



SHUNRA

# *Shunra Professional Services*

Project Report for:  
Fortune 500  
Pharmaceutical Company

Project:  
Application Performance  
Analysis

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## Executive Summary

### Objective

- The purpose of the project was to evaluate the performance of the new APPLICATION under six different network conditions. The six network conditions represent the actual CUSTOMER network between Toledo where the APPLICATION is hosted, and the following CUSTOMER locations:
  1. Brussels
  2. Little Rock
  3. Marwick
  4. New York
  5. Providence
  6. Roanoke
  
- The tests were designed to be able to capture Transaction Response Times (TRT) for various business processes under single-user conditions (low application load) and 200-user conditions (heavy application load).
  
- Results from these tests would be compared against a previous effort that captured response times for business processes from the legacy application.
  
- The following CUSTOMER Business Process were used to evaluate response times:
  1. B
  2. C
  3. D
  4. M
  5. P

The objective of this engagement was to develop empirical results that would enable CUSTOMER to decide if the application and architecture for APPLICATION would be able to meet their current performance needs.

The goals of this engagement were to:



- Capture single-user transaction response times for key business processes within the APPLICATION from six CUSTOMER global locations by using network simulations in a lab environment.
- Simulate a 200-user load against the APPLICATION from users at six CUSTOMER global locations and capture the transaction response times by using network simulations in a lab environment.

## Methodology

### Planning and Design

The first step in modeling the WAN characteristics of CUSTOMER's production network was to understand the network components and conditions. CUSTOMER provided Shunra with network diagrams and information that detailed the type of network and bandwidth utilization percentage for the existing network topology. Network templates were then created using Shunra's VE Modeler to represent the production network.

CUSTOMER also installed Shunra's VE Network Appliance on the CUSTOMER network and provided six virtual machines to be used to generate the load from the six simulated CUSTOMER test locations.

Appendix A has a complete listing of VE Modeler diagrams used for the evaluation.

### Test Preparation

Shunra worked with CUSTOMER to understand the business processes that were used in the simulation. These transactions were scripted using test automation tools including LoadRunner. The CUSTOMER network was configured so that the network traffic from the virtual load generating machines would travel through the Shunra VE Network Appliance. When replayed through the Shunra environment, these tools simulated a business user or transaction using the application as if they were located at a variety of remote locations.



## Test Execution

For each test in the suite, there were 6 phases of testing.

- 1) Understand the business processes used for testing
- 2) Determine the data requirements and data preparation needed for test runs
- 3) Create automated test scripts to simulate actual users executing these business processes
- 4) Verify and enhance the automated scripts to ensure playback under multiple users could be achieved
- 5) Prepare the application and database for test execution
- 6) Execute the test and record results

## Business Process Analysis

The business processes were executed to validate the virtual enterprise's functionality and to provide consistent and meaningful metrics for evaluating transaction response times to determine expected end-user experiences at remote locations. The suite of tests was representative of what typical end users do as part of their job.

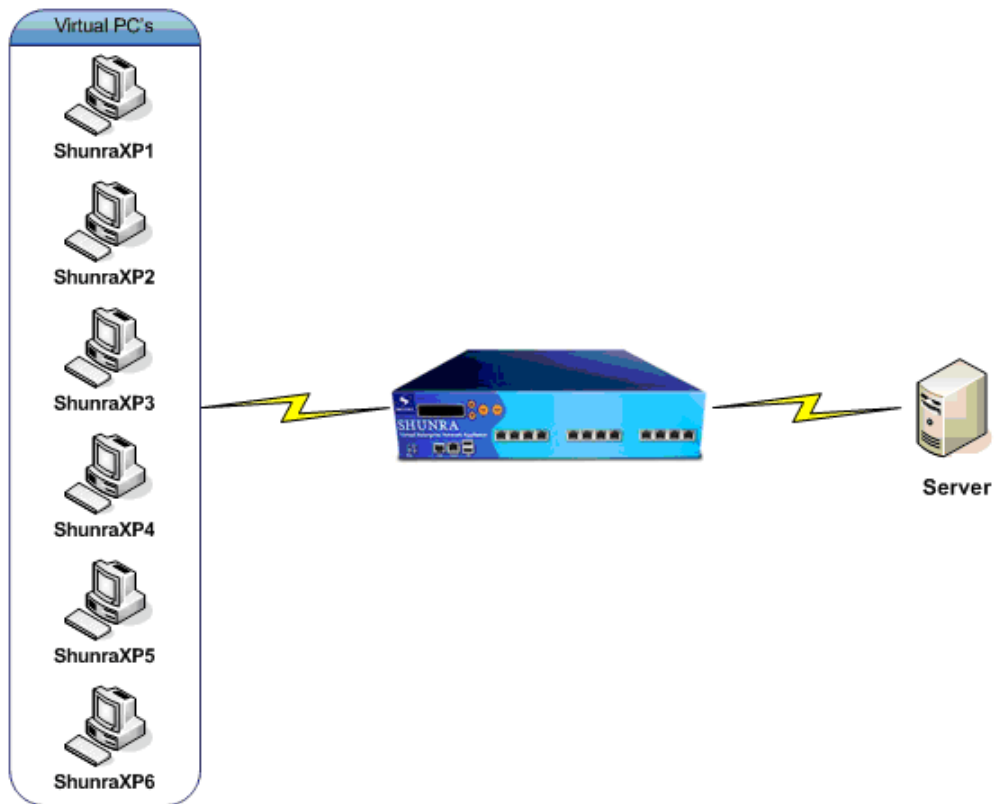
## Benchmark Tests

A benchmark test was executed simulating a user at each of the locations executing a single business process. These response times were used to compare against response times when the system was supporting a heavy load to determine the performance impact of 200 users.



## Test Environment Setup

The following diagram represents the environments used for the APPLICATION performance testing. The Shunra VE was connected in bridge mode, and is the blue box in the diagram below. The six PC's on the left (ShunraXP1 → ShunraXP6) were the CUSTOMER provided virtual machines that were used to generated the load.





## Test Network Definitions

For each test network, the factors that changed were the network bandwidth for each office, and WAN latency for each office (provided by CUSTOMER).

CUSTOMER chose the following 6 network conditions for testing.

Test Network Definitions			
<u>Source (Client)</u>	<u>Destination (Server)</u>	<u>(one way)</u> <u>Latency</u>	<u>Connection</u>
Brussels	Morris (Toledo)	60 ms	4 MB
Little Rock	Morris (Toledo)	30 ms	4.5 MB
Marwick	Morris (Toledo)	2 ms	1 <b>GB</b>
New York	Morris (Toledo)	27.5 ms	3 MB
Providence	Morris (Toledo)	40 ms	9 MB
Roanoke	Morris (Toledo)	32.5 ms	3 MB

Note: Detailed Shunra VE models used for this project can be seen in Appendix A.

## Generated Load

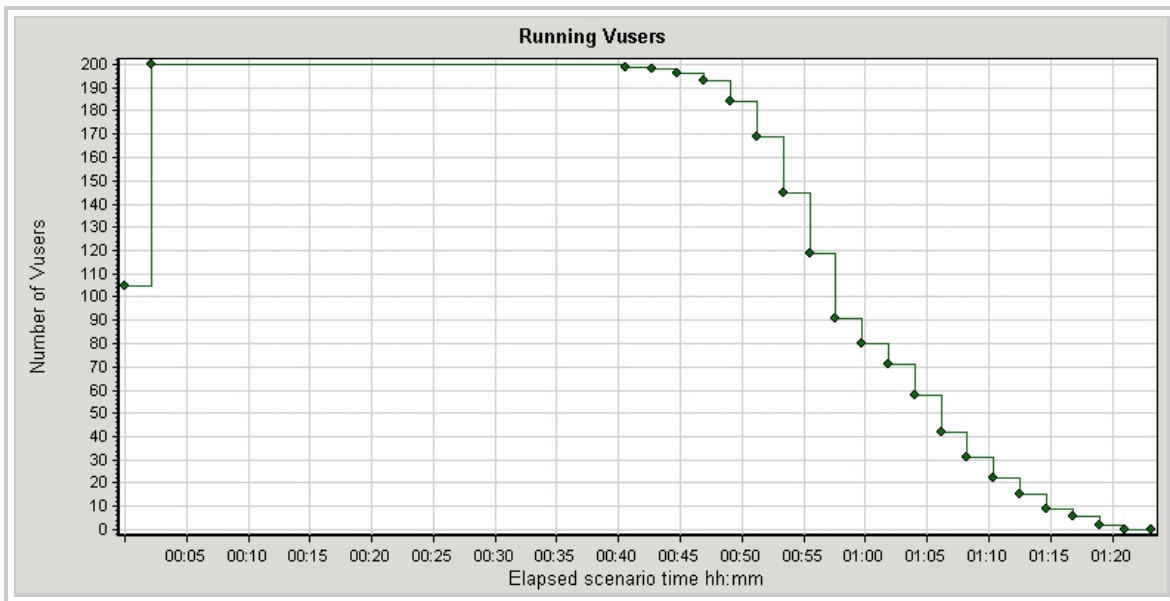
The following graphs show the actual load generated against the APPLICATION during the 200 user test run. They show the imposed load against the application infrastructure over the duration of the run.

## Running Vusers



Displays the number of Vusers (Virtual Users) that executed Vuser scripts, and their status, during each second of a load test. This graph is useful for determining the Vuser load on your server at any given moment.

**Title:** Running Vusers  
**Granularity:** 128 Seconds



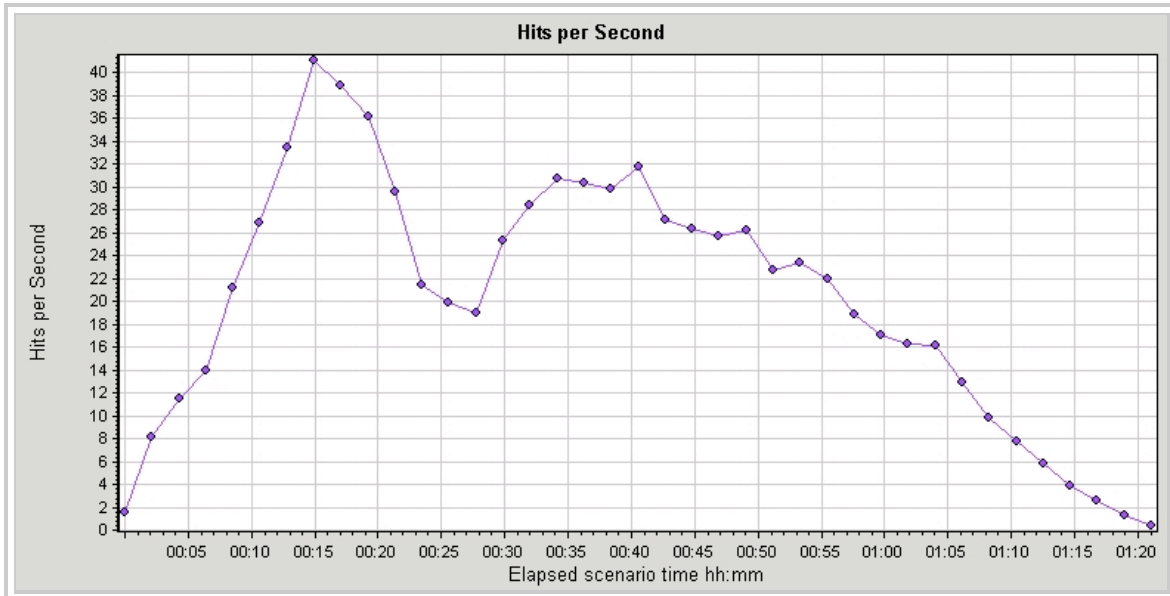
Color	Scale	Measurement	Graph Min.	Graph Ave.	Graph Max.	Graph Median	Graph SD
■	1	Run	0.0	92.826	200	80	75.629



## Hits per Second

Displays the number of hits made on the Web server by Users during each second of the load test. This graph helps you evaluate the amount of load Users generate, in terms of the number of hits.

**Title:** Hits per Second  
**Granularity:** 128 Seconds



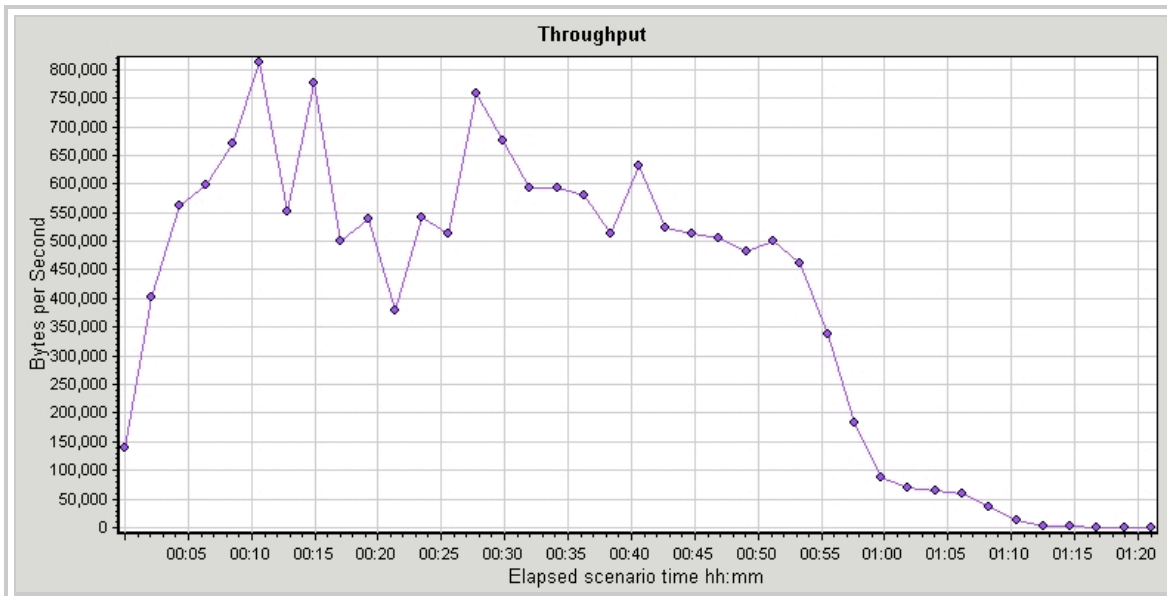
Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Hits	0.405	20.163	41.094	21.445	10.809



## Throughput

Displays the amount of throughput (in bytes) on the Web server during the load test. Throughput represents the amount of data that the Vusers received from the server at any given second. This graph helps you to evaluate the amount of load Vusers generate, in terms of server throughput.

**Title:** Throughput  
**Granularity:** 128 Seconds



Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Throughput	184.595	389324.656	812133.039	500506.102	257999.257



## Test Results

Following are the results for the tests. Lower times are better, and represent end-user experience measured in real-world time (seconds). The measured times do not include any client-processing time as it measures the time from when a user requests information from the server until the response has been returned.

All detailed testing results are available in an excel spreadsheet delivered separately. Testing was designed to be done in a “live” environment which uses portions of the production network, storage, and servers.



## Baseline Results

<b>Application Load Test</b>						
<b>Single User Baseline</b>						
Response times in Seconds						
<b>Process B</b>	<b>Brussels</b>	<b>Little Rock</b>	<b>Marwick</b>	<b>New York</b>	<b>Providence</b>	<b>Roanoke</b>
1	5.85	3.06	0.25	3.80	3.60	3.87
2	0.95	0.44	1.19	0.77	0.19	0.16
3	1.78	1.10	0.53	1.09	1.44	1.19
4	1.27	0.71	0.11	0.68	0.90	0.76
5	0.25	0.06	0.01	0.08	0.08	0.08
6	0.30	0.17	0.05	0.20	0.20	0.20
7	0.27	0.15	0.03	0.15	0.19	0.17
8	0.90	0.48	0.08	0.45	0.61	0.52
9	0.57	0.33	0.09	0.31	0.40	0.37
<b>Process C</b>	<b>Brussels</b>	<b>Little Rock</b>	<b>Marwick</b>	<b>New York</b>	<b>Providence</b>	<b>Roanoke</b>
1	5.49	3.10	0.25	3.76	3.66	3.88
2	0.65	0.20	0.02	0.18	0.52	0.29
3	1.85	1.30	0.56	1.37	1.36	1.26
4	1.30	0.88	0.11	0.66	0.84	0.78
5	0.41	0.29	0.05	0.22	0.28	0.24
6	0.23	0.13	0.00	0.11	0.16	0.14
7	0.23	0.13	0.00	0.13	0.16	0.14
8	0.23	0.13	0.00	0.11	0.16	0.14
9	0.23	0.13	0.00	0.11	0.16	0.14
10	0.24	0.16	0.00	0.13	0.16	0.14
11	0.39	0.20	0.03	0.21	0.26	0.23



<b>Process D</b>	<b>Brussels</b>	<b>Little Rock</b>	<b>Marwick</b>	<b>New York</b>	<b>Providence</b>	<b>Roanoke</b>
1	5.54	3.05	0.23	3.86	3.60	3.87
2	0.55	0.46	1.33	0.14	0.53	0.47
3	1.61	1.09	0.67	1.06	1.22	1.14
4	1.14	0.69	0.09	0.64	0.80	0.71
5	1.24	0.19	0.04	0.15	0.20	1.08
6	0.48	0.25	0.02	0.23	0.33	0.28
7	2.44	0.84	0.18	0.84	1.10	1.15
8	1.34	0.71	0.11	0.71	0.89	0.87
9	0.76	0.40	0.05	0.37	0.52	0.48
10	0.63	0.24	0.03	1.40	0.26	0.27
11	0.42	0.17	0.03	0.20	0.28	0.26
12	1.35	1.14	1.02	1.23	1.29	1.20
<b>Process M</b>	<b>Brussels</b>	<b>Little Rock</b>	<b>Marwick</b>	<b>New York</b>	<b>Providence</b>	<b>Roanoke</b>
1	1.28	0.70	0.07	0.69	1.99	0.76
2	0.77	0.53	1.31	0.14	0.53	0.45
3	1.86	1.13	0.52	1.05	1.21	1.18
4	4.22	3.64	3.09	3.67	3.81	3.92
5	0.27	0.06	0.00	0.10	0.08	0.08
6	0.28	0.29	0.03	0.14	0.19	0.17
7	0.51	0.32	0.03	0.26	0.35	0.30
8	0.28	0.17	0.05	0.16	0.20	0.17
<b>Process P</b>	<b>Brussels</b>	<b>Little Rock</b>	<b>Marwick</b>	<b>New York</b>	<b>Providence</b>	<b>Roanoke</b>
1	5.50	3.10	0.26	3.85	3.67	4.82
2	0.27	0.14	1.03	0.14	0.19	0.16
3	1.83	1.25	0.54	1.17	1.47	1.23
4	1.52	0.94	0.15	0.77	1.06	0.91
5	0.38	0.14	0.01	0.16	0.08	0.08
6	0.35	0.41	0.12	0.26	0.34	0.39
7	0.71	0.57	0.13	0.50	0.62	0.34



## Baseline Results Compared to Legacy Application

### Transaction Response Times (seconds)

#### Legacy App vs. APPLICATION

Application A				
Location	Transaction	Legacy	APPLICATION Single User	APPLICATION 200 Users
		TRT (Avg)	TRT (Avg)	TRT (Avg)
New York	Step 1	2.30	0.20	0.27
	Step 2	9.60	0.15	0.23
	Step 3	1.68	0.45	0.56
	Step 4	11.46	0.31	0.40
Providence	Step 1	2.80	0.20	0.24
	Step 2	15.10	0.19	0.27
	Step 3	1.66	0.61	0.70
	Step 4	12.12	0.40	0.50
Marwick	Step 1	2.00	0.05	0.13
	Step 2	9.16	0.03	0.04
	Step 3	1.68	0.08	0.08
	Step 4	12.10	0.09	0.11
Brussels	Step 1	3.10	0.30	0.36
	Step 2	9.10	0.27	0.39
	Step 3	1.74	0.90	1.05
	Step 4	12.44	0.57	0.73
Little Rock (Local User)	Step 1	4.00	0.17	0.23
	Step 2	8.78	0.15	0.25
	Step 3	1.82	0.48	0.62
	Step 4	11.26	0.33	0.45



Application B				
Location	Transaction	Legacy	APPLICATION Single User	APPLICATION 200 Users
		TRT (Avg)	TRT (Avg)	TRT (Avg)
New York	Step 1	1.60	0.16	0.17
	Step 2	4.80	0.26	0.35
	Step 3	8.30	0.50	0.17
Providence	Step 1	1.60	0.19	0.22
	Step 2	4.20	0.35	0.44
	Step 3	8.30	0.20	0.21
Marwick	Step 1	1.60	0.03	0.03
	Step 2	4.20	0.03	0.05
	Step 3	9.90	0.05	0.05
Brussels	Step 1	2.10	0.28	0.37
	Step 2	4.10	0.51	0.66
	Step 3	8.90	0.28	0.29
Little Rock (Local User)	Step 1	2.30	0.14	0.19
	Step 2	4.50	0.41	0.40
	Step 3	10.40	0.57	0.19

Application R				
Location	Transaction	Legacy	APPLICATION Single User	APPLICATION 200 Users
		TRT (Avg)	TRT (Avg)	TRT (Avg)
New York	Step 1	2.80	0.15	0.16
	Step 2	3.80	0.84	0.88
Providence	Step 1	2.90	0.20	0.20
	Step 2	3.60	1.10	1.00
Marwick	Step 1	5.50	0.04	0.02



	Step 2	4.30	0.18	0.18
Brussels	Step 1	1.90	1.24	0.29
	Step 2	6.20	2.44	1.44
Little Rock (Local User)	Step 1	2.60	0.19	0.20
	Step 2	5.60	0.84	0.93

Application C				
Location	Transaction	Legacy	APPLICATION Single User	APPLICATION 200 Users
		TRT (Avg)	TRT (Avg)	TRT (Avg)
New York	Step 1	2.10	0.22	
	Move to next screen 1	1.30	0.11	
	Move to next screen 2	1.60	0.13	
	Move to next screen 3	1.50	0.11	
	Move to next screen 4	2.10	0.11	
	Move to next screen 5	1.50	0.13	
Providence	Step 1	1.50	0.28	0.26
	Move to next screen 1	1.50	0.16	0.17
	Move to next screen 2	1.90	0.16	0.16
	Move to next screen 3	1.50	0.16	0.16
	Move to next screen 4	1.40	0.16	0.16
	Move to next screen 5	4.40	0.16	0.16
Marwick	Step 1	2.00	0.05	0.07
	Move to next screen 1	2.00	0.00	0.00
	Move to next screen 2	1.70	0.00	0.01
	Move to next screen 3	1.50	0.00	0.00
	Move to next screen 4	1.80	0.00	0.00
	Move to next screen 5	1.60	0.00	0.00
Brussels	Step 1	2.10	0.41	0.36
	Move to next screen 1	28.90	0.23	0.24



	Move to next screen 2	2.70	0.23	0.24
	Move to next screen 3	2.10	0.23	0.27
	Move to next screen 4	1.90	0.23	0.23
	Move to next screen 5	2.10	0.24	0.24
Little Rock (Local User)	Step 1	2.30	0.29	0.22
	Move to next screen 1	2.00	0.13	0.14
	Move to next screen 2	1.90	0.13	0.15
	Move to next screen 3	1.50	0.13	0.16
	Move to next screen 4	1.50	0.13	0.15
	Move to next screen 5	1.50	0.16	0.16

Application P				
Location	Transaction	Legacy	APPLICATION Single User	APPLICATION 200 Users
		TRT (Avg)	TRT (Avg)	TRT (Avg)
New York	Step 1 group	7.35	0.16	
	Step 2	10.30	0.50	
Providence	Step 1 group	7.30	0.08	
	Step 2	11.00	0.62	
Marwick	Step 1 group	7.40	0.01	
	Press Function	11.10		
	Step 2	9.90	0.13	
Brussels	Step 1 group	7.30	0.38	
	Step 2	10.60	0.71	
Little Rock (Local User)	Step 1 group	10.30	0.14	
	Step 2	9.70	0.57	