White paper

Optimizing XenApp Performance with XenServer 4.1.0 Enterprise Edition

This paper presents test results and recommendations for optimized performance of XenApp on XenServer. Results of testing in both physical and multiple virtualized server environments using an internal benchmark test suite developed by Citrix will be discussed.

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Test description

In an effort to determine the optimal system environment upon which to run XenApp™, tests were conducted on the following platforms:

- Physical — XenApp 4.5.1 running on a physical machine
- Virtual — XenApp 4.5.1 running on virtual machines

Tests were conducted using a load test tool called AutoSSS (Single Server Scalability). Developed internally by the Citrix XenApp product engineering group, AutoSSS calculates the maximum number of concurrent user (ICA) sessions sustainable on a single XenApp server by simulating multiple user sessions, thus representing the typical load on a XenApp server.

During test operation, the AutoSSS test suite launches a preconfigured number of ICA sessions, whose origins were distributed across multiple clients, to a desktop residing on the XenApp server. Once the sessions were established, a script was run to open Microsoft Office 2003 Excel from within the desktop. A subsequent script was then invoked to perform various editing operations within Excel.

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 AutoSSS test tool was configured to ensure that a sufficient number of concurrent ICA sessions would be created to reach approximately 90% of the systems maximum threshold, i.e., the point at which users could begin to notice a decrease in performance significant enough to potentially affect productivity. Once this level was attained, the number of concurrent ICA sessions was recorded and the associated data was analyzed.

This test employed four clients to create a total of 500 ICA sessions (125 per client). The test was configured to perform 9 iterations, starting with 240 ICA sessions for the first iteration and incrementing in steps of 40 for each subsequent iteration. At the culmination of the test, the session numbers for all iterations were combined and averaged to obtain the final results.

The initial testing of XenApp on a physical machine served to provide a benchmark upon which all subsequent testing could be compared. Once the maximum number of ICA sessions that could be created and maintained on a physical machine was determined, testing XenApp within virtual machines was performed using various system configurations which included modifications to CPU, RAM, and virtual page file size per VM.

Test System Specifications

Hardware

Servers: Dell PowerEdge 1950 (1 Quad-core 1.6GHz, 8GB-16GB RAM)

Clients: HP ML350 G5 (1 Dual-core 2GHz, 1GB RAM)

Console: Dell Precision 390 (Intel Dual-core 1.86GHz, 2GB RAM)

Software

Test Suite: Citrix AutoSSS v2.0 (Citrix-proprietary load test program for XenApp)

Test Suite Application: XenApp 4.5.1 (32bit, 64bit)

Test Suite Office Version: Microsoft Office 2003

Citrix Virtual Server Host Program: XenServer™ Enterprise v4.1.0

Operating System: Windows Server 2003 SP2, Enterprise Edition

Other leading enterprise virtualization solutions

Environment Settings

Physical: 32bit, 1.6GHz Quad-core, 3GB of RAM, 4GB page file

64bit, 1.6GHz Quad-core, 16GB of RAM, 24GB page file

Virtual: 32bit, 4 vCPUs, 3GB of RAM, 4GB page file (1VM)

64bit, 4 vCPUs, 14GB RAM, 24GB page file (1 VM)

Test Scenarios

Scenario #1: XenApp running on a Win2K3 SP2 Server Enterprise physical machine

Details

For the first test scenario, tests were performed using a Dell PowerEdge 1950 server (1.6GHz Quad-core, 64bit) running Win2K3 SP2 Server Enterprise edition (32bit and 64bit).

Results

32bit OS: Using 3GB of RAM and a 4GB page file, XenApp was able to support 200 user sessions
64bit OS: Using 16GB of RAM and a 24GB page file, XenApp was able to support 310 user sessions

Scenario #2: XenApp running on a XenServer 4.1.0 Enterprise Edition virtual machine

Details

For the second test scenario, tests were performed using a Dell PowerEdge 1950 server (1.6 GHz Quad-core, 64bit) running XenServer 4.1.0 Enterprise Edition, which boasts new features such as Shadow memory and various other enhancements designed specifically to allow XenApp to run at optimal performance levels. To determine just how much more bang for the buck XenApp could achieve running in a XenServer 4.1.0 virtual machine, the test was performed using default settings, including the default setting for Shadow memory (see figure 1 below).

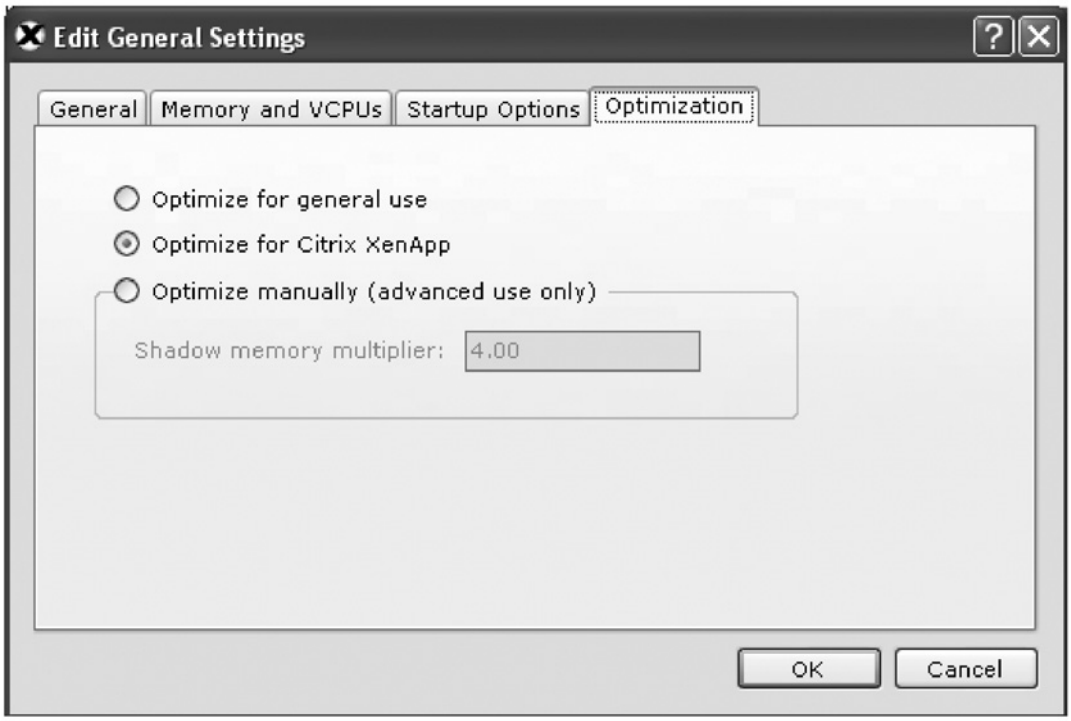

Figure 1

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

Results

32bit OS: Using 3GB of RAM and a 4GB page file, XenApp was able to support 157 user sessions, resulting in an overhead of 21.5% vs. the 32bit OS test on the physical machine. (See figure 2 on the following page.)

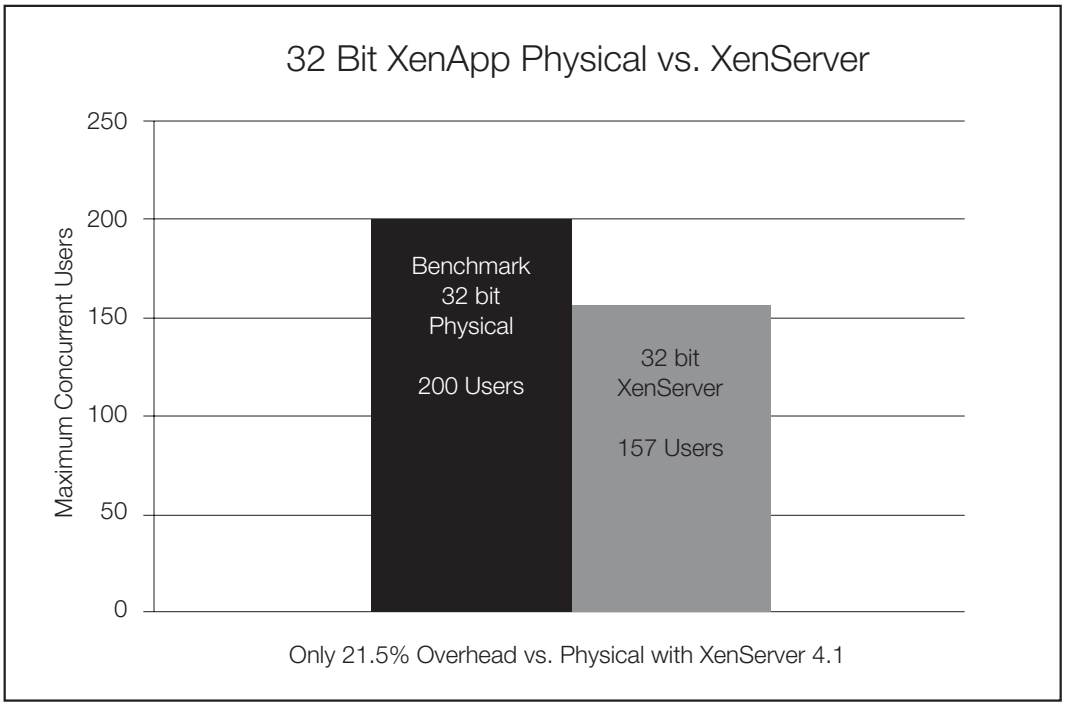

Figure 2

64bit OS: Using 14GB* of RAM and a 24GB page file, XenApp was able to support 287 user sessions, resulting in an overhead of 7.6% vs. the 64bit OS test on the physical machine. (See figure 3 below.)

* 64bit OS test utilized 14GB of RAM to afford the host system 2GB of RAM to perform normal operations.

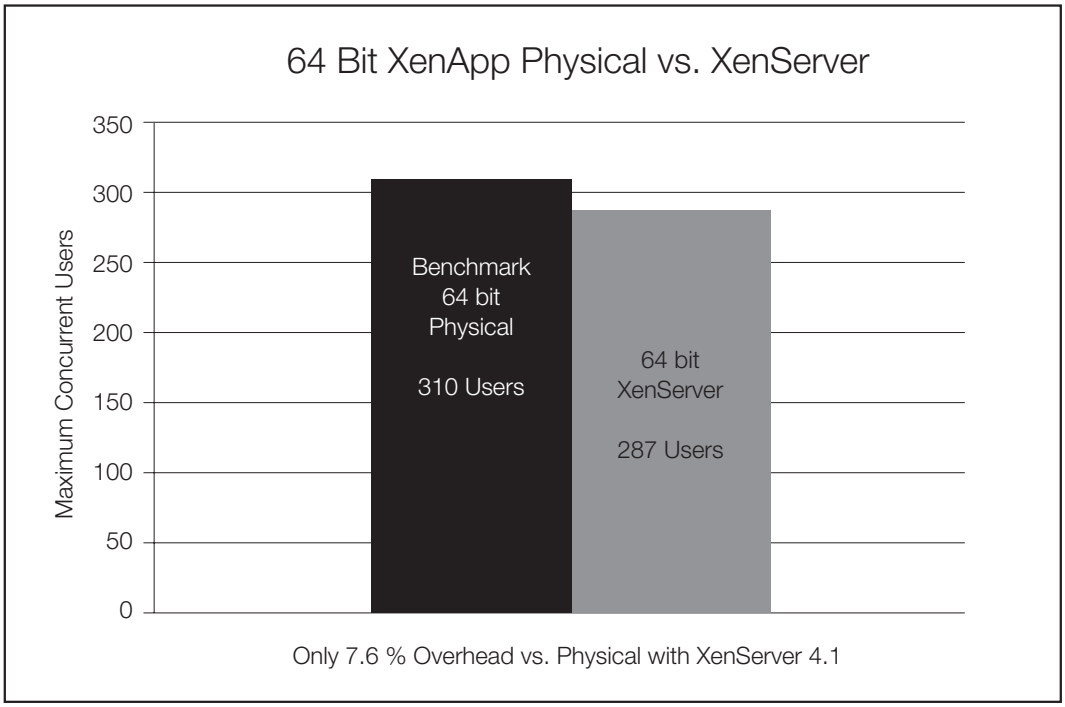

Figure 3

Based on these results, it was determined that a direct correlation exists between the levels of performance attainable by XenApp and the processing capabilities of the underlying system. In other words, XenApp performance appears to be largely CPU dependent, i.e., larger amounts of virtual processor resources result in higher performance of XenApp.

To summarize the results obtained from the first two test scenarios, figure 4 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 XenApp server.

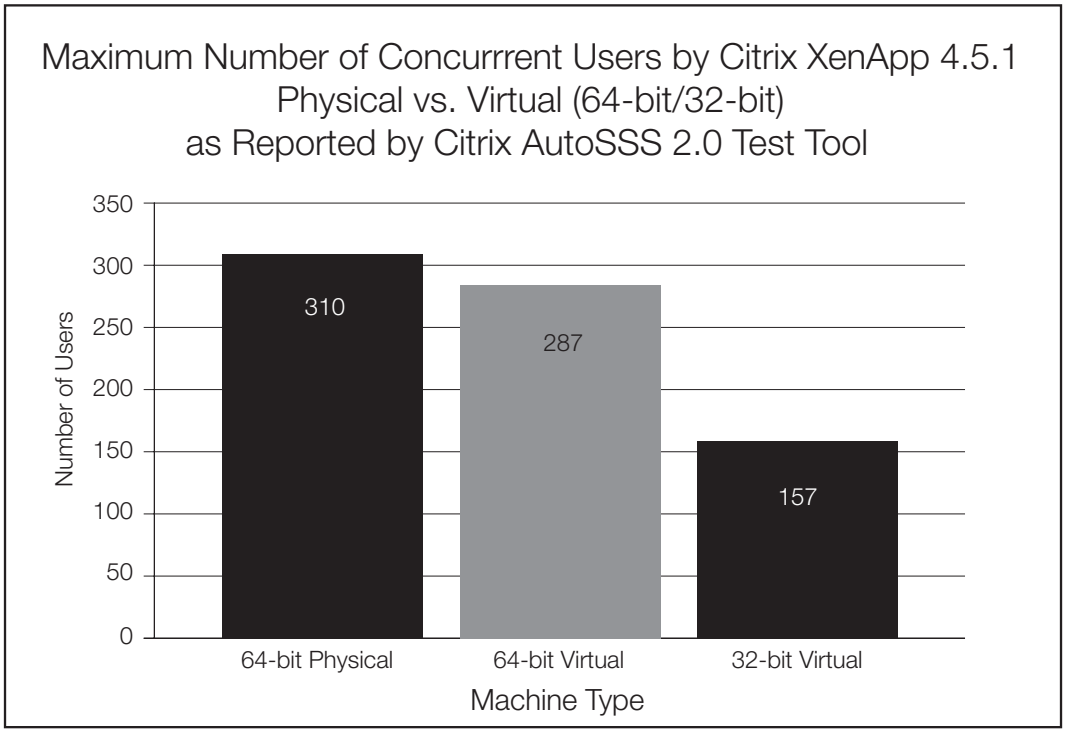

Figure 4

Scenario #3: XenApp running on another leading virtualization solution

Details

In order to compare the levels of performance that could be achieved by XenApp running on XenServer 4.1.0 Enterprise Edition with that of other leading virtualization solution providers, a final test scenario was devised using a Dell PowerEdge 1950 server (1.6GHz Quad-core, 64bit) running another leading virtualization solution.

Each test was conducted using a single Win2K3 SP2 Server Enterprise Edition (32bit and 64bit) virtual machine with four vCPUs and identical configuration settings and Auto SSS load tests that were used for the tests with XenServer 4.1.0.

Results

XenApp 4.5.1, when virtualized with XenServer 4.1.0, supports 70% more concurrent users than when XenApp is virtualized by other leading server virtualization products. These tests conclude that overhead resulting from running XenApp on a virtual machine is significantly reduced with XenServer 4.1.0 Enterprise Edition as opposed to using other leading virtualization solutions resulting in a far greater number of concurrent user sessions per XenApp server!

Conclusion

Testing conducted by the Citrix ISV Testing and Certification Lab proved effective at highlighting the following key points:

- XenApp 4.5.1 performs well in a virtual server environment with no discernable impact to the user experience. The overhead of virtualizing a single XenApp 4.5.1 server in a XenServer 4.1.0 environment is as little as 7.6% when compared to a XenApp server running on a similarly-configured physical server.
- When XenApp 4.5.1 is run in a XenServer 4.1.0 Enterprise Edition virtual server environment, XenApp performs best when using a single XenApp virtual machine server that is assigned larger CPU and page file resources than distributing the same resources across several XenApp virtual machine servers.
- While XenApp 4.5.1 can operate on 32-bit or 64-bit VMs, when run in a XenServer 4.1.0 Enterprise Edition virtual server environment, performance is significantly greater at 64-bits vs. 32-bits. This is due to the additional resources (CPU, RAM and page file) available with a 64-bit OS that are not available when using a 32-bit OS.
- XenApp 4.5.1 performance on XenServer 4.1.0 is superior to that of other leading virtualization solutions. Test results show that overall performance averages 70% more concurrent users than when XenApp is virtualized by other leading virtualization products.

With the above information in its possession, the Citrix VMD ISV test lab is able to present its recommendation for optimizing XenApp performance as follows:

To achieve the highest levels of performance (i.e., the maximum the number of concurrent, sustainable user sessions with minimal discernable impact on product usability), it is strongly recommended that XenApp be deployed within a XenServer 4.1.0 Enterprise Edition 64bit virtualized server environment utilizing powerful processing capabilities. For example, a Quad-core processor offers greater potential for performance improvements than a single or dual-core processor.

When running XenApp virtual machines at 32 bits, it is recommended that maximum CPU resources, a 4GB page file and 3GB of RAM be assigned to each VM. At 64 bits, maximum CPU resources, a 24 GB page file and 14GB of RAM per VM are recommended.

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