML resources should also be checked. This loads graphic images when accessing a page during replay. Do not check simulate a new user for each iteration (see scripting standards on Vuser\_init contents, above).
* Proxy: Use the custom proxy automatic configuration script for Avnet, “http://proxypac.avnet.com/”
* Preferences: Enable image and text check for debugging and smoke-testing. This consumes Vuser memory and should be disabled for final executions. Web performance graphs should be enabled according to the metrics needed for each test. Advanced settings: check only File and Line in automatic transaction names and Non-critical resource errors as warnings.
* Download Filters – none unless necessary
* Content Check – disabled (see text checks in scripting standards, above)
* Data Format Extension Configuration – disabled

## Scenarios

LoadRunner scenario names should define the test purpose and should also indicate the environment, unless parameterized environments are indicated within the test script. Scenarios must always be validated before test execution.

Best practice indicates that all tests should be run at least twice, and the results from both the transaction timing metrics and also from the server metrics should be similar (less than 25% variance). Test results may be adapted to the metrics gathered for each test cycle. Test results may be averaged across the same test, but the actual results data should be presented also. Any averaged data must indicate that it has been manipulated.

## Quality Center

All LoadRunner test scripts, test scenarios, and result files will be stored in Quality Center.

# Functions and Features

For this project, Avnet has identified nineteen CBPs, which are defined below. These CBPs have been identified as representative of the types of activities that will be most utilized on the production servers. The CBPs are chosen based upon the most frequently performed transactions, the most performance critical transactions, and the transactions which utilize key resources. Performance test cases will provide details for each business scenario listed. Like all test scripts, scenarios, and results, these test case documents will reside in Quality Center.

A CBP is a set of specific, step-by-step actions that a user performs to accomplish an end-to-end specific task. Five of the CBPs have been further identified as subject to additional load because of pagination, noted below and in the next section. Nineteen CBP business scenarios have been identified for the QRT project as shown in Table 4.

### Table 4. Critical Business Processes

|  | **Critical Business Process** | **QRT Name** | **Description** |
| --- | --- | --- | --- |
| 1 | View All Assigned Lines to Authorize | View Quote List | The PS user can either view all assigned lines or can view lines assigned to the user per certain filter criteria. Subject to additional volume for Pagination. |
| 2 | Authorize Line | PS Process and Save | No notation |
| 3 | Create Quote (Small Quote) |  | Both types of Create Quote (small and large) are available (1) by  manually entering all lines, line by line, or (2) through Copy Text |
| 4 | Create Quote (Large Quote) | Create Quote |
| 5 | Modify Quote | SMR Process and Save | Possible from Quote Summary and which includes (1) Modify from Header and (2) Modify multiple Lines (minimum 1 line and maximum 25 lines) |
| 6 | View Single Quote Line for Quote | View Line Item Details | Includes “Modify a Single Quote Line” from View Line Item Details. Edit single quote line will be available for SMR and PS. |
| 7 | View Active Quotes | View Work Queue | Subject to additional volume for Pagination. |
| 8 | Search for quotes | Quick Search | Includes only search for a single quote. |
| 9 | View All Quote Lines for Quote | View Quote Summary | “View all” works with pagination, either “view 5 lines” of a quote or “view 25 lines.” Subject to additional volume for Pagination. |
| 10 | Send Line item to PS | Submit to Product | No notation |
| 11 | Lost Sale Quote Line | Lost Sale | Also two options “Lost Sale a single line” and “Lost Sale an entire Quote” |
| 12 | Create PO/ Create Booking | Book Quote | The user clicks the “Book” button from QS |
| 13 | Book Quote | Complete Booking | The user clicks “Complete Booking” on a Booking screen |
| 14 | Lookup Customer | Lookup Customer | No notation |
| 15 | Refresh Quote Line Info | SMR Process and Save | Subject to additional volume for Pagination. |
| 16 | View Booking / View Customer Decision | View Purchase Order | Subject to additional volume for Pagination. |
| 17 | Part Search and Replace | Lookup Part | No notation |
| 18 | Attach Registration to Line | SMR Process and Save | No notation |
| 19 | Search Design Wins for Lines | Lookup Registration | No notation |

# Workload Distribution

A workload can be defined as a distributed quantity or mix of business processes that will be executed, or tested, in order to meet the objectives of a performance test.

## Methodology

The transaction rates for each CBP are based on the legacy system transaction count data provided by Avnet. The measured heaviest hour of work yields a calculated 100% average or normal volume of approximately 72,000 transactions per hour and a calculated 125% peak volume of approximately 90,000 transactions per hour. These rates were derived from the maximum number of quote lines created and booked on the busiest day of the busiest month during the past five years. To test scalability, various load points will be tested based on the 125% peak load as outlined below.

## Pagination

In order to emulate pagination (multiple calls to the database to view quote lines by page volumes of 5 or 25), we recommend testing some transactions at an increased load. By incrementing transactional volume for the five transactions that are a part of pagination by 35% (transactions noted above in section 3), the performance tests will in turn increase the total transactional volume for all transactions by approximately 10%.  This additional load will provide at least enough additional transactional overhead to account for increased system load when the user paginates.

## Load Mix

Load mix includes employee type, location, and transactional workload mix (see individual charts below)

### Employee Type

The employee types related to transactions under test are shown below as a percentage of the total counts of employees and also as percentage of the normal 100% transactional workload. The distributions are similar but not equal to the actual breakdown of employee counts. The discrepancy arises because of the selection of specific transactions for QRT performance test inclusion.

### Table 5. Employee Counts

|  |  |  |  |
| --- | --- | --- | --- |
| Employee Counts by User Type | | Percentage of Total | Normal Workload Percentage |
| Product Specialist/ Management | 233 | 30.70% | 20.13% |
| Sales & Marketing Representatives | 526 | 69.30% | 79.87% |

### Locations

The locations listed in Table 6 were chosen by the Avnet Business Program Director as a representative and qualified subset of all locations.

### Table 6. Test Locations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Locations Included in Testing** | |  |  |  |  |  |
| **Rank** | **Location** | **Headcount** | **Percentage of Total Count** | **Cumulative Total Percentage** | **Contact Person (minimal support may be needed)** | |
| 1 | Phoenix AZ | 193\*\* | 25.43% | 25.43% | Ed Mattson | |
| 2 | North Reading MA | 58 | 7.64% | 33.07% | Romulo Roma | |
| 3 | Milpitas CA | 57 | 7.51% | 40.58% | Sam Hosn | |
| 8 (tie) | Orlando FL | 19 | 2.50% | 43.08% | Lisa Lee | |
| 13 (tie) | San Diego CA | 14 | 1.84% | 44.93% | Lori Revling Miller | |
| 22 (tie) | Austin TX | 8 | 1.05% | 45.98% | Jenny Soto | |
| 22 (tie) | Madison AL | 8 | 1.05% | 47.04% | Janet King | |
|  | *Subtotal* | *357* | *47.04%* |  |  |  |
|  | *All Locations Total* | *759* | *100.00%* |  |  |  |

*\*\*The Phoenix location will be incremented with the remaining headcount during Vuser simulation, so that its Vuser count would simulate 595 employees rather than its actual headcount of 193.*

## Summary of Parts Breakout by Location

Table 7 shows parts by location derived from the Genesis production data of December 2010.

### Table 7. Parts by Location

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| City | Total Record Counts | Location | Percentage |  |
| All "H" Locations | 626,575 | "H" Locations | of All H |  |
| Phoenix | 4,389 | H004 | 0.70% |  |
| N Reading | 11,601 | H018 | 1.85% |  |
| Milpitas | 10,553 | H003 | 1.68% |  |
| Orlando | 4,737 | H076 | 0.76% |  |
| Austin | 2,462 | H026 | 0.39% |  |
| Madison | 3,657 | H023 | 0.58% |  |
| San Diego | 6,591 | H002 | 1.05% |  |
|  | 43,990 | Subtotal 7 locations | 7.02% |  |
|  |  |  |  |  |
| ALL LOCATIONS | Registerable | BOM | Programmable | Simple |
| Percentage  Yes of Total | 15.19% | 2.12% | 3.27% | 79.42% |

### Table 8. 100% Normal Transactional Workload Mix (Including Pagination Increments)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 100% Load Hour Total Users **Vusers representing 759 actual users** | | | | |
| 100% Load Hour Total Transactions **72,000 TPH** | | | | |
|  | **Critical Business Process** | **Workload Mix** | **Load Users** | **100% Load TPH** |
| 1 | View All Assigned Lines to Authorize | 13.27% | 101 | 9,542 |
| 2 | Authorize Line | 8.34% | 63 | 6,000 |
| 3 | Create Quote (Small Quote) | 3.91% | 30 | 2,812 |
| 4 | Create Quote (Large Quote) | 0.03% | 1 | 22 |
| 5 | Modify Quote | 17.58% | 133 | 12,643 |
| 6 | View Single Quote Line for Quote | 8.45% | 64 | 6,072 |
| 7 | View Active Quotes | 5.38% | 41 | 3,867 |
| 8 | Search for quotes | 3.98% | 30 | 2,865 |
| 9 | View All Quote Lines for Quote | 2.49% | 19 | 1,788 |
| 10 | Send Line item to PS | 8.34% | 63 | 6,000 |
| 11 | Lost Sale Quote Line | 4.22% | 32 | 3,036 |
| 12 | Create PO/ Create Booking | 1.14% | 9 | 817 |
| 13 | Book Quote | 1.28% | 10 | 923 |
| 14 | Lookup Customer | 3.71% | 28 | 2,664 |
| 15 | Refresh Quote Line Info | 14.40% | 109 | 10,351 |
| 16 | View Booking / View Customer Decision | 2.01% | 15 | 1,442 |
| 17 | Part Search and Replace | 0.68% | 5 | 486 |
| 18 | Attach Registration to Line | 0.57% | 4 | 408 |
| 19 | Search Design Wins for Lines | 0.23% | 2 | 163 |
|  | **Total** | **100.00%** | **759** | **71,902** |

### Table 9. 125% Peak Transactional Workload Mix (Including Pagination Increments)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 125% Load Hour Total Users **Vusers representing 759 actual users** | | | | |
| 125% Load Hour Total Transactions **90,000 TPH** | | | | |
|  | **Critical Business Process** | **Workload Mix** | **Load Users** | **125% Load TPH** |
| 1 | View All Assigned Lines to Authorize | 13.27% | 101 | 11,927 |
| 2 | Authorize Line | 8.34% | 63 | 7,500 |
| 3 | Create Quote (Small Quote) | 3.91% | 30 | 3,515 |
| 4 | Create Quote (Large Quote) | 0.03% | 1 | 28 |
| 5 | Modify Quote | 17.58% | 133 | 15,804 |
| 6 | View Single Quote Line for Quote | 8.45% | 64 | 7,590 |
| 7 | View Active Quotes | 5.38% | 41 | 4,834 |
| 8 | Search for quotes | 3.98% | 30 | 3,581 |
| 9 | View All Quote Lines for Quote | 2.49% | 19 | 2,235 |
| 10 | Send Line item to PS | 8.34% | 63 | 7,500 |
| 11 | Lost Sale Quote Line | 4.22% | 32 | 3,795 |
| 12 | Create PO/ Create Booking | 1.14% | 9 | 1,021 |
| 13 | Book Quote | 1.28% | 10 | 1,154 |
| 14 | Lookup Customer | 3.71% | 28 | 3,330 |
| 15 | Refresh Quote Line Info | 14.40% | 109 | 12,939 |
| 16 | View Booking / View Customer Decision | 2.01% | 15 | 1,803 |
| 17 | Part Search and Replace | 0.68% | 5 | 607 |
| 18 | Attach Registration to Line | 0.57% | 4 | 511 |
| 19 | Search Design Wins for Lines | 0.23% | 2 | 203 |
|  | **Total** | **100.00%** | **759** | **89,878** |

# Entry and Exit Criteria

The following are the performance test entrance and exit criteria. NFR-specific performance use case pass/ fail criteria are found within the performance-related NFR document.

## Entry Criteria

* Application functionality has been coded and unit-tested to a level where end-to-end tests can be scripted and executed alone and multi-threaded without error (assigned to: Project Team, due date: June 30)
* CBP and workload mix has been established and defined in detail with associated performance NFR and agreed upon (Performance Team, May 31)
* Performance data quantity and quality are agreed upon (Performance Team, June 30)
* Application is deployed in performance test environment (Project Team, June 30)
* Performance test environment infrastructure hardware is configured and available and has been verified by program architects (Project Team, June 30)
* Hardware required to support the LoadRunner tool is setup and configured (Controllers and Load Generator servers) (Performance Team, June 30)
* Performance test environment is a representation of Production (Project Team, June 30)
* Pass a Test Readiness Review (TRR) (Performance Team, July 31) to include:
  + - Smoke Test
    - QRT code implemented in performance environment
    - LoadRunner scripts executing successfully
    - Data validation complete in performance environment
* No open severity 5 or 4 defects (Development Team, June 30)
* Plans in place for severity 3 and 2 defect closure (Development Team, June 30)
* Sign-off of this Performance Test Plan (Program Review Board, June 10)

## Exit Criteria

* Pass a Test Exit Review (validation of execution of test plans) (assigned to: Performance Team, due date: August 31)
* 100% of tests executed (Performance Team, August 31)
* All severity 5 and 4 defects raised during performance testing have been fixed (Development Team, August 19)
* System is performing within the guidelines of the defined performance NFR (Performance Team, August 31)
* Unresolved issues have been communicated to the project team (Performance Team, August 31)
* Plans in place for severity 3 and 2 defect closure (Development Team, August 31)

# Testing Tools and Monitors

The following is a list of test tools that will be used during performance testing:

* LoadRunner 11: This commercial tool will be used for simulating user workload.
* LoadRunner Vuser Generator (VuGen): Allows a user to record a scenario or test case. It also provides a user with the ability to modify scripts, allowing more flexibility and versatility with regards to script execution.
* Introscope Wily 9: This commercial tool will be used for monitoring and collecting performance metrics on all back-end servers involved in the test.
* QRT DB Monitor: The Avnet DBA team will conduct database monitoring as needed.
* IMS Monitor: IMS monitoring will be conducted by Avnet resources.

# Performance Test Milestones

|  |  |
| --- | --- |
| Performance Engineering Project Plan | February 28th, 2011 |
| Performance Test Plan | June 30th, 2011 |
| Performance Environment, Data, and Code Delivered | June 30th, 2011 |
| Performance Test Readiness Review | July 31st, 2011 |
| Interim Performance Results Readout | August 15th, 2011 |
| Test Exit Review | August 31st, 2011 |
| Final Analysis Report | September 9th, 2011 |
| Post Go-Live Tuning Complete | November 9th, 2011 |
| Performance Test Closure Memo | November 11th, 2011 |

# Roles

|  |  |  |  |
| --- | --- | --- | --- |
| **Area** | **Name** | **Role** | **Note** |
| Administration | Beth McMullen  Kyle Penrose | PMO | Avnet Accenture |
| Beth Scheer | Business Analysis Lead |  |
| Infrastructure | Vince Stammegna | Release Manager | Deployment to Environments |
| Sandeep Panasa | Websphere Administrator | Websphere |
| Security | Anjani Jha | LDAP and WebSeal |  |
| ESB/ Web Methods | Ayman Taha | ESB Director |  |
| David Smith | ESB Manager |  |
| Brian Luu | MW Team Lead |  |
| IMS | Mark Middents | IMS Lead |  |
| Daniel Chen | IMS API/Application |  |
| Scott Vail | Operations & Z10 monitoring |  |
| Gary Wilson | Genesis Logic |  |
| Charles Kim | IMS DB monitor/ reporting |  |
| Monitoring | Scott Hanks | Wily Admin | Introscope Wily Admin |
| QRT Application | Dharmesh Patel | Performance Development Lead |  |
| Amit Padole | Performance Dev | Performance Optimization Dev |
| Michael Johnson | Performance Dev | Performance Optimization Dev |
| Surya Mukerjee | Performance Dev | Performance Optimization Dev |
| Joseph Potter | Performance Dev | Wily Monitoring Configuration |
| Ben Haefner | Architecture Lead | Architecture Lead |
| Nathan Frank | Performance Test Lead |  |
| LR Scripter 1 | Performance Test Scripter | LR Scripter |
| LR Scripter 2 | Performance Test Scripter | LR Scripter |
| Kedar Karnik | Development Workstream Lead |  |
| Marc Blecher | Development Workstream Lead |  |
| Fred Mburu | Quote Development Team Lead |  |
| Network | Insight | Team |  |
| Database | Dana Day | QRT Local DB | Schema Design |
| Steven Worden | QRT Local DB | Schema Design |

# Performance Environment

The performance environment is a dedicated test system for NFR-related testing. This environment is production-like in that all components are available in the environment and in terms of data volume and speed. It verifies the integration of all applications, including interfaces internal and external to the organization, with their hardware, software and performance NFR infrastructure components in a production-like environment.

The IMSP Production system will also be included in some cycles during the performance test execution, although it will not be represented in every test cycle. It is important to validate final testing against the production architecture as well as against the test environment. During testing, the component timings for each environment will be tracked in order to quantify the difference between production and test systems. For CBP 13, “Book Quote,” performance testing will not process to production. Instead we will stub out the actual booking call on ESB and receive a confirmation without any processing to Genesis.  We will use a stubbed, bogus SCN to confirm that the order had been “booked.”

Please also see the diagram referenced here: [QRT Technical Architecture Overview](http://myavnet.avnet.com/sites/csEMAQuote/Shared%20Documents/Forms/EditForm.aspx?ID=545&RootFolder=%2fsites%2fcsEMAQuote%2fShared%20Documents%2fArchitecture%2f1%20%2d%20Design&Source=http%3A%2F%2Fmyavnet%2Eavnet%2Ecom%2Fsites%2FcsEMAQuote%2FShared%2520Documents%2FForms%2FAllItems%2Easpx%3FRootFolder%3D%252fsites%252fcsEMAQuote%252fShared%2520Documents%252fArchitecture%252f1%2520%252d%2520Design%26View%3D%257b25CFCD30%252d8960%252d4644%252dBA14%252d9CE8A882B4FF%257d).

# Execution Reporting

This section describes the Test Status Reporting for QRT performance testing. The following sample spreadsheet shows typical results from a performance test execution. Also shown is one native LoadRunner reporting chart, featuring Average Response Time, one of several default charts produced with the LoadRunner basic analysis. More detailed and varied types of analyses can also be produced.

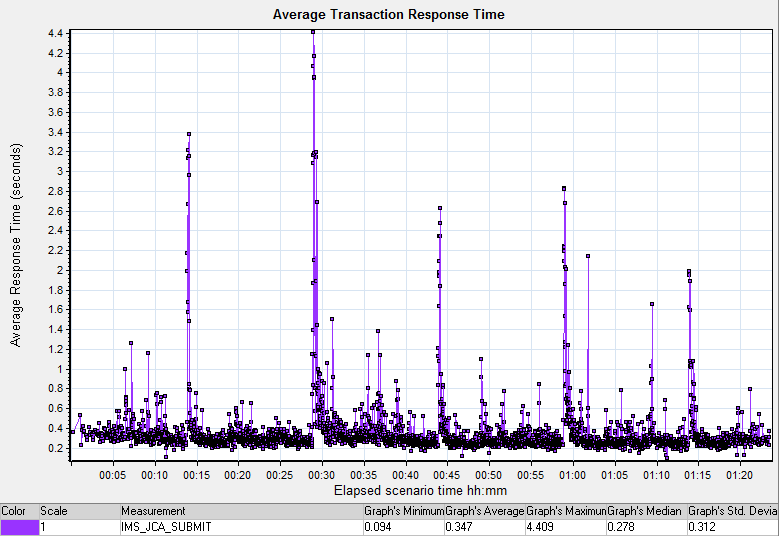
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Date |  | | | | | | |
| Build |  | | | | | | |
| Test Run Window | 15:43 to17:24 | | | | | | |
| Data Timeslot Window | 16:13 to 17:13 | | | | | | |
| Scenario | **Transaction Mix** | | | | | | |
| Target Load | 100% | | | | | | |
| Code |  | | | | | | |
| Mainframe | **STUB** | | | | | | |
| Hardware | **NEW** | | | | | | |
| Notes | **New load model - 759 users** | | | | | | |
| **Transaction Name** | **NFR  Avg RT** | **Average Load Runner RT** | **LR RT + Network + Render** | **TPH** | **100.00% NFR TPH** | **NFR TPH Variance** | **% NFR TPH** |
| **Executed Transactions** | **4.4** | **3.8** | **LR RT + 2** | **68,180** | **64193** |  | **106.21%** |
|  |  |  |  |  |  |  |  |
| View Quote List | 4.3 | 6.6 | 8.6 | 1,574 | 1256 | 318 | 125.32% |
| PS Process and Save | 7.3 | 6.3 | 8.3 | 12 | 13 | (1) | 92.31% |
| Create Quote (1 line) | 3.0 | 6.8 | 8.8 | 1,342 | 1284 | 58 | 104.52% |
| Create Quote (5 lines) | 3.0 | 6.1 | 8.1 | 459 | 472 | (13) | 97.25% |
| SMR Process and Save | 3.5 | 7.8 | 9.8 | 26 | 26 | 0 | 100.00% |
| View Line Item Details | 4.8  **SAMPLE ONLY** | 11.7 | 13.7 | 1,717 | 1386 | 331 | 123.88% |
| View Work Queue | 4.2 | 5.1 | 7.1 | 881 | 698 | 183 | 126.22% |
| Quick Search | 4.2 | 4.5 | 6.5 | 9,507 | 8742 | 765 | 108.75% |
| View Quote Summary | 3.7 | 4.6 | 6.6 | 9,431 | 8742 | 689 | 107.88% |
| Submit to Product | 3.1 | 5.0 | 7.0 | 10,083 | 8742 | 1,341 | 115.34% |
| Lost Sale | 3.2 | 3.1 | 5.1 | 5,343 | 5335 | 8 | 100.15% |
| Book Quote | 4.2 | 2.5 | 4.5 | 7,638 | 8742 | (1,104) | 87.37% |
| Complete Booking | 4.5 | 2.7 | 4.7 | 7,147 | 6418 | 729 | 111.36% |
| Lookup Customer | 4.5 | 2.5 | 4.5 | 2,585 | 2362 | 223 | 109.44% |
| View Purchase Order | 3.4 | 1.7 | 3.7 | 5,173 | 4775 | 398 | 108.34% |
| Lookup Part | 3.4 | 1.5 | 3.5 | 5,241 | 4728 | 513 | 110.85% |
| SMR Process and Save | 3.4 | 1.0 | 3.0 | 20 | 20 | 0 | 100.00% |
| Lookup Registration | 3.2 | 5.3 | 7.3 | 1 | 2 | (1) | 50.00% |

The sample LoadRunner report is shown below.

|  |  |
| --- | --- |
| **LR Script** | [TD]\...\QRT\_Prototype\_Load\_Quote\_Summary\IMS\_Test\_Harness\_JCA\_v4 |
| **LR Scenario** | IMS Capacity Soap Prod |
| **Results Location** | [QC]...Subject\Test Folder\QRT\_Prototype\_Load\_Quote\_Summary\IMS Capacity Soap Prod\res |
|  |  |
|  |  |
| **Total Throughput (bytes)** | 16,955,371  **SAMPLE ONLY** |
| **Average Throughput (bytes/second)** | 3,385 |
| **Total Hits** | 7,273 |
| **Average Hits per Second** | 1.452 |
| **Total Errors** | 74 |

The performance test team updates the detailed test results to include the summary of test runs with response times, Defects, Wily and LoadRunner logs and outstanding issues. If needed OS metrics, server metrics, and database metrics are also shown, and these reports will be available throughout the performance testing cycle of each test.

A sample test output report shows some of the key measurements below:

SAMPLE ONLY

**SAMPLE ONLY**

# Defects

## Defect Tools

The Performance defects will be logged, tracked, and managed through HP Quality Center 11 in the same manner as functional testing defects. The defects will be tracked by the following severity levels: Urgent, Very High, High, Medium, and Low. Performance defects will be assigned to the Performance Development Team and will undergo triage to their appropriate resolution. Defect status will follow the standard defect resolution methodology.

## Defect Severity Definitions

**5 – Urgent** (Entire System or Application is inaccessible or missing critical functionality. No work around is available. Business Processes cannot be completed)

**4 – Very High** (System or Application is accessible but a major functional area is inaccessible. No work around is available. Some Business Processes can be completed)

**3 – High** (functional area is accessible but some sub-functions are inaccessible without a workaround available. Most Business Processes can be completed)

**2 – Medium** – (System or application is accessible and a workaround is available wither systemically or manually. All Business Processes can be completed with alternate methods)

**1 – Low** – (Cosmetic or nice to have. All Business Processes can be completed)

## Defect Resolution

Performance defects will be raised as testing progresses, to reflect issues found. This will result in some retest needing to occur. In some cases the team may need to re-test an entire scenario due to the nature and severity of a given error. In other cases, the error may be contained and therefore will not require a complete re-test of the scenario. The decision over the level of re-testing required will be made jointly by the development team and the test phase lead. Where agreement cannot be found as to the degree of regression testing required, the final decision will be made by the Performance Testing Manager.

# Risks and Contingencies

Table 10 shows risks that are foreseen in QRT performance testing and their probability, impact, and mitigation actions.

### Table 10. Risks and Mitigation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RISK** | **MITIGATION** | **PROBABLE** | **IMPACT** | **RESPONSIBLE** |
| Incomplete test data set-up: Lack of data integrity and incompleteness of data set up or delayed resolution | Carry out the script design and mock execution with the data before the load test begins. Scrub invalid data. | Low | High | Performance Leads |
| Unstable functionality creates an overhead and delay to Performance testing due to maintenance of automated scripts | (1) Proper Change control procedures for Requirements, Design & Testing deliverables  (2) Maintain communication between development, verification testing, and performance testing teams  (3) Perform ad hoc and targeted testing within the development environment prior to the beginning of the performance testing phase. | Med | High | Environments Team and Development Leads |
| Performance defect turnaround time is critical to meet the project timeline. | Ensure that adequate development and deployment support is available for turning defects around during testing hours. This is applicable to resources to support all areas of the solution. | Med | High | Performance Leads |
| Performance Test Environment Health Check: performance test environment preparation and stability of all components. | (1) Send Health Check reminder outlining testing goals & objectives, request that support teams perform health check of their perspective areas, and facilitate health check meeting with support team.  (2) Execute HP LoadRunner test scripts upon completion of the environmental health check to ensure the scripts run successfully.  (3) Scripts enhanced as required in preparation for testing based on step 2. | Med | High | Environments Team  Performance Leads |
| LoadRunner Protocol Licenses required for creating test scripts | LoadRunner protocols and licenses must be available. | Low | High | Performance Leads |
| Lack of appropriate support, development, DBAs, Network, hardware, software administrators etc. (nights and weekends) | (1) Leadership must be supportive to ensure that proper support is available during after hours and weekends.  (2) Compose a list of key contacts with the appropriate escalation process in place. | Med | Med | Program Managers |

# Glossary

* CBP – Critical Business Process
* NFR – Non-Functional Requirement
* QRT – Quote Replacement Tool
* VuGen – Virtual User Generator (HP LoadRunner tool component)
* Vuser – HP LoadRunner Virtual User