SERENA SOFTWARE

Enterprise Performance and Scalability Test Results

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Who Should Read This Paper?

This paper is intended for system administrators or others interested in high-load performance and scalability test results for Serena Business Manager (SBM). This paper provides results for performance tests that mimic real-world runtime scenarios, along with server and application configuration information for each scenario.

Enterprise Performance and Scalability

SBM is architected as an enterprise-level application, capable of scaling to meet the demands of organizations that are global in reach and that handle a high volume of data and business transactions across various groups and organizations. SBM enables you to tackle these challenges while allowing for high productivity, minimal infrastructure cost, and a robust runtime experience for end users and system service interactions.

Test Scenarios and Methodology

Testing for the results discussed in this paper was conducted in a private enterprise performance testing lab. Tests measured application response time, throughput, and system resource usage under varying load conditions and dataset configurations.

To narrow the testing gap, enterprise customer configurations and test datasets are modeled for testing purposes.

Testing Application: SBM 2009 R2

Test Driver: HP LoadRunner 8.1.4

LoadRunner generates load by creating virtual users to model real human user activity. Each virtual user performs scripted tasks and sends crafted HTTP requests to the target application. LoadRunner then uses a threading execution model to create multiple instances of unique virtual users to create load and concurrency on the target application.

Specific configuration information is included in the Runtime Test Architecture [page 4] section. Virtual user information is included in the Test Scenarios section for each of the tests described in this document:

- **Database Load Performance Results [page 7]**

  Tests simulate a combination of repeated, concurrent manual tasks performed by 200 virtual users. Tests gauge response times and system resource usage for supported database management systems (Microsoft SQL Server Enterprise Edition and Oracle).

  Manual tasks include submitting items, updating items, running reports that return large data sets, and searching for items. Tests were performed in an SBM system with over 1,000 users and several hundred projects, which store process items and tasks. Results reflect response times and system resource usage.
- **Scalability Test Results for Common End-user Tasks [page 12]**

  Test simulates large number of concurrent, repeated manual tasks performed by sets of 50, 100, and 200 virtual users in an hour and measure response times and system resource usage

for supported database management systems (Microsoft SQL Server Enterprise Edition and Oracle).

Manual tasks include keyword searches, submitting items, transitioning items through the process, adding notes and attachments to these items, and running reports that return large data sets. Tests were performed in an SBM system with over 1,000 users and several hundred projects, which store process items and tasks. Results reflect response times and system resource usage.

- **Scalability Test Results for Complex, High-Load System Service Interactions [page 15]**

  Simulates system service interactions initiated by manual transitions by sets of 20, 40, and 80 virtual users in an hour. These system service interactions are also referred to as "orchestrations."

  Includes repeated automated searches for and updates of items using built-in Web services, representing complex Web service calls that mimic high-load business usage. Both synchronous and asynchronous system service interactions were tested in a large dataset with 5,000 projects, 21,000 users, and 147,570 folders.

Runtime Test Architecture

The runtime test activities described in this document were executed on the SBM Server. There are two types of runtime activities:

- Manual end-user tasks performed by the SBM Application Engine
- System service interactions kicked off by users as they perform manual tasks. These system service interactions, or orchestrations, are performed by the SBM Orchestration Engine.

Runtime data is stored along with process design data in the SBM database, which resides in a relational database. This data can be accessed using Web services, SBM AppScript, or APIs.

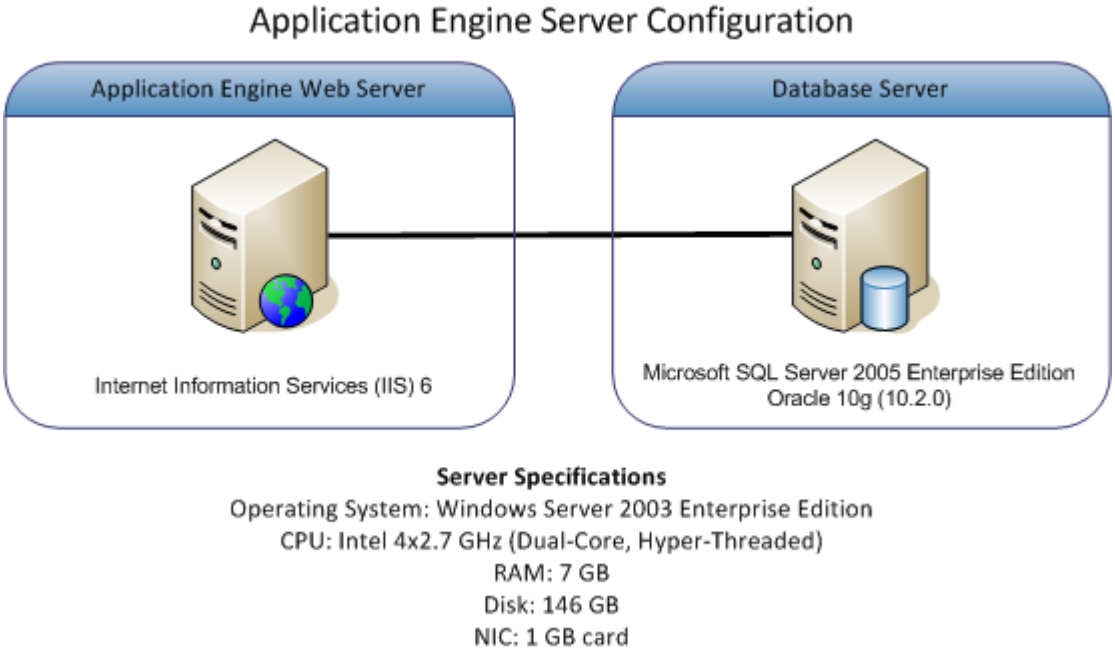
For more information about the full SBM system architecture, refer to *SBM: Scaling for the Enterprise* white paper located on http://www.serena.com or the product documentation.

SBM Application Engine Test Architecture

Manual end-user tasks are performed in the SBM User Workspace using a standard Web browser. The SBM User Workspace is implemented using HTML, JavaScript, and Flash.

The SBM Application Engine coordinates these "human" workflow, or "application," activities by executing as an in-process ISAPI plug-in to Internet Information Services (IIS). It receives processes and responds to HTTP and Web service requests from the Web server.

The following SBM Application Engine configuration was used for the database load performance and common end-user task scalability tests. Tests were performed in standard two-server environment: a Web server and a database server, as shown in the following figure.



Server Specifications
Operating System: Windows Server 2003 Enterprise Edition
CPU: Intel 4x2.7 GHz (Dual-Core, Hyper-Threaded)
RAM: 7 GB
Disk: 146 GB
NIC: 1 GB card

The dataset for the test application is shown in the table below. These numbers reflect a mid-sized enterprise system.

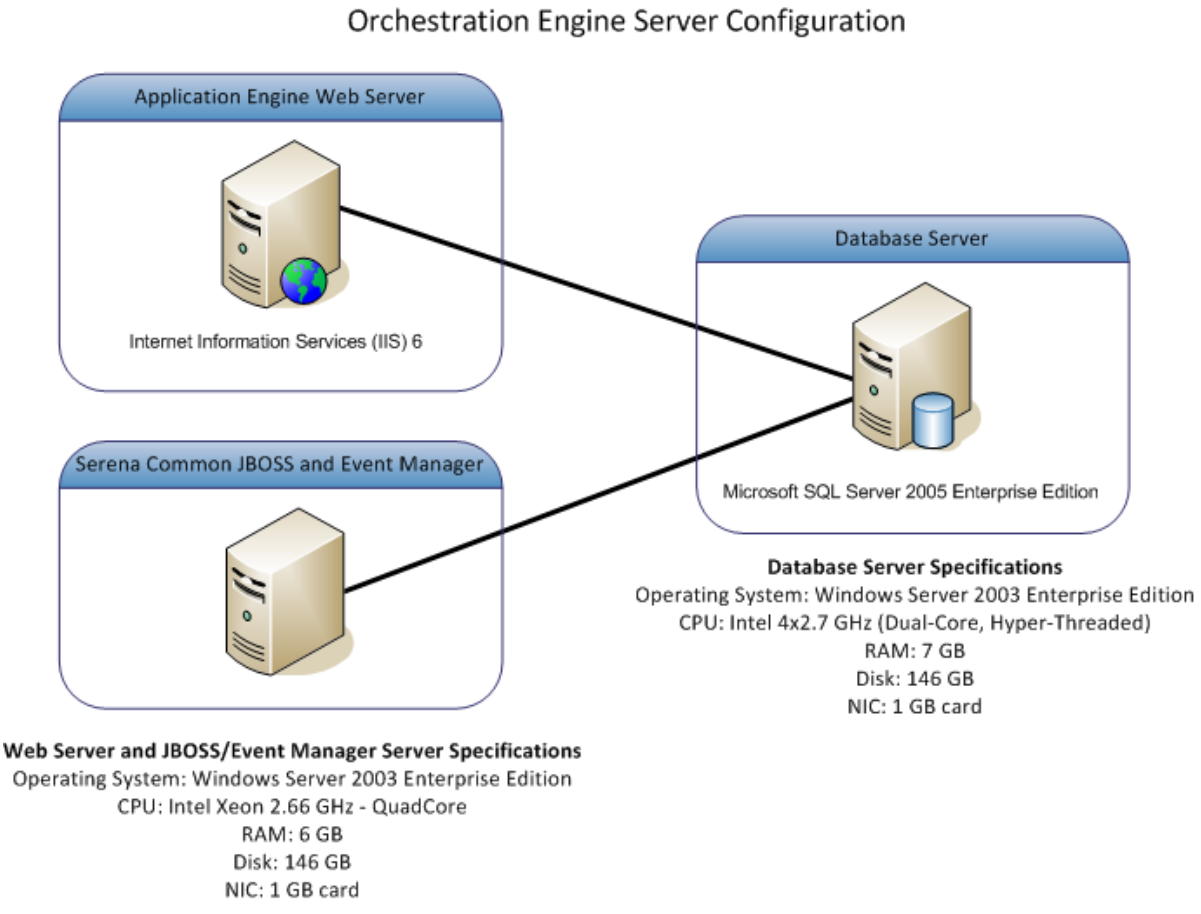
Application Item	Number of Items
Workflows (define the process items follow)	31
Projects (store process items, such as issues and incidents)	235
Users	1,100
Groups	138
Folders (store personal and group favorites)	7,555
Contacts (similar to address book entries)	52
Issues (process items that follow a workflow)	57,984

SBM Orchestration Engine Test Architecture

System service interactions, or orchestrations, are coordinated by the SBM Orchestration Engine, which receives events from applications and executes associated orchestrations as BPEL processes. These BPEL processes can use Web services to execute a business process across multiple tools. The SBM Orchestration Engine is part of the Serena Common JBOSS service, which is a J2EE container for various services provided in the SBM Server.

The scalability test for complex, high-load system service interactions was performed using the recommended configuration for orchestrations: a three-server environment containing the SBM Application Engine Web server on one server, Serena Common JBOSS and the Event Manager on a second server, and a third machine acting as a database server, as shown in the following figure.

NOTE: The SQL Server database was configured to use the Read Committed Snapshot isolation level. For details, refer to Microsoft's configuration documentation.



The dataset for the test "human" application used to initiate orchestrations is shown in the table below. These numbers reflect a large enterprise system.

Application Item	Number of Items
Workflows (define the process items follow)	31
Projects (store process items, such as issues and incidents)	5,000
Users	21,000
Groups	138

Application Item	Number of Items
Folders (store personal and group favorites)	147,570
Contacts (similar to address book entries)	20,053
Issues (process items that follow a workflow)	58,026

Database Load Performance Results

Load testing completed against the two database management systems supported by SBM (Microsoft SQL Server and Oracle) demonstrate similar overall performance in the SBM Application Engine. Response times for each supported DBMS were well below one second per transaction, and system resource usage numbers are well within acceptable ranges for critical enterprise-level applications.

Test Scenarios

Database load test were performed using the SBM Application Engine Test Architecture [page 4], a standard two-server environment with the Web server on one machine and the database on a second machine. The following DBMS versions were hosted on the same database server:

- Microsoft SQL Server 2005 Enterprise Edition
- Oracle 10g (10.2.0)

Each DBMS was tested by 200 virtual users, who performed a combination of repeated number of common manual tasks over the test period. “Think” time between virtual user clicks was 10 seconds. Tasks included:

- Submittal of new items
- Updates of existing items
- Run reports
- Search for items

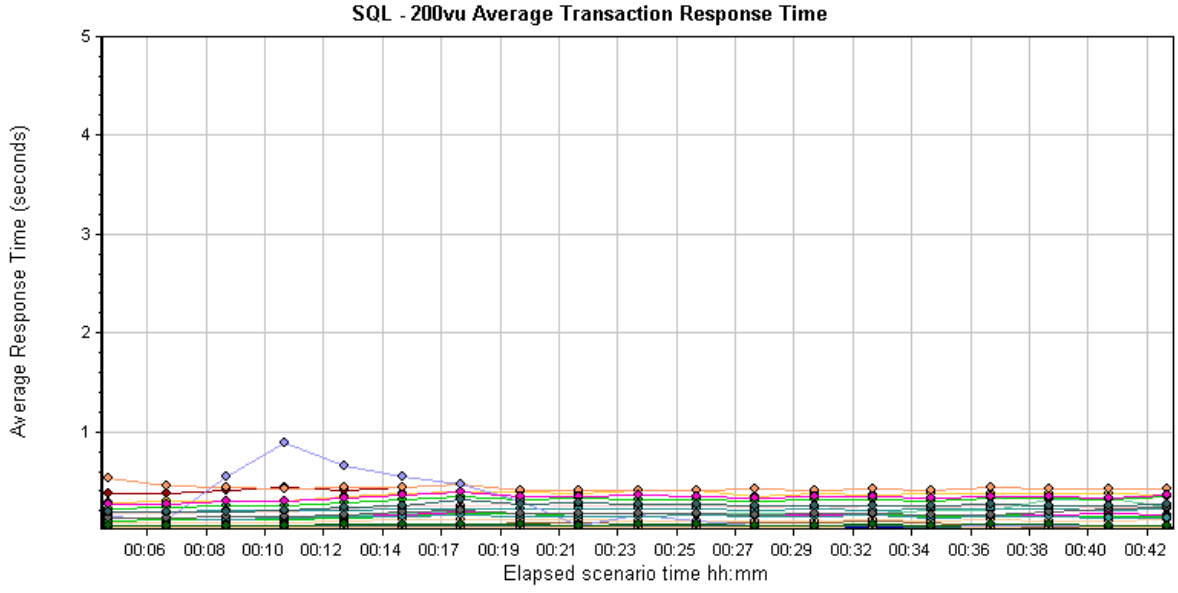
Microsoft SQL 2005 Enterprise Edition Server Test Results

Results reflect strong response times and stable system resource usage in these four categories:

- Average Transaction Response Time [page 7]
- Web Server CPU Usage [page 8]
- Web Server Memory Usage [page 8]
- Database Server CPU Usage [page 9]

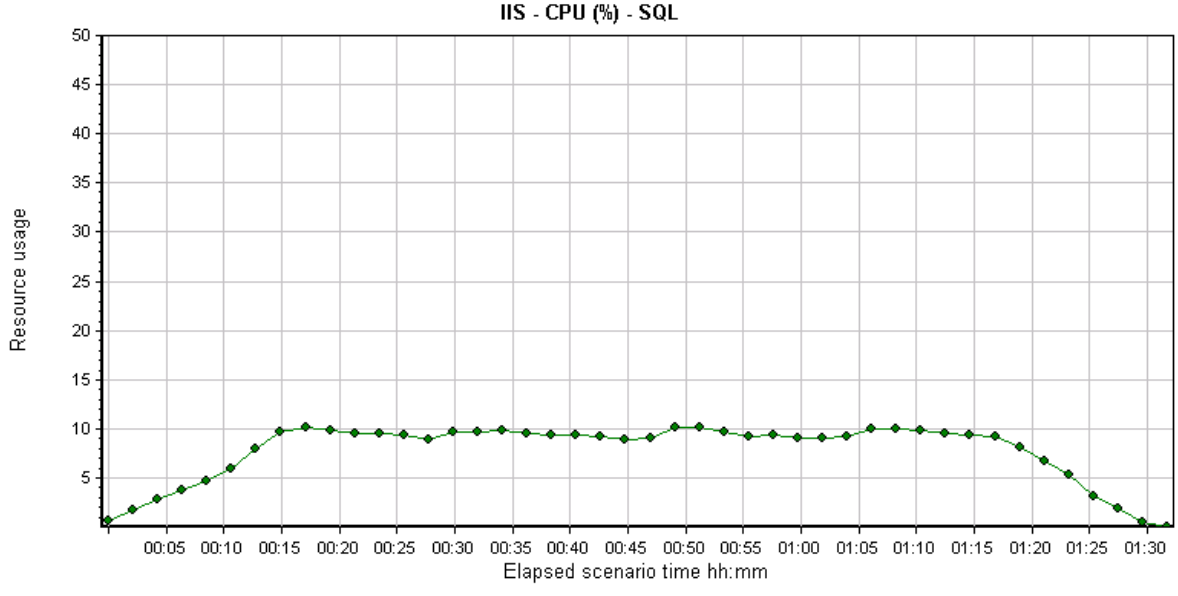
Average Transaction Response Time

The following chart represents the average transaction response time in seconds. A transaction represents a single virtual user click that causes interaction with the Web and database servers. The chart represents a combination of 200 virtual users repeatedly performing the same set of transaction. All measured transaction response times remained below the sub-second level.



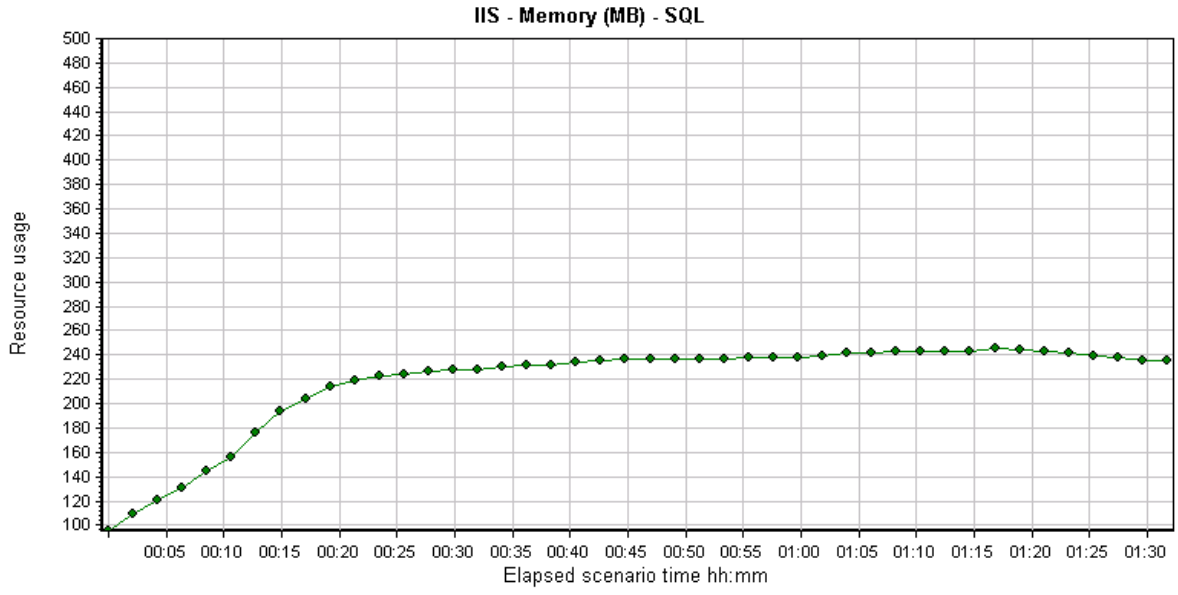
Web Server CPU Usage

The following chart demonstrates an average of 10 percent CPU usage on the Web server during the test period. After an initial ramp-up phase, the Web server CPU usage remains stable through the remainder of the test period and shows no sporadic CPU usage.



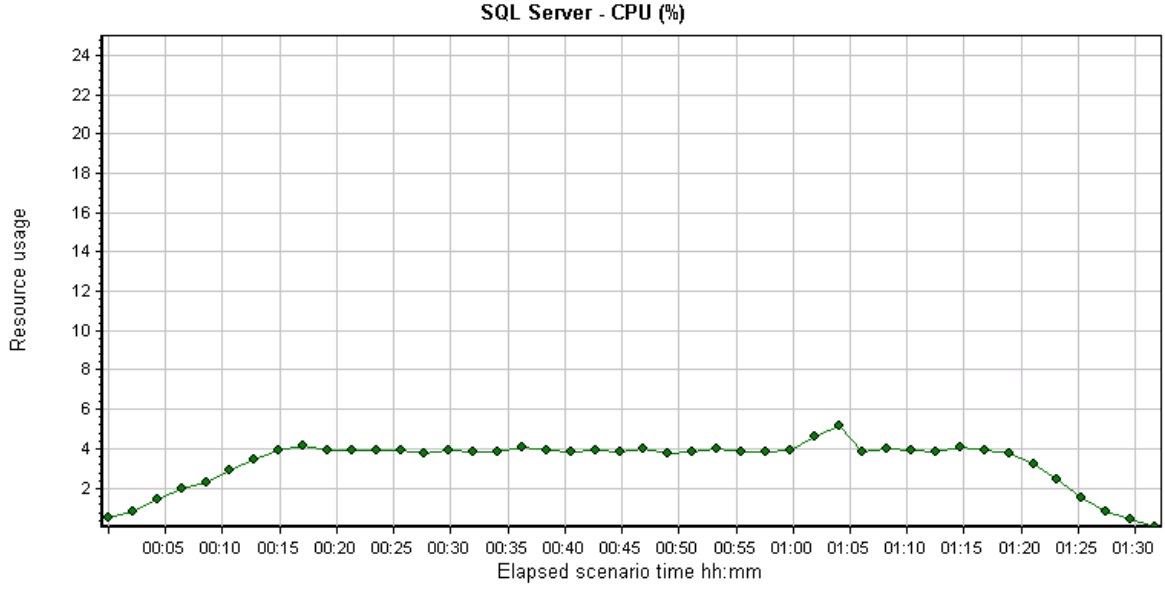
Web Server Memory Usage

The following chart demonstrates an average of 240 MB physical memory usage on the Web server during the test period. After an initial ramp-up phase, the Web server memory usage remains stable and consistent through the remainder of the test period.



Database Server CPU Usage

The following chart demonstrates an average of 4 percent CPU usage on the database server during the test period. After a short ramp-up period, the database server CPU remains consistent and stable for the majority of the test cycle.



ORACLE 10G (10.2.0) TEST RESULTS

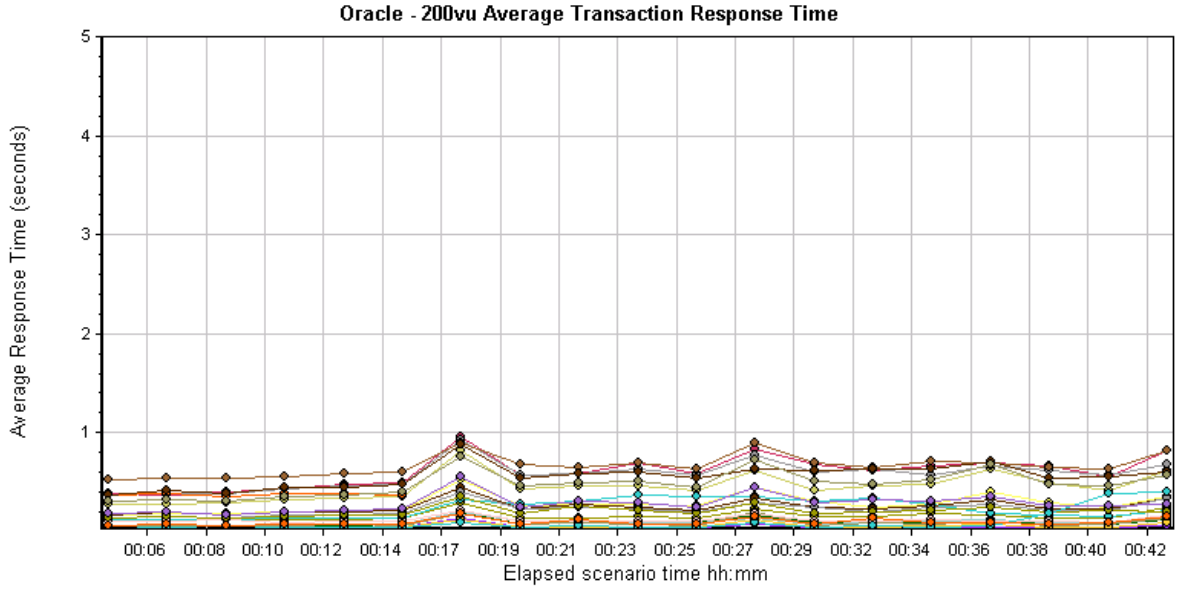
Results reflect strong response times and stable system resource usage in these four categories:

- Average Transaction Response Time [page 10]
- Web Server CPU Usage [page 11]
- Web Server Memory Usage [page 11]

- Database Server CPU Usage [page 12]

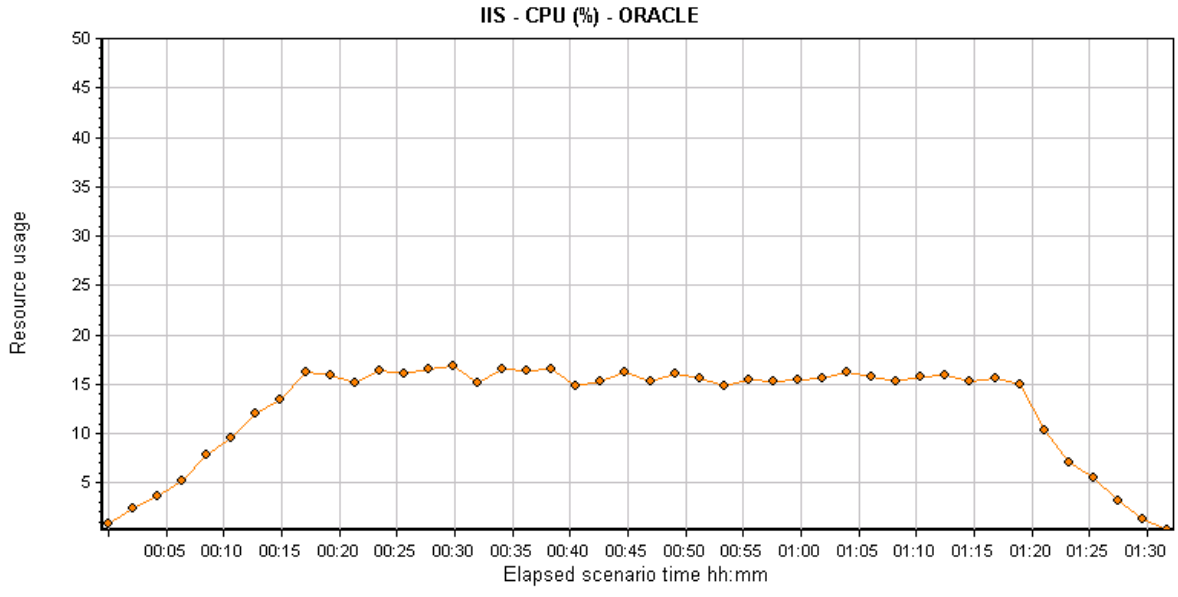
Average Transaction Response Time

The following chart represents the average transaction response time in seconds. A transaction represents a single virtual user click that causes interaction with the Web and database servers. The chart represents a combination of 200 virtual users repeatedly performing the same set of transaction. All measured transaction response times remained below the sub-second level.



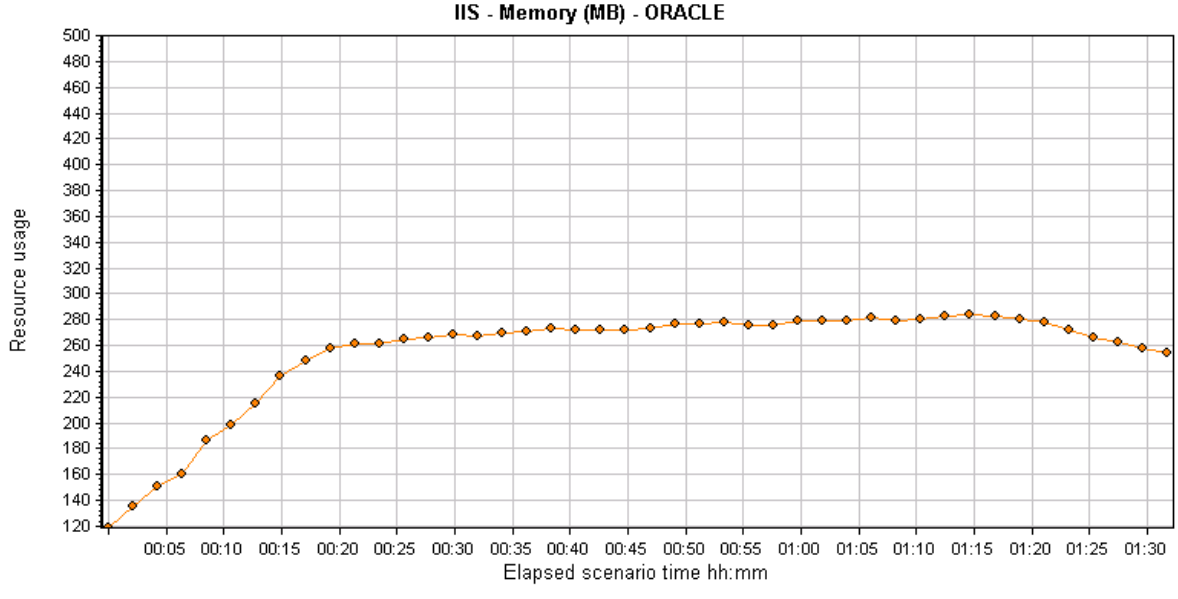
Web Server CPU Usage

The following chart demonstrates an average of 15 percent CPU usage on the Web server during the test period. After an initial ramp-up phase, the Web server CPU usage remains stable through the remainder of the test period and shows no sporadic CPU usage.



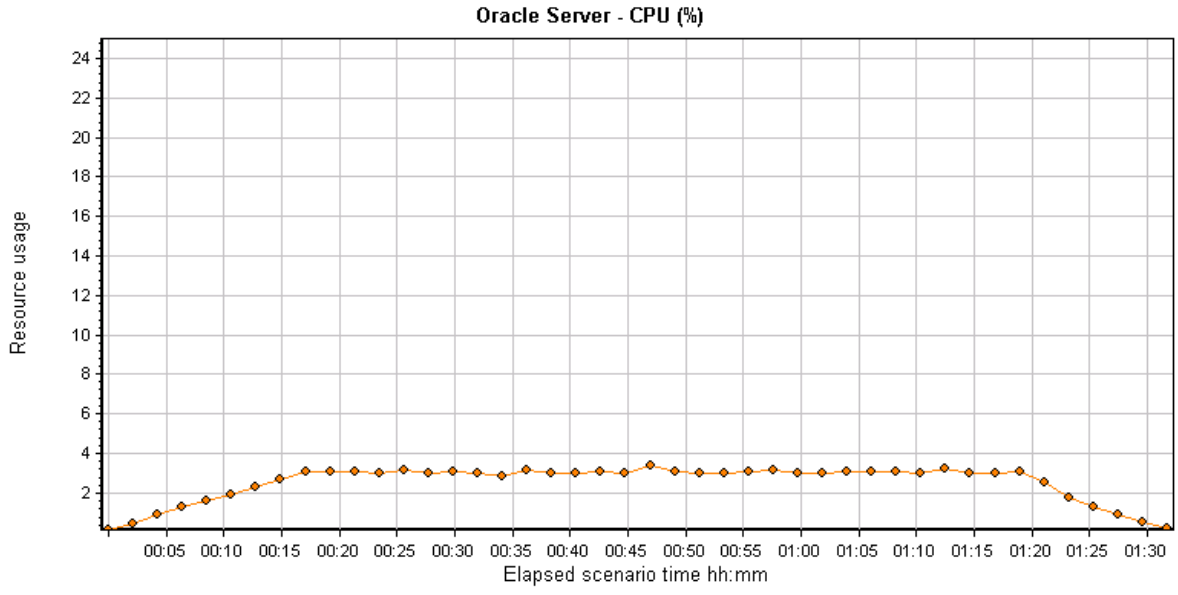
Web Server Memory Usage

The following chart demonstrates an average of 280 MB physical memory usage on the Web server during the test period. After an initial ramp-up phase, the Web server memory usage remains stable and consistent through the remainder of the test period.



Database Server CPU Usage

The following chart demonstrates an average of 3 percent CPU usage on the database server during the test period. After a short ramp-up period, the database server CPU remains consistent and stable for the majority of the test cycle.



Scalability Test Results for Common End-user Tasks

The SBM Application Engine tests simulate a scaling number of common, concurrent, repeated tasks completed by varying numbers of virtual users.

Using a standard defect tracking application that enables a team to track product defects, the tests replicate the life cycle of defects from submittal, approval, and assignment. Notes and attachments are added to each item as it moves through the process. Keyword searches, ID searches, and various reports are also run against the system.

TEST SCENARIOS

Scalability tests for end-user tasks were performed using the SBM Application Engine Test Architecture [page 4] by a set number of unique virtual users over a one-hour time period. “Think” time between virtual user clicks was 10 seconds. To test scalability, sets of 50,100, and 200 unique virtual users log in to the SBM User Workspace once, perform a variety of tasks, and then log out at the end of the test.

Tasks include:

- Keyword search
- Submit item
- Assign item to an owner
- Reassign item
- ID search

- Add note to an item (2 kb in size)
- Add attachment to an item (12 kb in size)
- Run a Listing report
- Run a Multi-view report

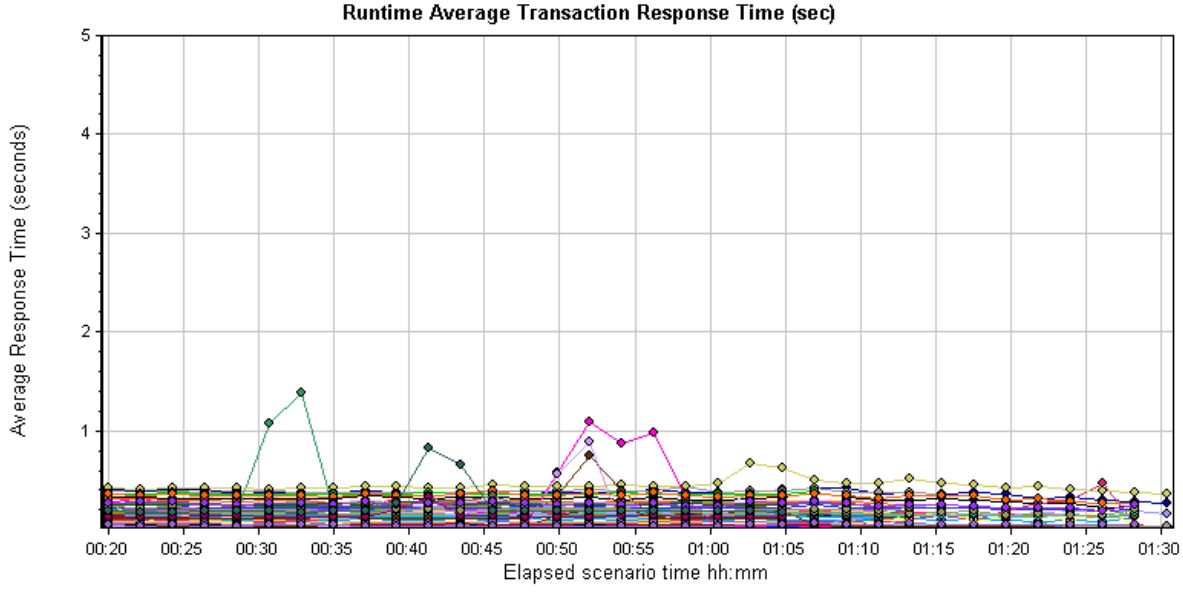
TEST RESULTS

Results reflect strong response times and system resource usage in these four categories:

- SBM Application Engine Response Time [page 13]
- Web Server CPU Usage [page 14]
- Web Server Memory Usage [page 14]
- Database Server CPU Usage [page 15]

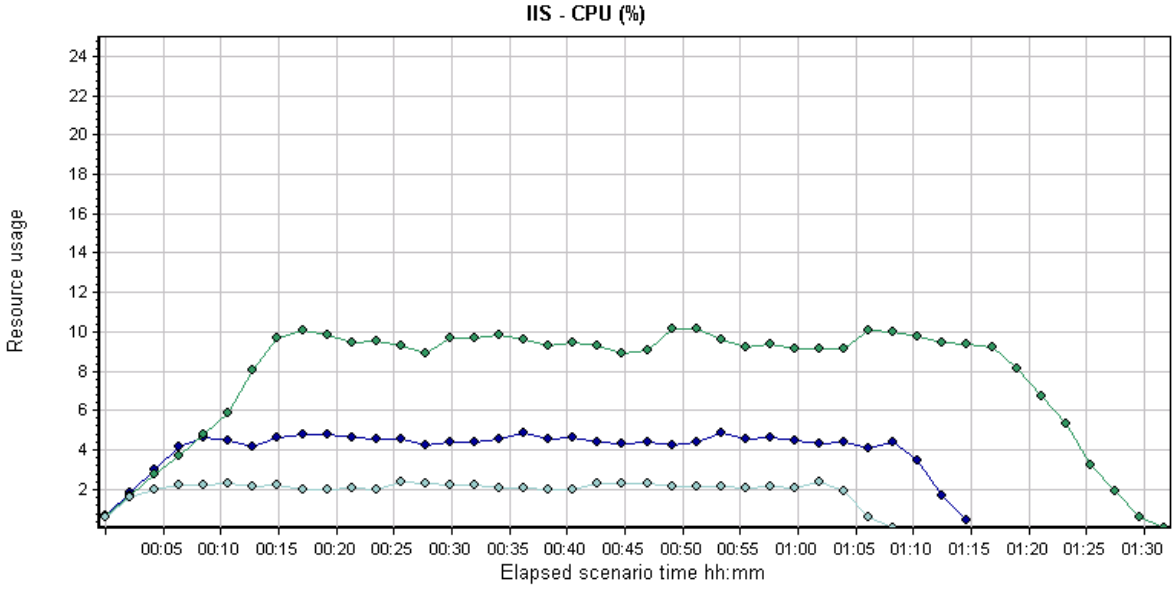
SBM Application Engine Response Time

The following chart reflects transaction response time for all load-level tests (50,100, and 200 virtual users). Each line represents individual test operations at various loads. The average measured transaction response times remained below the sub-second level for all operations.



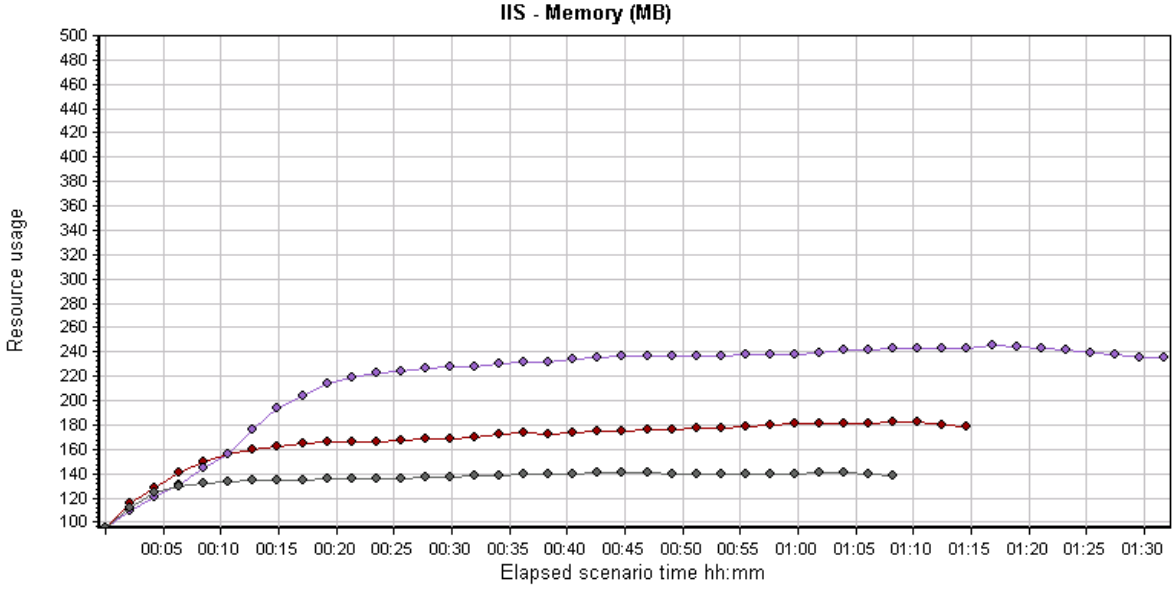
Web Server CPU Usage

The following chart shows the Web server's CPU resource usage under three load-level tests with 50, 100, and 200 virtual users. As the load level increases, the resource usage increases in a linear fashion with maximum CPU resource usage under 10 percent.



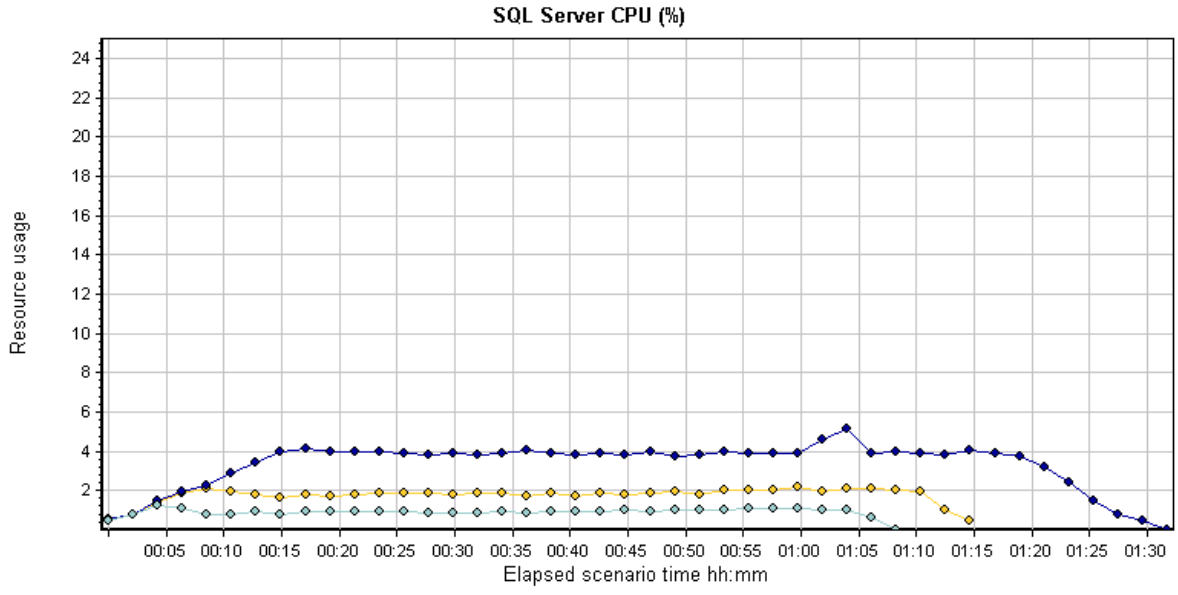
Web Server Memory Usage

The following chart shows the Web server's IIS physical memory resource usage as load levels increase from 50 to 100 to 200 virtual users. The runtime memory usage remains stable at all load levels.



Database Server CPU Usage

The following chart shows database CPU resource usage as load levels increase from 50 to 100 to 200 virtual users. The runtime database resource usage remained stable and minimal as the load increased.



Scalability Test Results for Complex, High-Load System Service Interactions

The SBM Orchestration Engine tests simulate a repeated, scaling number of synchronous and asynchronous events initiated by virtual users as they submit items into a “human” workflow application. These system service interactions are referred to as orchestrations.

Using a simple human process to initiate orchestrations, the tests replicate large, complex business processes that continually increase the amount and size of data processed by the SBM Orchestration Engine. Tests include repeated updates of items and automated searches using built-in Web services, representing complex Web service calls that mimic high-load business usage. This ensures that the system can concurrently process a small to large number of business transactions.

Test Scenarios

Tests were performed using the SBM Orchestration Engine Test Architecture [page 5] by a set number of unique virtual users over a one-hour time period. “Think” time between virtual user clicks was 10 seconds. To test scalability, sets of 20, 40, and 80 unique virtual users log in to the SBM User Workspace once, submit an item into the system to initiate the orchestrations, perform additional tasks, and then log out of the system.

Asynchronous and synchronous orchestration tests were run concurrently. For each scaling model, the total number of virtual users was split at 80 percent for the asynchronous calls and 20 percent for the synchronous calls.

Asynchronous Tasks

Virtual users:

- Login
- Submit Item
- ID Search
- Logout

Orchestrations (Initiated by virtual users submitting items):

- 7 Web service calls to update the item
- 2 Web service calls to perform a keyword search by title

Synchronous Tasks

Virtual users:

- Login
- Submit Item
- Logout

Orchestrations (Initiated by virtual users submitting items):

- 1 Web service call to update the title of an item

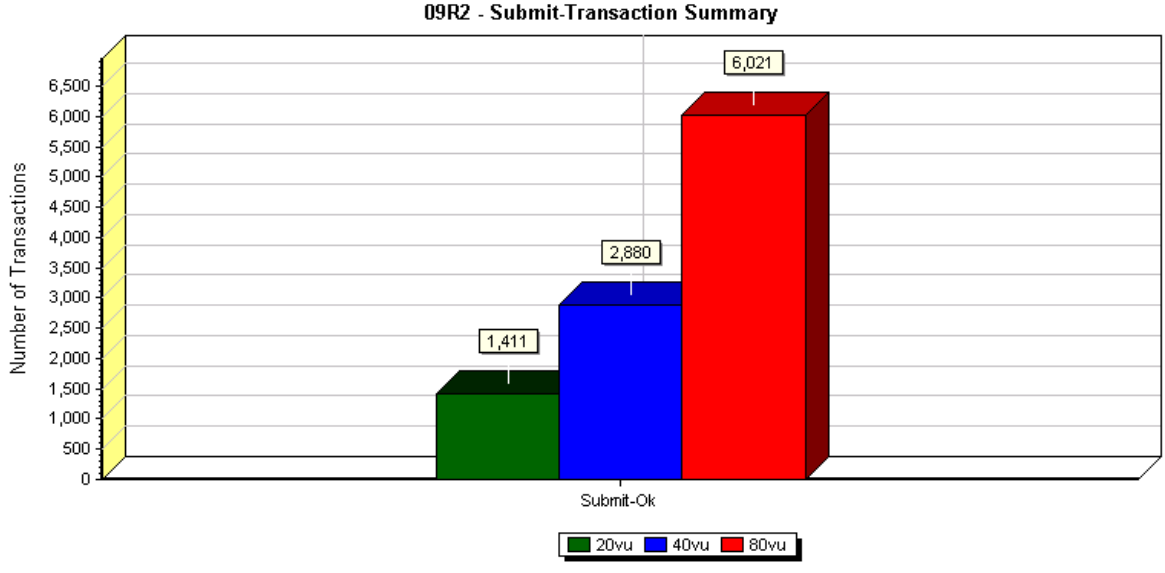
Test Results

Results reflect strong response times and system resource usage in these four categories:

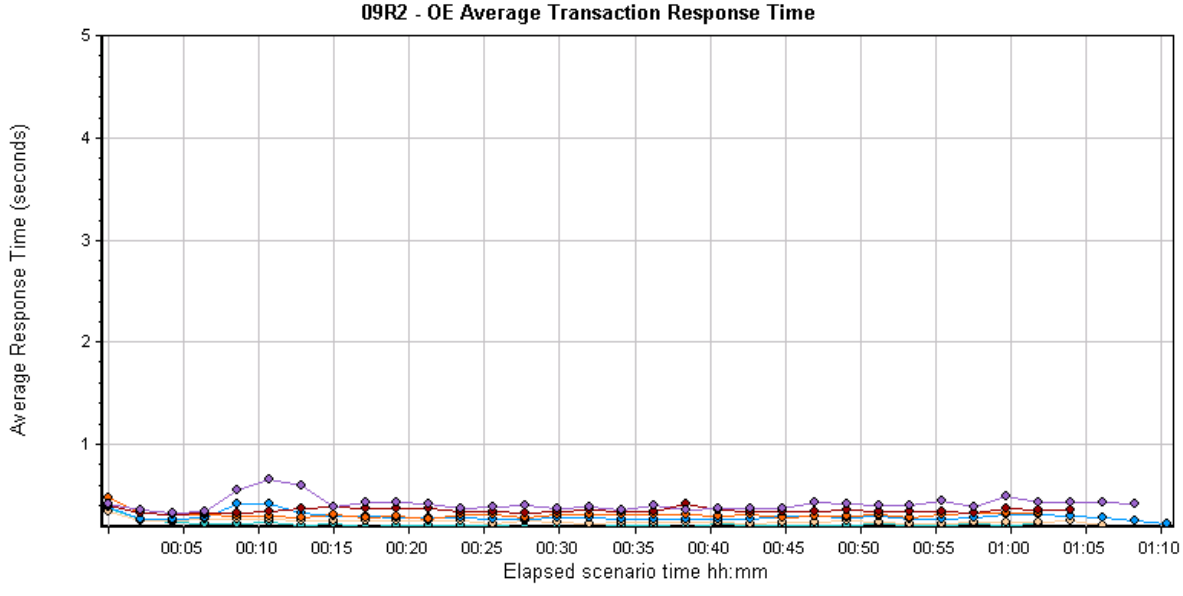
- SBM Orchestration Engine Response Time [page 17]
- JBOSS Server CPU Usage [page 18]
- JBOSS Server Memory Usage [page 18]

SBM Orchestration Engine Response Time

The following chart reflects the number of synchronous and asynchronous transactions processed during the one-hour test by a scaling number of virtual users. The bar on the left represents the numbers of transactions for 20 virtual users; the middle bar represents 40 virtual users, and the bar on the right represents 80 virtual users.

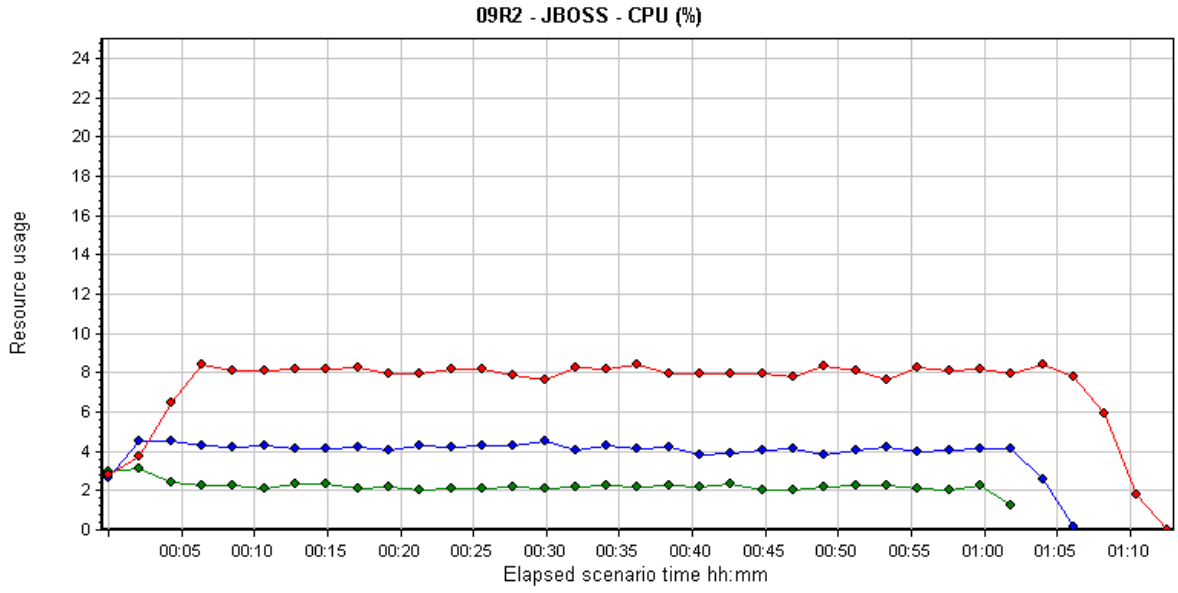


The following chart reflects the transaction response time for all virtual user load levels. All manual and synchronous transaction response times remain below the sub-second level. Note: For asynchronous orchestrations, process completion time remained below 10 seconds based on surveying completed after each test.



JBOSS Server CPU Usage

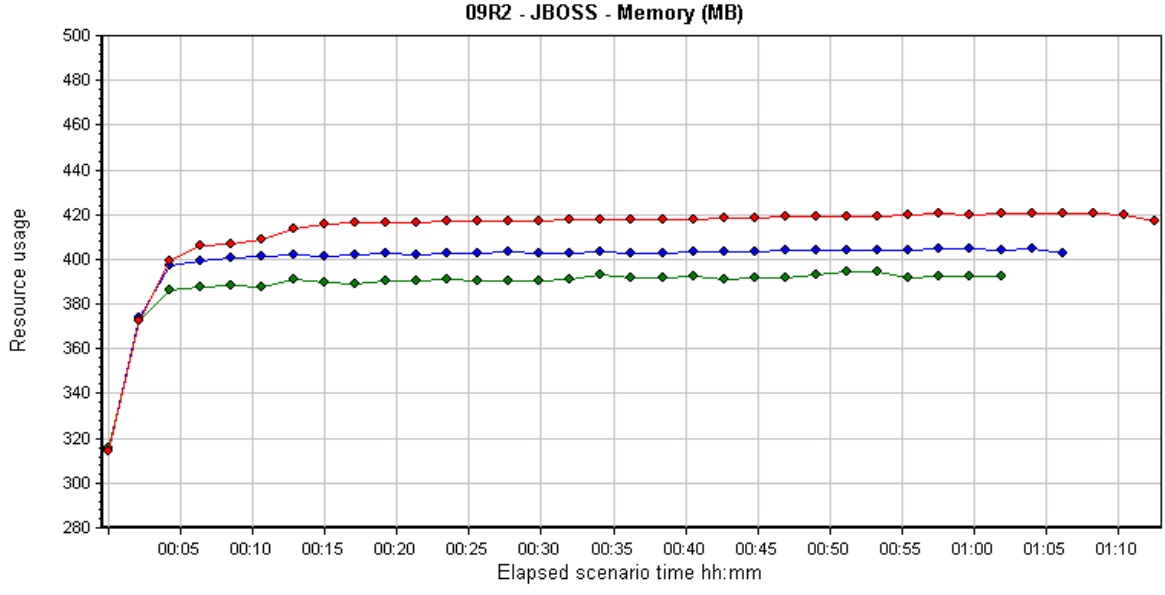
The following chart shows JBOSS server CPU resource usage at varying load levels. Each line represents handling of complex orchestration workloads initiated by 20, 40, and 80 virtual users.



JBOSS Server Memory Usage

The following chart demonstrates stable JBOSS server memory usage under a heavy orchestration load.

Note: To achieve scalable and stable runtime performance, the SBM Orchestration Engine uses JMS queues and an internal throttling mechanism to moderate the load while providing high transactional throughput and reliability.



Conclusion

SBM clearly demonstrates enterprise-level performance and scalability. Testing thoroughly examined runtime load and scalability performance at a large scale, scope and varying load conditions. Results indicate a stable, scalable, and robust runtime experience for your users and system service interactions.

ABOUT

Serena Software, Inc., the Change Governance leader, helps more than 15,000 organizations around the world—including 96 of the Fortune 100 and 90 of the Global 100—turn change into a business advantage. Serena is headquartered in Redwood City, California, and has offices throughout the U.S., Europe, and Asia Pacific.

CONTACT

Website: http://www.serena.com