White Paper

Citrix Consulting

Siebel 8.0 CRM on XenApp

Scalability Analysis for Physical and Virtual Servers

January 2009

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Overview

With Siebel's Customer Relationship Management (CRM) solutions, Oracle offers a complete, complementary, world-class set of customer-centric applications. In the past, Citrix and Siebel Systems have evaluated application performance and functionality. This document represents the results of XenApp and Siebel scalability tests conducted on physical and virtual servers.

Executive Summary

With the ongoing trend of server virtualization, Citrix administrators now ask the question whether or not the virtualization of XenApp servers delivering Siebel 8.0 applications makes sense. There are numerous factors to consider. Virtualization will add overhead and reduce server scalability. This draw-back is often outweighed by numerous benefits, such as simplifying operating system, application patching and improving disaster recovery response times by moving virtualized servers instantly between physical servers and bringing additional servers online in a few minutes.

The overhead associated with server virtualization depends on the applications delivered by the server. While some applications have seen overhead of as little as 7-8% delivering 64-bit applications on 64-bit operating systems, the overhead tends to increase when 32-bit applications are delivered. This analysis quantifies the overhead associated with virtualizing 32-bit and 64-bit XenApp 4.5 servers delivering Siebel 8.0, aiding IT architects and administrators in planning and sizing a XenApp farm on both physical and virtual servers.

The following represents the key findings of the scalability analysis:

Scalability Factors. Processor, Memory and disk I/O utilization were the major constraints observed throughout the test process, with Processor Utilization representing the primary factor limiting scalability.

- **Processor.** Average processor usage was a key factor during the tests. All platforms were configured to use two dual-core processors using identical clock speeds. The team observed processor usage peaks at portions of the test workflows, such as the login into the Siebel environment. The peaks constituted a major contribution to the user limit recommended in this paper.
- **Memory.** Memory footprint per user varied throughout the test. The 64-bit platforms consumed between **43-46 MB** per user while the 32-bit platform consumed between **29-34 MB**. Kernel memory depletion was the limiting factor for the 32-bit platform server. During the tests the memory usage was optimized by increasing Page Pool allocation and Page Table Entries (PTE) to the maximum for 32-bit systems. Despite those optimizations, the disk activity generated to free PTE space in kernel memory slowed down the server and ultimately made it unresponsive when reaching a very high user load.
  Note that this is a limiting factor for the 32-bit servers only.

Scalability Results. In summary, this analysis showed a virtualization overhead of 20% to 27% in the number of users per server on 64-bit and 32-bit operating systems respectively.

- **64-bit Operating Systems User limits.** Running XenApp 4.5 delivering Siebel CRM 4.5 yielded a maximum user density of 150 concurrent users on XenServer and 180 concurrent users a physical server. The final result demonstrated a **20%** overhead with the physical server versus XenServer 4.1.
- **32-bit Operating Systems User limits.** Running XenApp 4.5 delivering Siebel CRM 4.5 yielded a maximum user density of 132 concurrent users on XenServer and 163 concurrent users a physical server. The final result demonstrated a **27%** overhead with the physical server versus XenServer 4.1.

Test Environment

This section provides an overview of the Siebel 8.0 CRM, EdgeSight for Load Testing and Citrix XenApp environment.

Architecture

The diagram below provides a high-level overview of the scalability testing environment. The architecture for the Citrix XenApp 4.5.1 environment was designed with two physical servers and two virtual machines hosted on XenServer. The Data Store was located locally on each XenApp server and is using Microsoft Access. The infrastructure components such as the domain controller, license server, Siebel servers and EdgeSight for Load Testing have been shared by the four farms.

As illustrated, the scalability test environment consists of the following components:

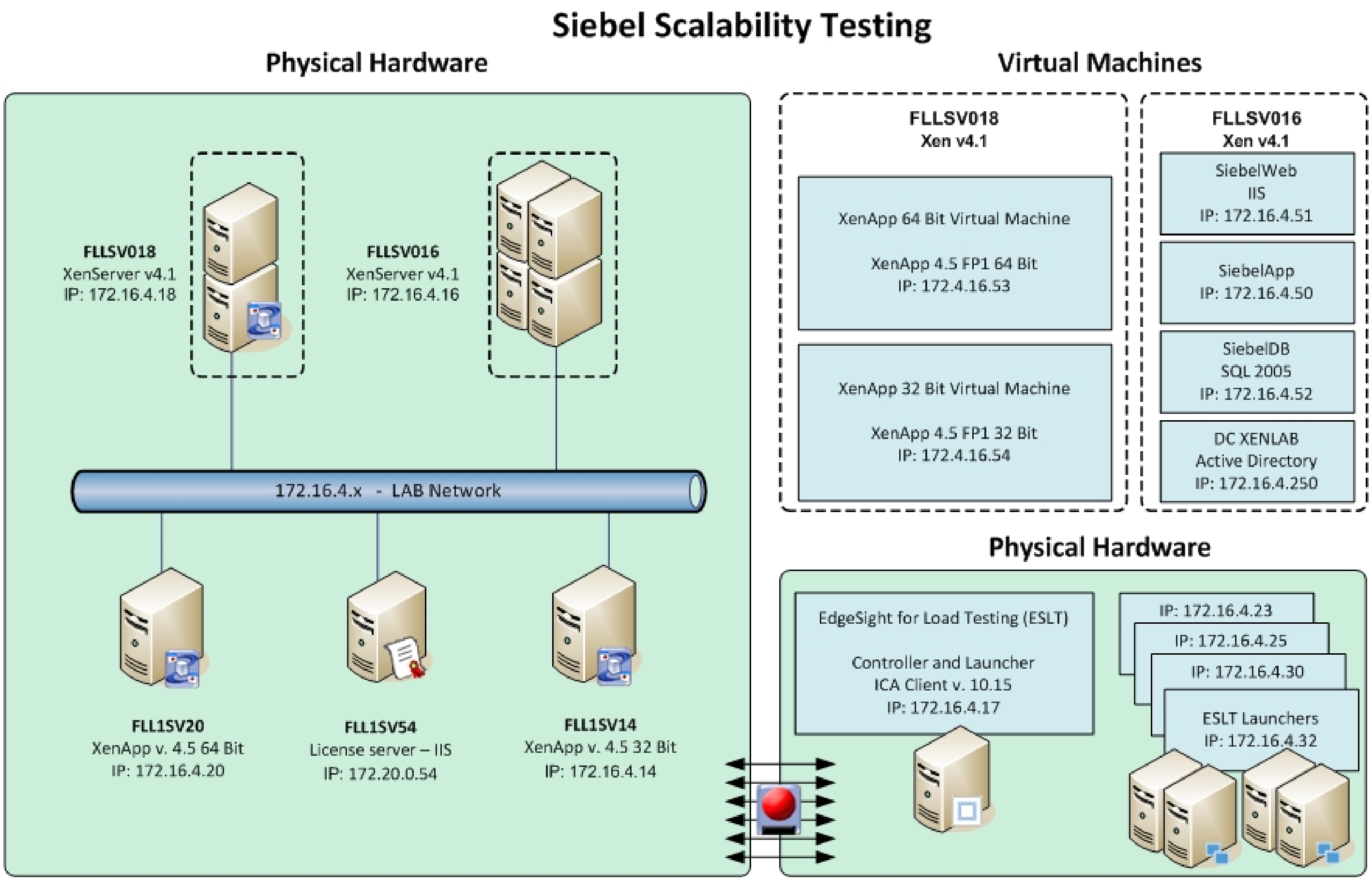


Figure 1 – Siebel Scalability Test Architecture

Please refer to the Appendix for additional details on the scalability testing environment.

Scalability Results and Analysis

Measurements

Throughout the testing cycle, server performance activity was monitored and recorded using the Microsoft Performance Monitoring Utility. The following table contains the performance counters that were recorded during test execution.

Table-7: Key Counters

Logical Disk	% Disk Time, % Free Space
Memory	Available Bytes, Pages Input/Sec, Pages Output/Sec
Paging File	% Usage
Physical Disk	Current Disk Queue Length
Processor	% Interrupt Time, % Processor Time
System	Context Switches, Processor Queue Length
Terminal Services	Active Sessions
Application Responsiveness	User Experience
Collect counters using Microsoft Performance Monitor writing to file on local hard drive of server being tested. An interval of 4 seconds was used.	

While executing the script, both concurrency and rate control factors where enabled for a period of 3 hours. Over the period for which the load was defined, the rate at which users connected changed, from the start rate to the end rate.

As a result, the ESLT Controller was connecting users every five seconds and over the course of 180 minutes increases this rate to ten seconds. The first 120 users were loaded every five seconds then the remaining users were loaded every ten seconds. Depending on the environment (32-bit or 64-bit/ physical or virtual), the maximum concurrent users was defined differently.

All of the potential 500 users were configured to use the same mandatory profile. This configuration allowed the same scenario to be run in multiple independent ICA sessions.

During test execution, an administrator remained logged into the Citrix XenApp Server. After several users logged onto the Citrix XenApp server, the session was used to obtain qualitative measurements of the server, including application responsiveness of Siebel 8.0 and screen refresh speed.

It is important to note that utilizing EdgeSight for Load Testing to perform this test did not add any additional overhead to the Citrix XenApp server. Therefore, the scalability results directly correlate to users logging into a Citrix XenApp server while simultaneously following the workflows.

When analyzing the raw data, it may be beneficial to convert the performance monitor logs into comma separated values for further processing in Excel. The Appendix details this process.

Table-8: Application Responsiveness Definitions

Application Responsiveness	Details and Color
Excellent	Equivalent or better than local PC performance.
Acceptable	Screen updates are fluid with minimal effect on user's workflow.
Poor	Screen updates are noticeable and latency is increased. However, the user is still able to function.
Failure	The session becomes frozen or disconnected. Therefore, the user cannot continue their tasks.

Results Scenario #1: XenApp running on a 32-bit Win2k3 SP2 Server Enterprise Physical and Virtual Machines

Qualitative Performance Analysis

Qualitative usability thresholds are listed in the chart below. For an explanation of the rating system, refer to the section Measurements.

Table-9: 32-bit Physical Platform Results

Total Sessions	Baseline	50 Users	100 Users	125 Users	145 Users	155 Users	165 Users	175 Users	185 Users	195 Users	205 Users	Avg/ User
CPU (%)	6	20	34	41	46	49	52	55	57	60	63	**0.28**
Memory (MB)	566	2035	3503	4238	4825	5119	5412	5706	6000	6294	6587	**29**
User Experience	Excellent	Excellent	Excellent	Excellent	Excellent	Acceptable	Acceptable	Poor	Poor	Failure	Failure	

Table-10: 32-bit Virtual Platform Results

Total Sessions	Baseline	50 Users	100 Users	125 Users	145 Users	155 Users	165 Users	175 Users	185 Users	195 Users	205 Users	Avg/ User
CPU (%)	11	31	51	61	69	73	77	81	85	89		**0.37**
Memory (MB)	379	2067	3755	4599	5275	5612	5950	6287	6625	6963		**34**
User Experience	Excellent	Excellent	Acceptable	Acceptable	Poor	Poor	Failure	Failure	Failure	Failure		

Result and Analysis

To summarize the results obtained from the first scenario, figure-6 below presents a comparison between physical and virtual machines with respect to the maximum number of concurrent user sessions that can be sustained on a single 32-bit XenApp server.

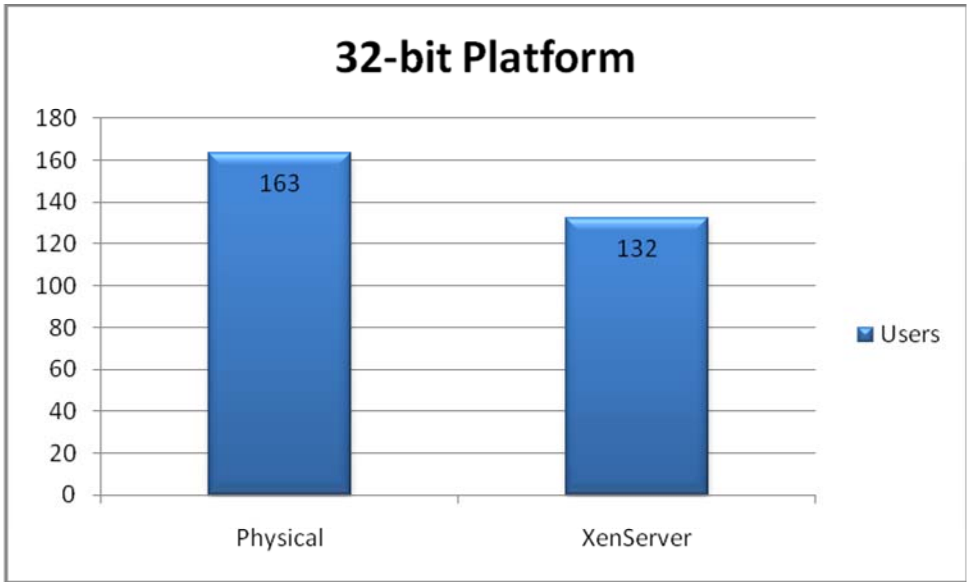


Figure 2 - 32 bit XenApp Physical versus XenServer

The final result demonstrated a **27 %** overhead with the physical server versus the XenServer 4.1.

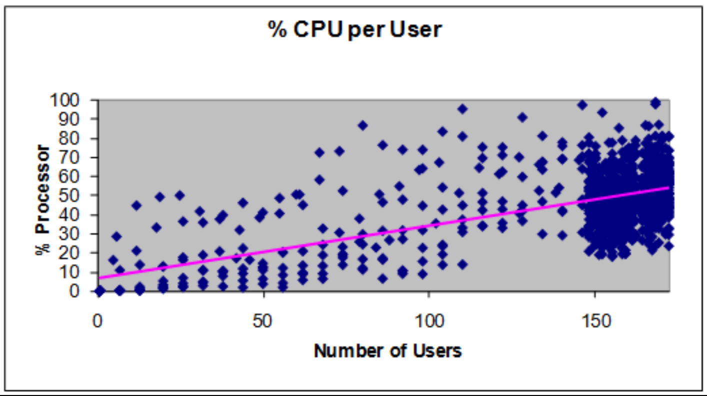
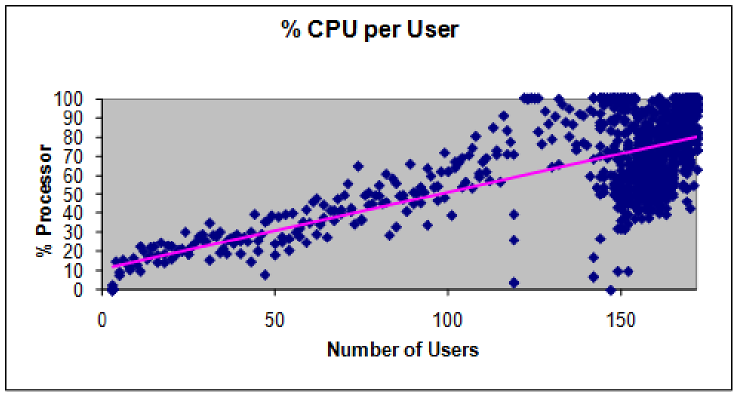
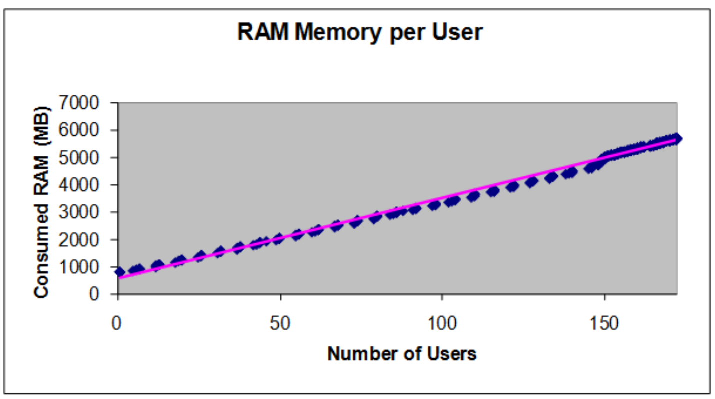
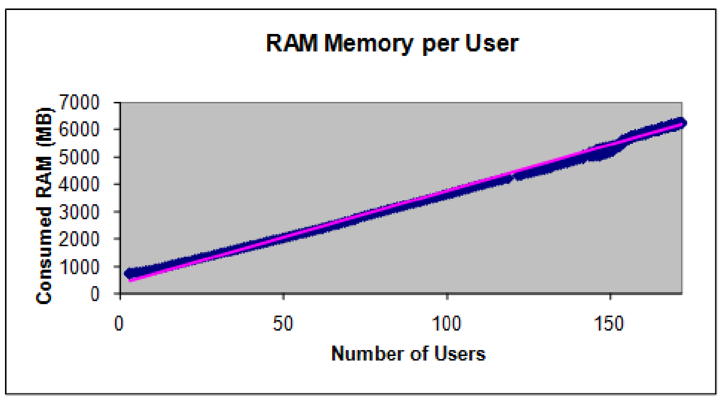
Based on the results, **Kernel Memory** depletion is the principal limiting factor for 32-bit Operating System scalability.

- On the Physical server %Disk Time was climbing to 90% when reaching 168 users causing slowness in the application.
- On the Virtual server each session was using more processor time (0.37% versus 0.28%). As a result, the virtual server accepted 27% less users.

During the tests the memory usage was optimized by increasing Page Pool allocation and Page Table Entries (PTE) to the maximum for 32-bit systems. Enabling the Physical Address Extension (PAE) mode in the boot.ini file provided more User Memory (6GB) but did not increase the Kernel Memory size still limited to 2GB.

The following table compared Processor and Memory usage for 32-bit XenApp servers when ramping up users. The left column was captured on a physical server and the right column on virtual server.

Table-12: 32-bit Detailed Results

Processor - 32 bit XenApp Physical	**Processor - 32 bit XenApp on XenServer**
Linear Trend: % Processor = 0.2754 * Number of Users + 6.3892	Linear Trend: % Processor = 0.4029 * Number of Users + 10.693
	
Memory - 32 bit XenApp Physical	**Memory - 32 bit XenApp on XenServer**
Linear Trend: Memory Usage = 29.373 * Number of Users + 565.93	Linear Trend: Memory Usage = 33.761 * Number of Users + 379.24
	

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Results Scenario #2: XenApp running on a 64-bit Win2k3 SP2 Server Enterprise Physical and Virtual Machines

Qualitative Performance Analysis

Qualitative usability thresholds are listed in the chart below. For an explanation of the rating system, refer to the section Measurements.

Table-13: 64-bit Physical Platform Results

Total Sessions	Baseline	50 Users	100 Users	125 Users	145 Users	155 Users	165 Users	175 Users	185 Users	195 Users	205 Users	Avg/ User
CPU (%)	6	20	34	41	46	49	52	71	74	78	81	**0.34**
Memory (MB)	566	2035	3503	4238	4825	5119	5412	9382	9845	10308	10771	**46**
User Experience	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Acceptable	Acceptable	Poor	Poor	Failure	

Table-14: 64-bit Virtual Platform Results

Total Sessions	Base line	50 Users	100 Users	125 Users	145 Users	155 Users	165 Users	175 Users	185 Users	195 Users	205 Users	Avg/ User
CPU (%)	22	41	61	71	79	82	86	90	94	98		**0.39**
Memory (MB)	971	3141	5312	6397	7265	7699	8133	8567	9001	9435		**43**
User Experience	Excellent	Excellent	Excellent	Acceptable	Acceptable	Poor	Poor	Failure	Failure	Failure		

Result and Analysis

To summarize the results obtained from the second scenario, figure-7 below presents a comparison between physical and virtual servers with respect to the maximum number of concurrent user sessions that can be sustained on a single 64-bit XenApp server.

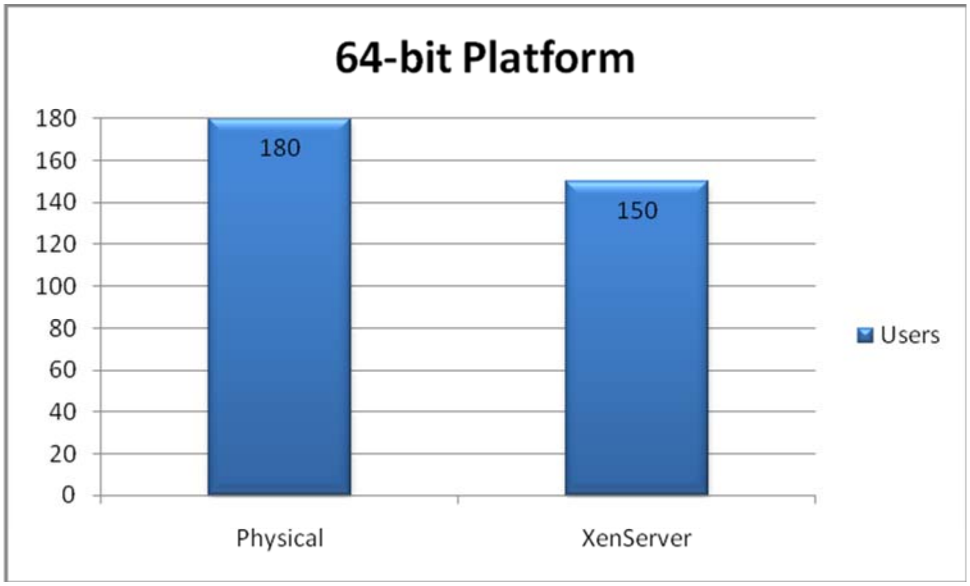


Figure 3 - 64 bit XenApp Physical versus XenServer

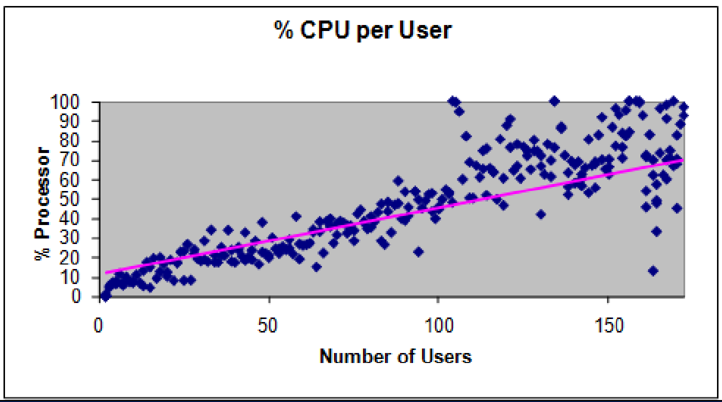
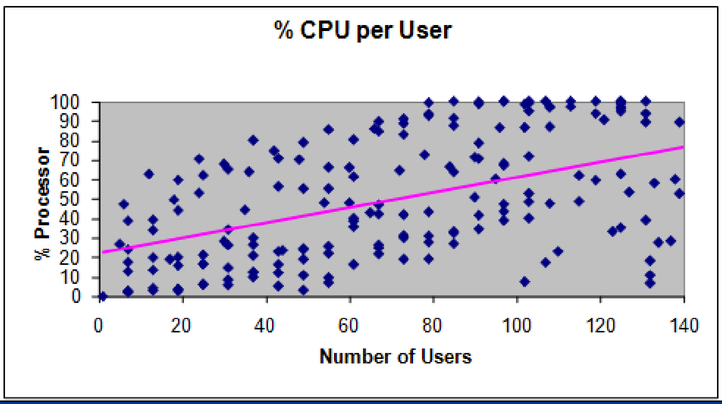
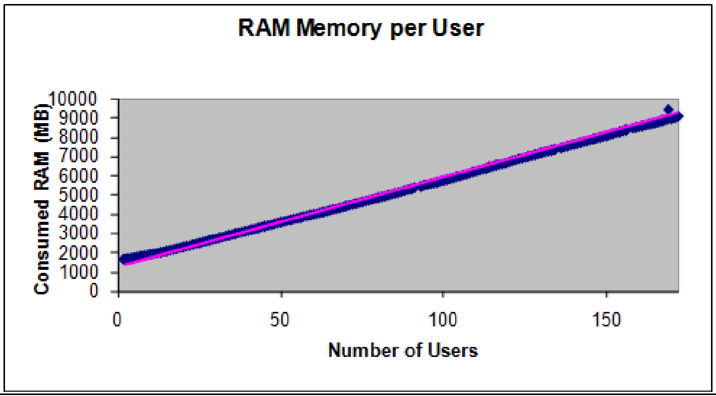
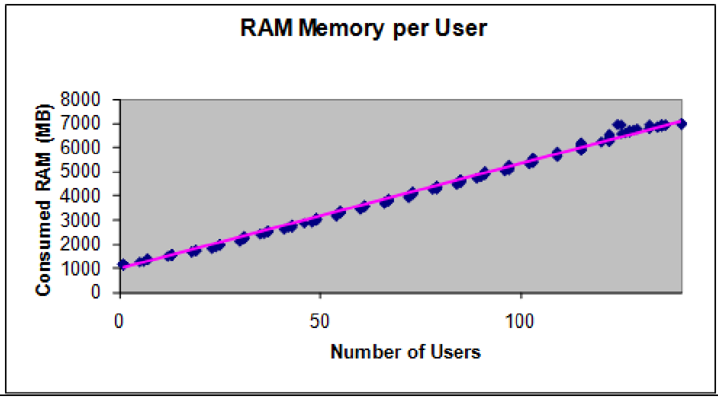
The final result demonstrated a **20 %** overhead with the physical server versus XenServer 4.1.

Based on the results, **Processor Time** was the principal limiting factor for 64-bit Operating System scalability.

- On the physical server %Processor Time were climbing at 100% when reaching 180 users causing slowness in the application.
- On the virtual server each session was using more processor time (0.39% versus 0.34%). As a result, the virtual machine accepted 20% less users.

The following table compared Processor and Memory usage for 64-bit XenApp servers when ramping up users. The left column was captured on a physical server and the right column on virtual server.

Table-15: 64-bit Detailed Results

Processor - 64 bit XenApp Physical	**Processor - 64 bit XenApp on XenServer**
Linear Trend: % Processor = 0.3389 * Number of Users + 11.433	Linear Trend: % Processor = 0.3899 * Number of Users + 21.984
	
Memory - 64 bit XenApp Physical	**Memory - 64 bit XenApp on XenServer**
Linear Trend: Memory Usage = 46.305 * Number of Users + 1278.5	Linear Trend: Memory Usage = 43.407 * Number of Users + 970.98
	

Results Conclusion

The test results yield the following key conclusions:

- Virtualizing XenApp servers on XenServer can have significant benefits as outlined in the executive summary of this document. Doing so on Windows Server 2003 32-bit with XenApp 32-bit decreases the number of user sessions supported by a single server by 27%. The overhead associated with Windows Server 2003 64-bit and XenApp 64-bit reduces that overhead to 20%.
- The tests detailed in this analysis show that although Siebel 8.0 CRM runs on the 32-bit version of Internet Explorer, the use of a 64-bit OS combined with XenApp 64-bit achieves higher scalability numbers in both physical and virtual implementations compared to 32-bit implementations.
- Why didn't the 64-bit servers double scalability as compared to the 32-bit servers? Since the 64-bit version of Internet Explorer 6.0 does not support 32-bit ActiveX controls, the 64-bit version of Internet Explorer 6.0 was not able to meet the deployment requirements of the Siebel framework. In order to utilize the Siebel application on a 64-bit operating system, the 32-bit version of Internet Explorer needs to be used. This configuration requires extra resources on the 64-bit server to convert and emulate the 32-bit version of Internet Explorer.

Overall, higher user density was found when running XenApp on physical servers. If administrators chose to run the 32-bit version of XenApp, server virtualization can actually increase the total number of users supported by a single physical server. This can be achieved by running more than one virtual XenApp server on a physical server. Since the 32-bit OS cannot address more than 4 GB of memory and many servers today come with 64-bit CPUs and relatively inexpensive RAM upgrades, as many as two virtual XenApp servers can be hosted on a single physical server.

Appendice A: Test Methods

There are four primary types of scalability testing methods appropriate for a Citrix XenApp environment. Therefore, a decision must be made in selecting a test method in order to standardize a valid scalability test of the environment. Below are the appropriate testing methods:

- **Scripted Test.** Automated execution of scripts that mimic a user's actions without any user intervention
- **Real Users Test.** Actual users log in to the system and run through their daily tasks without any specified order
- **Real Users with Tasks List.** Actual users log in to the system and run through a set of pre-defined tasks
- **Combination.** A combination of two or more of the aforementioned testing methods

This section discusses each method in more detail and compares the advantages and disadvantages of using each method.

Scripted Test

For this method, a standard set of scripts are leveraged to control the actions of test users that are similar to typical Siebel 8.0 users. These scripts are developed to simulate a desired set of predefined actions (workflows), which are based on the user's role and applications used during a typical user session. Each workflow may contain sub-workflows that dictate the multiple paths users take to complete these daily tasks. These sub-workflows will be the basis for scripts that are generated. Initiation of script execution would be at set intervals to ensure that steps taken while working in an application are not repeated simultaneously for all virtual users during the test. These intervals ensure more accurate results since the application is able to respond in a more realistic manner.

For the test process detailed in this document, the functional flows for these scripts have been developed by Citrix Consulting and are based on test flows created by Oracle for application verification testing.

Real User Test

The second method for scalability testing is to have users log into the system and perform tasks similar to those of a typical workday. The results obtained from this method are geared toward real-life scenarios. The caveat to using this method is that more variables exist in the test, such as the number of users, activities, and interruptions. This makes it more difficult to run the same exact test while increasing user load, making system configuration changes, or repeating the test.

When running this type of test, most client environments would benefit from monitoring the systems and capturing the performance counters and data in a database format over an extended period of time. Citrix EdgeSight for Citrix XenApp is designed to accomplish this, and these figures can provide significant value and accuracy, provided that a large enough population sample of data is captured.

Real Users with Task List

The next method for scalability testing is a combination of Scripted Tests and Real User Testing. Real User Testing with task lists includes having real users access the system, while executing a written set of tasks in a random order. These tasks are analogous to the workflows defined in this document. Developing customer specific tasks for scalability testing will represent the different types of users that will access the system on a daily basis. Each user will be accessing the system at different speeds, reflecting a realistic production environment. However, these users will be following a common set of tasks that will help with standardizing the scalability tests when they need to be re-run with additional users.

This type of test is resource intensive and can be difficult to coordinate. Most corporate environments cannot provide multiple resources for this type of application testing and evaluation.

Combination

The final method for scalability testing is a combination of a custom script and real users accessing the test environment. For example, five client computers emulating six users each could be used in conjunction with several real users performing searches and more complex customer transactions. This would allow the administrators to load the system to specific level, and then evaluate the subjective and objective results of the users' interaction with the Citrix Presentation Servers.

Scalability Test Methods Summary

The Scalability Test Methods Summary table summarizes the advantages and disadvantages of each scalability test method described above.

Testing Method	Advantages	Disadvantages
Scripted test	• Completely controlled with no variables • Identical tests can be repeated as many times as needed • User time is not required to do test • Tests can be re-run as environment grows	• Takes significant time/tools to create test scripts • User skill levels not incorporated in test
Real Users Test	• Real life test • Allows for different user types and skill levels	• Impossible to have two identical tests • User's time is needed to perform test • Need Users from ISV's customer base
Real Users with Task List Test	• Can be as controlled as necessary • Tests can be repeated with high degree of similarity between previous tests • Allows for different user types and skill levels	• User's time is needed to perform test • The project team will have to create task list for users customized to their role. (very complex and time consuming)
Combination	• Can emulate most user activities with custom scripts while real users can test actions that are not scripted	• Multiple users' time is needed to perform tests

Siebel 8.0 and Citrix XenApp Scalability Testing Method

Based on the project requirements, the Scripted Test Method has been leveraged. This ensured identical, controlled tests that could be repeated for multiple tests. The scripts developed for testing were carefully formulated by Citrix Consulting Solutions while following the workflows created by Oracle to accurately simulate normal user load on the XenApp Servers. Citrix EdgeSight for Load Testing was the primary testing tool which was used to develop and execute the scripts.

Appendice B: Test Plan

This section provides details of the test plan for the scalability testing on the XenApp and Siebel 8.0 environment. As with all testing strategies, a clearly defined testing process helps to ensure accurate and repeatable results.

Scalability Testing Process

The purpose of the scalability tests in this project was to determine the maximum number of users that could access the Siebel 8.0 applications via a published Internet Explorer on XenApp 4.5 without overwhelming the server. Four different test scenarios were executed to assess differences in scalability between using 32 and 64-bit operating systems on the XenApp servers and comparing both cases to XenApp running directly on physical servers compared to running XenApp on virtual servers running on Citrix XenServer.

Citrix EdgeSight for Load Testing (ESLT) v2.7 was leveraged to develop and execute the scripts. The ESLT controller managed the number of simulated users while the Windows Performance Monitor was used to log the performance characteristics of the XenApp servers. The data was used to determine the limiting resource of the server and the maximum number of active concurrent users a Citrix XenApp server can support in each test case.

The test scripts simulated, as best as possible, how most users would use the Siebel 8.0 application. The simulated users launched an ICA session to the Citrix XenApp server and opened the published Internet Explorer application like a real user would. After launching Internet Explorer, the simulated users logged into the Siebel 8.0 application and followed the steps provided by selected workflows. Refer to the Appendix for more details on the workflows.

During test operation, EdgeSight for Load Testing launches a preconfigured number of ICA sessions, which originates from five Launcher servers, to a published application on the designated XenApp server. Once the sessions were established, a script was run to authenticate users in Siebel 8.0 CRM and simulate user's activities.

This first test established a baseline or threshold regarding the maximum number of concurrent ICA sessions a XenApp server could effectively support on a typical physical XenApp server prior to initiating comparative testing in virtual environments. Although the focus of testing was to ascertain the highest number of user sessions supported by a single XenApp server, it was also necessary to ensure that product usability was in no way adversely affected. The primary focus of the testing was to evaluate objective factors such as memory and utilization.

The EdgeSight for Load Testing tool was configured to ensure that a sufficient number of concurrent ICA sessions would be created to reach approximately 85% of the processor usage, i.e., the point at which users could begin to notice a decrease in performance significant enough to potentially affect productivity. To ensure functional validity in the testing, the test team performed logins and limited manual application execution to evaluate application response and usability. The number of concurrent ICA sessions was recorded using Microsoft Performance Monitor and the associated data was analyzed.

EdgeSight for Load Testing Requirements

- According to EdgeSight for Load Testing best practices, the following steps were taken: in the Connections folder open the ICA-tcp properties and choose the Sessions tab. Under "When session limit is reached…" Ensure that the "end session" option is enabled and that the override user settings checkbox is also enabled.
- In the "Logon Settings" tab make sure that the "Use Client-provided logon information" option is selected and that the "Always prompt for password" checkbox is unchecked.
- If using Windows Server 2003 or later please also ensure that the "Restrict each user to one session" settings, in the Server Settings folder, is set to No.

Appendice C: Test Environment

Server Specifications

Table-1: XenApp Servers

Role	Physical Host	VM Hostname	IP	Domain
XenServer (host)	FLL1SV018	N/A	172.16.4.18	N/A
x86 XenApp (vm)	FLL1SV018	XenApp45FP1x86	172.16.4.54	Xenlab
x64 XenApp (vm)	FLL1SV018	XenApp45FP1x64	172.16.4.53	Xenlab
x86 XenApp (physical)	FLL1SV014	N/A	172.16.4.14	Xenlab
x64 XenApp (physical)	FLL1SV020	N/A	172.16.4.20	Xenlab
X86 License Server (vm)	FLL1SV54	FLL1SV068	172.20.0.54	Xenlab
Domain Controller	FLL1SV016	FLLFLLVMDC01	172.16.4.250	Xenlab

The Siebel system is accessed with a web client via a 32-bit Internet Explorer 6 hosted on the XenApp servers.
The Siebel Web Server and application reside both on separate Virtual Machines.
The Siebel database is hosted on virtual machine running Microsoft SQL Server 2005.

Table-2: Siebel Servers

Role	Physical Host	VM Hostname	IP	Domain
XenServer (host)	FLL1SV016	N/A	172.16.4.16	N/A
Siebel App	FLL1SV016	SiebelApp	172.16.4.50	Xenlab
Siebel Web	FLL1SV016	SiebelWeb	172.16.4.51	Xenlab
Siebel DB (SQL 2005)	FLL1SV016	SiebelDB	172.16.4.52	Xenlab

The EdgeSight for Load Testing environment consists of five physical servers.
The two main components of the EdgeSight for Load Testing product are:

- **EdgeSight for Load Testing Controller** – Acts as the administrative mechanism for creating and controlling the virtual users running on each of Launcher servers.
- **EdgeSight for Load Testing Launchers** – Generates multiple virtual user sessions to launch the published applications running on Citrix Presentation Server.

Table-3: EdgeSight for Load Testing Servers

Role	Physical Host	IP
Controller & Launcher	FLL1SV017	172.16.4.17
Launcher	FLL1SV023	172.16.4.23
Launcher	FLL1SV025	172.16.4.25
Launcher	FLL1SV030	172.16.4.30
Launcher	FLL1SV032	172.16.4.32

Hardware Specifications

Table-4: Hardware Specifications

Server Role	Specifications	Configuration	
XenServer hosting Siebel and XenApp Environment	Vendor/Model	HP, ProLiant DL360 G5	
	System Type	x64-based Server	
	Number of Processors	Two dual-core Intel Xeon 5150	
	Processor Speed	2667 MHz	
	Memory (GB)	8GB for the 32bit OS and 16GB for the 64bit OS	
	Disk Capacity	2x 72GB Raid1	
	Disk Speed (RPM)	15k	
	BIOS Version/Date	HP P58, 5/1/2007	
XenApp Server	Vendor/Model	HP, ProLiant DL360 G5	
	System Type	x64-based Server	
	Number of Processors	Two dual-core Intel Xeon 5150	
	Processor Speed	2667 MHz	
	Memory (GB)	8GB for the 32bit OS and 16GB for the 64bit OS	
	Disk Capacity	2x 72GB Raid1	
	Disk Speed (RPM)	15k	
	BIOS Version/Date	HP P58, 5/1/2007	
EdgeSight for Load Testing Controller	Vendor/Model	HP, ProLiant DL360 G5	
	System Type	x64-based Server	
	Number of Processors	Two dual-core Intel Xeon 5150	
	Processor Speed	2667 MHz	
	Memory (GB)	8GB	
	Disk Capacity	2x 72GB Raid1	
	Disk Speed (RPM)	15k	
	BIOS Version/Date	HP P58, 5/1/2007	
EdgeSight for Load Testing Launcher	Vendor/Model	HP, ProLiant DL360 G3	HP Proliant DL360 G2
	System Type	x64-based Server	X32-based Server
	Number of Processors	One Intel Xeon	One Intel Xeon
	Processor Speed	3.2 GHz	1.4GHz
	Memory (GB)	3 GB	2 GB
	Disk Capacity	32GB	32GB
	Disk Speed	15k	15k
	BIOS Version/Date	HP P31, 1/28/2004	HP P26, 03/10/2004

Software Specifications

Table-5: Software Specifications

Role	Software
Load Generation Tool	Citrix EdgeSight for Load Testing
Application Delivery Tool	XenApp 4.5.1 (32bit and 64bit)
Test Application	Oracle - Siebel 8.0 CRM
Hardware Virtualization	XenServer Enterprise v 4.1.0
XenApp Operating System	Windows Server 2003 SP2, Enterprise Edition (32bit and 64bit)

Workflow Configuration

The workflows used during this testing are based on Oracle's Siebel 8.0 workflows provided to Citrix Consulting Solutions during a Siebel 8.0 validation initiative.

Human Resources Script: **Create new employee record** (Simulates how a typical HR agent enters information pertaining to a new employee)

- HR agent launches a published Internet Explorer
- HR agent enters Siebel credentials
- HR agent creates a new employee account
- HR agent enters employee info and manager last name
- HR agent closes the function

EdgeSight for Load Testing Script

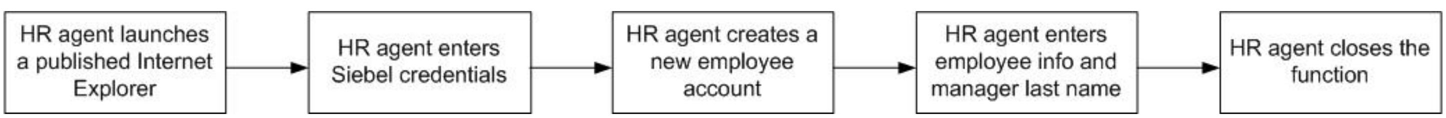


Figure 4 – User Workflow

The script was configured with an unlimited loop to generate new employees. A timestamp variable was used in a Scriptlet to create a unique employee identifier. Please see the JavaScript (Scriptlet) below used to create different accounts for each run:

```
var rootString = "CTX", dateStamp, temp = "", UniqueString = "";

dateStamp = new Date();

temp += dateStamp.getYear();
temp += dateStamp.getMonth();
temp += dateStamp.getDate();
temp += dateStamp.getHours();
temp += dateStamp.getMinutes();
temp += dateStamp.getMillisecond ();

UniqueString = rootString + temp;
```

Windows Server 2003 and XenApp Server Optimizations

Table-6: XenApp Server Settings

Server Type	Operating System	Settings
XenApp on Physical 64-bit server	32-bit Windows 2003	2 x Dual-core 2.6 GHz, 8 GB RAM, 8GB page file with Physical Address Extension (PAE) enabled
	64-bit Windows 2003	2 x Dual-core 2.6 GHz, 16 GB RAM, 12GB page file
XenApp on Virtual Machine hosted on 64-bit server	32-bit Windows 2003	2 x Dual-core 2.6 GHz, 8 GB RAM, 8GB page file (single VM) with Physical Address Extension (PAE) enabled
	64-bit Windows 2003	2 x Dual-core 2.6 GHz, 16 GB RAM, 12GB page file (single VM)

In preparation for this analysis, Citrix Consulting Solutions applied a standard set of server tuning to improve performance for Citrix XenApp operating in a terminal services environment on Windows Server 2003. These adjustments can help avoid commonly-seen issues such as frequent session disconnects or sluggish servers, and can increase user load. Modifications to the operating system were centered on the following types of optimizations: kernel memory, hard disk and file system, file sharing, network, and operating system.

For 32-bit operating systems, kernel memory depletion is one of the primary limiting factors that affect server load. Kernel memory improvements made to both the physical and virtual XenApp servers include ensuring sufficient resources are allocated to the following four areas, which are interdependent: paged pool, non-paged pool, system page table entry (PTE), and the system cache. The optimum values for these kernel memory areas were verified on the 64-bit servers as well. Additional details can be seen in the optimization table.

Tuning for the hard disk was performed both within the operating system and on the RAID controller on the hardware. Within Windows Server 2003 device manager, write caching was enabled where applicable and advanced performance was also selected. Registry changes were made to prevent against known terminal services issues. These and other details are outlined below.

File sharing in a terminal services environment, to access resources such as user profiles, in Windows Server 2003 is dependent on legacy protocols, and can also be tuned to operate much more reliably for users and between servers and file shares. Improvements that were made to the environment included those that allow for additional file sharing requests per session, reduced network traffic and improved network utilization. These adjustments to the registry on the XenApp servers are also detailed in the table below.

The XenApp user experience can be further improved by tuning various built-in operating system services and components in Windows Server 2003. Adjustments to graphics and user inputs were made such as cursor and menu item displays, Windows visual effects adjustments, automatic warning messages, and auto-end-task or other notifications. In addition, lower-level operating system services were modified to improve operating system performance with a high user load, such as disk paging and file system notify events. Further details are outlined in the optimizations table below.

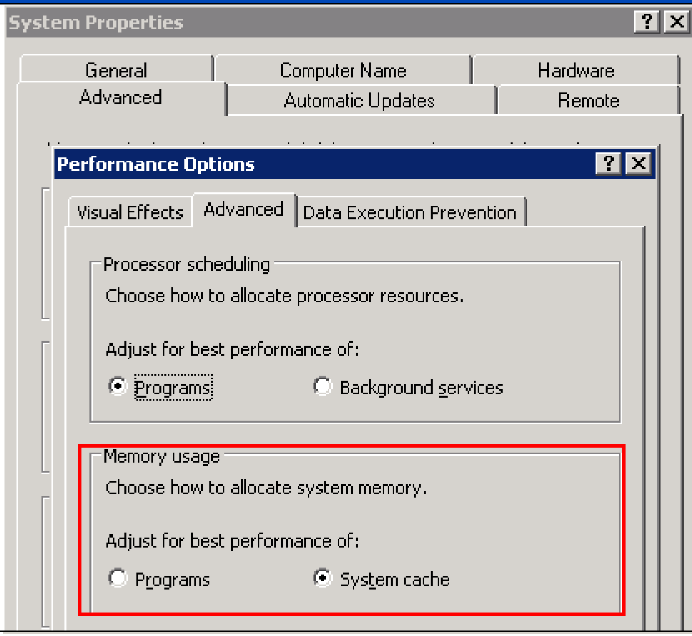
Table-16: XenApp Server Optimizations

Optimization Name	Category	Applicable Servers	Details
System Cache	Kernel Memory	All	Verified system cache is enabled in performance options
Non-paged Pool	Kernel Memory	All	Verified that the paged pool allocation is allocated automatically
Page Pool allocation	Kernel Memory	x32P & x32V	Increased to maximum for 32-bit systems
System PTE	Kernel Memory	x32P & x32V	Increased Page Table Entries
Page File	Kernel Memory	All	Page file size increased to size of RAM, which is 8 GB for x32 servers and 16 GB for x64 servers
Write Cache	Hard Disk & File System	All	Write caching improves hard disk read/write times
Lazy Flush Interval	Hard Disk & File System	All	Improves reliability for terminal services sessions
SMB Requests	File Sharing & Network	All	Max open files and file requests are optimized for this file sharing protocol
Packet Resubmit	Network	All	Optimizes the number of times that lost packets are resubmitted
System Messages	Operating System	All	System error messages are reduced and not reliant on user input
NTFS Updates	Operating System, File System	All	Disables file system updates to the operating system to improve performance
Visual Effects	Operating System	All	Changes Windows graphics settings to best performance
Executing Paging	Operating System	All	Decreases amount of paging to disk for drivers and other system components
Auto End Tasks	Operating System	All	Automatically ends non-responsive applications
Menu Delays	Operating System	All	Increases response time for mouse-overs and menu items
Cursor Blink Rate	Operating System	All	Cursor blink rate reduced in half to decrease devoted resources

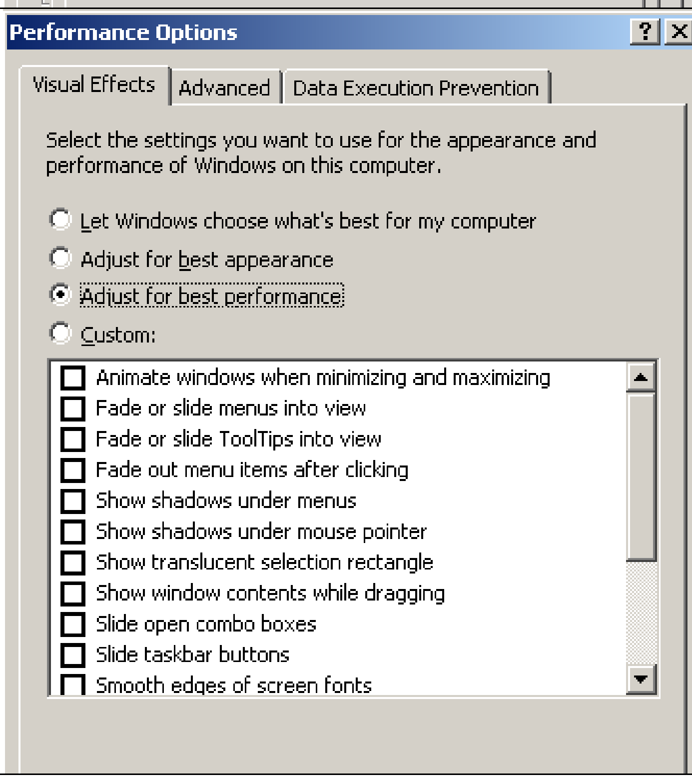
* Virtual and Physical machines are denoted as “V” and “P” under Applicable Servers

Performance Settings

Configure Advanced Performance Options as mentioned in the two screenshots below:

<table>
<tr><th colspan="3">Performance Settings</th></tr>
<tr><th></th><th>Screenshot</th><th>Description</th></tr>
<tr><td>1</td><td>
</td><td>

- Launch System Properties and select the advanced tab.
- Choose Performance Options and select the advanced tab.
- Configure the processor scheduling section to use programs instead of background services.
- Configure the memory usage section to use system cache instead of programs.

</td></tr>
<tr><td>2</td><td>
</td><td>

- In the Performance Options window select the Visual Effects tab.
- Configure the settings for the appearance and performance to adjust for best performance.

</td></tr>
</table>

Figure 5 – Performance Options Configuration

User Optimizations

A unique mandatory user profile was created for all users, including application's settings requirements for the ActiveX component and the following optimizations:

- Disable Active Desktop
- Set sound scheme to "No Sounds"

Virtual Machines Configuration

Tests were performed using the default settings for Shadow memory: "Optimized for Citrix XenApp".

Each test was conducted using a single Win2K3 SP2 Server Enterprise Edition (32bit and 64bit) virtual machine with four Virtual CPUs.

ICA Files Configuration

Disable Persistent Cache otherwise conflicting with the EdgeSight for Load Testing bitmap synchronization feature.

```
[WFClient]
    Version=2
    TcpBrowserAddress=<XenApp IP address>
[ApplicationServers]
    Siebel=
[Siebel]
    Address=Siebel
    InitialProgram=#Siebel
    ClientAudio=Off
    Compress=On
    TWIMode=On
    DesiredHRES=1024
    DesiredVRES=768
    DesiredColor=4
    TransportDriver=TCP/IP
    WinstationDriver=ICA 3.0
    PersistentCacheEnabled=Off
```

Load Balancing

- Citrix Server - A new Citrix load evaluator was created. The built-in default load evaluator limits the number of users at 100 Concurrent Users (CCU) per XenApp server. For the test purpose this counter was extended to 300 CCU by creating a custom load evaluator.
- EdgeSight Launchers – The workflow script was configured to use a balanced model. In the balanced model, the controller directed an equal number of users on each Launcher to execute the test workflow.

Siebel Configurations

Siebel Backend Configuration

To allow more than 15 concurrent connections the following action needed to be performed on the backend servers:

1. Login to a Siebel Web application as SADMIN
2. Click SiteMap (Globe icon)
3. Click Administration- Server Configuration
4. Click Server Components
5. Find Call Center ENU component
6. Open its Parameters and change "Max Tasks" to 1500
7. Find Server Request Broker, Request Processor and change its "Max Tasks" to 1500
8. Log off
9. Restart Siebel Server Service using "Services" in Control Panel

Siebel Front-End Configuration (High Interactivity Framework)

The Siebel High Interactivity Framework for IE is designed to provide users of Siebel applications with a feeling of traditional GUI-based client application usage. The high-interactivity client reduces the number of page refreshes when interacting with an application by performing data-only updates from the Siebel server. As a result, the network bandwidth usage is optimized. The high-interactivity framework also provides performance and usability enhancements by utilizing supported capabilities within Microsoft Internet Explorer, such as Document Object Model (DOM), Java, and ActiveX controls.

In order to utilize the Siebel CRM 8.0 application, the high-interactivity framework must be downloaded and installed on the XenApp Server. The client must meet one of the following security settings:

- Utilize a Local intranet zone with default security settings (Medium -low) for the Siebel application. To use this zone, the application URL must be hosted on the same intranet as the end users' Web browsers.
- Utilize a Trusted sites zone with default security settings (Low) for the Siebel application. To use this zone, the application URL must be added as a site to the Trusted sites zone.

To simplify the user configuration individual security settings have been adjusted in a mandatory profile.

High-interactivity mode relies on ActiveX controls to deliver features such as interactive controls, keyboard accelerators, and email client integration. In order to run this, the Web browser must be enabled to download, instantiate, and script ActiveX controls. For most deployments, downloading the controls on demand from a Web server is preferable. In addition, downloading and running many ActiveX controls requires permissions associated with Power Users. The following options have been implemented:

- Allow end users to download ActiveX controls by modifying user groups or permissions in one of two ways:
  - Add users to the Power Users group
  - Relax default permissions granted to the Users group
- Pre-deploy ActiveX controls in environments with secure user permissions

In addition to the security setting and ActiveX control handling, certain features accessed when using the high interactivity client require a supported Java Runtime Environment (JRE).

Converting Windows Performance Monitor Logs

Data collected using Performance Monitor may need to be converted to be opened in a spreadsheet application.

How to Create a Comma Separated Values (CSV) file

Windows 2003 and XP provide a number of command-line tools to monitor performance. These are the logman utility (logman.exe), the relog utility (relog.exe), and the typeperf utility (typeperf.exe).

The relog.exe utility can create new performance logs from existing performance logs. Use the relog.exe tool to:

- Convert a log from one type to another, such as a Microsoft Windows 2003 binary log file (.blg) to a comma-separated values (.CSV) file.

To convert a binary PerfMon log to a CSV file, use the command:

```
>>relog.exe logfile.blg -f csv -o logfile.csv
```

For details on how to use relog.exe, in a Windows XP from a command prompt window, run "relog.exe -?" or review the following Citrix KB article: http://support.microsoft.com/?kbid=303133

Appendice D: Definitions

EdgeSight for Load Testing Definitions

Load Testing

Load Testing is a load generating software solution that enables administrators to predict how systems will cope with high levels of user load. By simulating hundreds of virtual Citrix users and monitoring the responsiveness of the system during testing, the administrator is allowed to determine how the current configuration and hardware infrastructure will support anticipated demand.

Controller

The central management console for load testing is the Controller. This component is used to create virtual users and record, manage and monitor the scripts. ESLT is licensed on the computer that contains the controller. An organization that has multiple controllers would require multiple licenses.

Launcher

The Launcher creates the virtual user sessions. The Launcher connects to the server that is being tested to re-enact the transactions that a user would perform and record the responsiveness of the system. An administrator can use the Controller to connect to multiple Launchers on different computers in any location to test responsiveness while simulating multiple locations across the organization. Launchers on servers or workstations with hardware meeting the minimum specifications outlined below should be capable of generating loads of 30-50 users, depending on the resource intensity of the automation scripts; therefore, tests requiring more than 50 users will typically require more than one Launcher. Launchers require the following:

- Windows XP, Windows 2000, or Windows 2003
- ICA Client 8.1 or later
- CPU – 2GHz or faster
- Memory – 1 GB or more
- Disk – Minimum 200 MB of free space

Mouse Click

Mouse inputs contain two sets of coordinates (screen coordinates and windows coordinates) so that the virtual user knows exactly where to click in the screen. In addition, the window ID field matches the value for the preceding synchronization point to ensure that when a virtual user relays this instruction it will deliver the mouse input directly to the window specified by the window ID. If a window appears in a different location when the script is replayed the mouse click will still be delivered in the correct location.

Idle Timeout

When virtual users execute the script, the time specified as idle time will pause the user for the specified time before continuing the instructions. The idle time is represented in milliseconds. This field can be edited to make sure that the wait is reasonable.

Synchronization Points

Synchronization Points ensure that during the script playback virtual users wait for the correct window to appear in a defined state. These points ensure that virtual users do not try to interact with program windows before they appear before proceeding with the test. Also, when a load test is running, the system may experience slower performance so the synchronization points help to make sure that the script runs reliably. Synchronization Points can be based on Windows titles or bitmaps, which are graphical elements in the screen. These points have multiple settings, some of which include type, fail mode, timeout and conditions. For a complete list of the settings see the product help documentation.

Timeout - The Timeout settings are the time in seconds that a virtual user will wait for a synchronization point to be satisfied. The fail mode settings will determine what course of action to take if the synchronization point is not satisfied within the configured timeout period. An administrator can specify two settings for the fail mode:

- Logout - an error is generated and the virtual user terminates its scripts and logs out.

Or

- Continue - an error will not be generated and the script will continue.

Bitmap - To enable this function configure the controller as follows:

Select option>recorder options then choose Match or Search or Not. Then click OK.

Performance Objects and Counters

This section details the counters used to monitor Citrix XenApp Servers during the scalability testing effort.

Counter	Description
LogicalDisk: % Disk Time	The average number of read and write requests that were queued for all logical disks. Sustained value of 2-3 or greater indicates disk speed may become a bottleneck, and typically increases processor activity. If hard disk performance becomes a bottleneck, a hardware disk controller that includes both read and write cache can improve disk performance.
LogicalDisk: % Free Space	% Free Space is the percentage of total usable space on the selected logical disk drive that was free.
Memory: Available Bytes	Amount of physical memory available to processes, measured in MB. Paging should be monitored if less than 25% of physical memory is available, as excessive paging may occur.
Memory: Pages Input/sec	The rate at which pages are read from disk to resolve hard page faults. Hard page faults occur when a process refers to a page in virtual memory that is not in its working set or elsewhere in physical memory, and must be retrieved from disk. When a page is faulted, the system tries to read multiple contiguous pages into memory to maximize the benefit of the read operation. Compare the value of Memory\\Pages Input/sec to the value of Memory\\Page Reads/sec to determine the average number of pages read into memory during each read operation.
Memory: Pages Output/sec	The rate at which pages are written to disk to free up space in physical memory. Pages are written back to disk only if they are changed in physical memory, so they are likely to hold data, not code. A high rate of pages output might indicate a memory shortage. Windows writes more pages back to disk to free up space when physical memory is in short supply. This counter shows the number of pages, and can be compared to other counts of pages, without conversion.
Memory: Pages/sec	The number of memory pages read from or written to disk to resolve memory references that was not in memory at the time of reference. A value greater than 100 is not a problem unless it is accompanied by low Available Bytes or high Disk Transfers/sec.
Paging File: % Usage	The percentage of page file in use. If greater than 75% of the page file is in use, physical memory (RAM) should be increased.

PhysicalDisk(_Total): Current Disk Queue Length	Current Disk Queue Length is the number of requests outstanding on the disk at the time the performance data are collected. It also includes requests in service at the time of the collection. This is an instantaneous snapshot, not an average over the time interval. Multi-spindle disk devices can have multiple requests that are active at one time, but other concurrent requests are awaiting service. This counter might reflect a transitory high or low queue length, but if there is a sustained load on the disk drive, it is likely that this will be consistently high. Requests experience delays proportional to the length of this queue minus the number of spindles on the disks. For good performance, this difference should average less than two.
Processor: % Interrupt Time	Percentage of total usable space on the selected logical disk drive that was free.
Processor: % Processor Time	Percentage of elapsed time a CPU is busy executing a non-idle thread. High value is a concern only if accompanied by a Processor Queue Length sum greater than <2 x # of CPU's> or growing with % Processor Time greater than 80-90%.
System: Context Switches/sec	Combined rate at which all CPU's are switched from one thread to the other. This occurs when a running thread voluntarily relinquishes the CPU, is preempted by a higher-priority thread, or switches between user mode and privileged mode to use an executive or subsystem service. A baseline should be established to determine if excessive context switching is occurring. For example, some systems have been observed to behave just fine with context switches between 50,000 – 60,000, but on other systems values this high negatively impact performance.
System: Processor Queue Length	Number of threads in the processor queue; for ready threads only, not threads that are running. Greater than <2 x # of CPU's> for 5-10 minutes or with %Total Processor Time of 80%-90%.
Terminal Services: Active Sessions	Number of active terminal server sessions.

Version History			
Author	Version	Change Log	Date
Cedric Courteix	0.1	Initial Draft	07/01/2008
Cedric Courteix	0.2	Added System Specifications and Testing Methodology	07/03/2008
Zachary Menegakis	0.3	Added Server Optimizations	07/04/2008
Cedric Courteix	0.4	Added Scalability Tests Results and Key Findings	07/09/2008
Florian Becker	0.5	Consulting Solutions Quality Assurance	07/10/2008
Consulting Solutions	0.7	Final Draft	07/15/2008
HP	1.0	HP Technical QA and Final	08/27/2008
Nick Rintalan	1.1	Revisions and Quality Assurance	12/08/2008
Cedric Courteix	1.2	First Revision	01/14/2009

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