

Citrix Systems, Inc.

XenServer Enterprise 4.1.0



Test Summary

Performance Evaluation of XenApp in a 64-bit Virtualized Server Environment Using XenServer

Premise: Citrix customers have already experienced the benefit of application virtualization through XenApp. For the last few years, IT professionals have questioned whether or not it makes sense to virtualize XenApp environments. Adding server virtualization impacts single server performance and adds complexity while providing greater server utilization, higher availability and increased flexibility. One of the key aspects IT professionals have to consider is how much performance overhead a particular virtualization solution adds to a single XenApp server environment.

Citrix Systems, Inc. commissioned The Tolly Group to evaluate the performance of XenApp when it is virtualized and optimized by its XenServer virtualization solution.

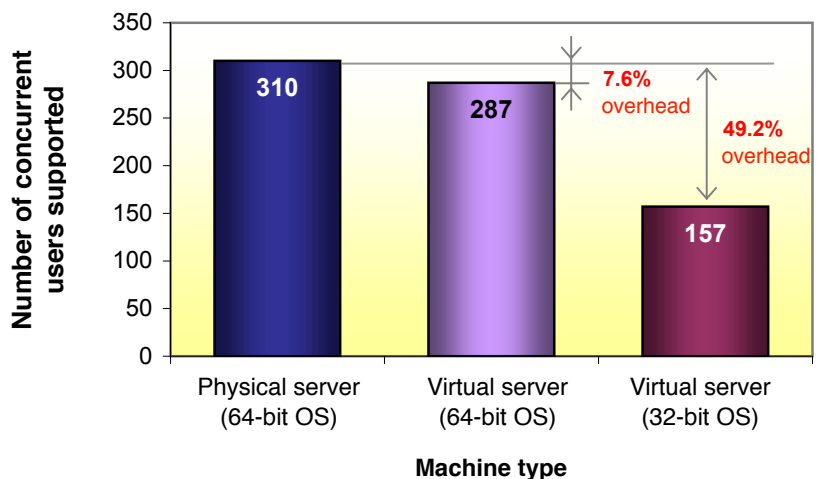
Tolly Group engineers examined the maximum number of concurrent users a single XenApp server could support in a 64-bit virtualized server environment using XenServer.

Engineers measured the performance of XenApp running on a physical 64-bit server and both 32-bit and 64-bit virtualized environments. The aim was to prove that virtualizing XenApp with XenServer does not degrade user scalability significantly compared to a native physical server environment. Tests were conducted in April 2008.

Test Highlights

- ▶ Achieves maximum performance for users when XenApp runs on a 64-bit XenServer virtual machine, operating with as little as 7.6% overhead versus running XenApp in a comparable physical server environment
- ▶ Virtualized 64-bit XenApp exhibits 82% higher performance than a 32-bit virtualized environment using XenServer
- ▶ Provides features to allow XenApp to run at optimal performance levels with default configuration

Maximum Number of Concurrent Users (ICA Sessions) by Citrix XenApp running on Physical vs. Virtual (64-bit/32-bit) Machines as Reported by Citrix AutoSSS 2.0 Test Tool



Note: All tests were conducted in the same server platform and each machine was optimally configured to perform at its highest levels. See Figure 2 and Test Setup & Methodology section for detailed configurations.

Source: The Tolly Group, April 2008

Figure 1

Executive Summary

Citrix Systems XenServer best optimizes XenApp performance in virtualized environments by operating with just 7.6% overhead compared to a native physical server. The 64-bit XenServer scales up to 82% more concurrent users than 32-bit XenServer.

Large IT organizations are either deploying or considering server virtualization solutions due to their server consolidation, greater availability and increased flexibility. IT professionals are beginning to question whether or not virtualizing XenApp servers will result in the same benefits that other server-based solutions have brought after successful deployments of virtualization.

The key to server virtualization is using untapped CPU cycles within clusters of servers, either in the data center or elsewhere. XenApp server is more highly utilized than other typical server-based solutions and its performance is highly processor-bound. Thus, the challenge in running XenApp on virtualized servers is that the server virtualization solution must incur minimal overhead to make server virtualization of XenApp economically viable.

Tolly Group engineers examined the maximum number of simultaneous

users, that a single XenApp server can support, in different machine types when emulated users perform various editing operations in Microsoft Excel. The different machine types included a bare-metal physical server running XenApp on 64-bit Windows Server 2003 and the same XenApp server on 64-bit/32-bit Windows Server 2003 virtualized by XenServer.

To make the results more meaningful, the workload was developed carefully to represent the typical core business application load on a XenApp server.

In the 64-bit physical server test, engineers found that XenApp supported 310 maximum concurrent users (ICA sessions) with realistic workloads without degrading each user's work experience more than 10% from the baseline single-user experience.

In the 32-bit virtual machine test, engineers measured 157 concurrent users when the same XenApp and 32-bit Windows OS handled the same type of workload as the physical machine test above.

Engineers also verified that the XenServer 64-bit virtual machine

supported 287 XenApp users simultaneously. This proved that virtualizing XenApp using XenServer resulted in just 7.6% performance overhead compared to the native physical machine in the same configuration. Considering the levels of performance degradation that are commonly found in the real world, achieving virtualization of a single XenApp server, with less than 10% performance overhead, is an indication that Citrix has succeeded in tuning XenServer to virtualize XenApp workloads.

Compared to the 32-bit virtual machine test, the 64-bit result demonstrated an 82% performance improvement on the same hardware platform. This proved that XenApp within XenServer 64-bit virtual machine is recommended to achieve the highest levels of performance.

RESULTS

PHYSICAL VS. VIRTUAL

The Tolly Group measured and compared user scalability on a single XenApp server, when it was deployed in a native 64-bit physical server, and in a comparative virtualized server environment by Xen-

Environmental Variables Configured for Different Machine Types

Machine Type	Overhead ¹	RAM size	Page file size
64-bit Physical	---	16GB	24GB ²
64-bit Virtual	7.6%	14GB ³	24GB ⁴
32-bit Virtual	49.2%	3GB ⁵	4GB ⁵

Notes:

1. % overhead compared to running XenApp on a physical machine
2. 24GB Page File based on documented XenApp recommendation
3. 14 GB RAM leaves 2GB RAM to support host system operation
4. 24GB Page File consistent with physical machine test
5. 3GB RAM, 4GB Page File based on 32-bit system limitation

Source: The Tolly Group, April 2008

Figure 2

Server. The results show that XenApp on the physical server handled 310 simultaneous users, while XenApp in the virtualized environment supported 287 users, before a decrease in performance was enough to affect productivity.

These results show that the virtualization overhead resulted in just 7.6% degradation of performance. This is attributable to a lightweight software layer installed directly on the hardware to provide less overhead and near native performance for guests. Also, XenServer 4.1.0 supported various features such as a dynamic shadow memory setting to allow XenApp to run at optimal performance levels in a default configuration.

To draw an apples to apples comparison, all aspects of test configurations remained the same except that the physical server was equipped with 16 GB RAM while the virtual server was configured with 14 GB RAM. This was designed to give 2 GB of memory to the host OS. This is a common configuration for the hardware with 16 GB RAM. Both machine types used an Intel Quad-core CPU, XenApp 4.5.1 and Windows Server 2003 R2 Enterprise Edition x64 with SP2.

64-BIT VIRTUAL VS. 32-BIT VIRTUAL

Test results, shown in Figure 1, demonstrate that a 64-bit virtual machine supported 287 concurrent users and a 32-bit virtual machine support 157 users. The 64-bit

virtual machine supported 82% more concurrent users than the 32-bit scenario. Even if they used the same processing power, the 32-bit OS had technical limitations such that it supported up to 4 GB memory and 4 GB of page file size. However, engineers configured a 32-bit virtual machine with 3 GB memory given that 32-bit Windows does not make all 4GB space available to applications and it needs to leave room for host system operations.

TEST SETUP & METHODOLOGY

Tolly Group engineers tested the Citrix XenServer Enterprise Edition 4.1.0 with Citrix XenApp Enterprise Edition 4.5.1 using AutoSSS 2.0, a Citrix in-house tool used for single server scalability testing.

For the server platforms, three identical Dell PowerEdge 1950 servers were used to run three machine types. The platforms were equipped with one Intel Xeon E5310 Quad-core 1.6-GHz CPU, 16 GB RAM and a 146GB 15K SAS HDD. The 64-bit systems ran Microsoft Windows Server 2003 R2 Enterprise Edition x64 with Service Pack 2 and 32-bit system Microsoft Windows Server 2003 R2 Enterprise Edition with Service Pack 2.

Engineers used three HP ML350 G5 clients to generate traffic loads. They created 100 or 125 users per each client. AutoSSS test agents ran on all the clients and servers so that they were managed by the AutoSSS test console. (See Figure 3.)

The AutoSSS test suite automatically found the maximum number of concurrent user (ICA) sessions sustainable on a single XenApp server by simulating multiple user sessions. Each user session emulated a typical workload on a XenApp server.

During test operation, the AutoSSS test suite launched a pre-configured

Citrix
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XenServer
Enterprise
4.1.0



Performance
Evaluation of XenApp in 64-bit
Virtualized Environment

Product Specifications

Vendor-supplied information not necessarily verified by The Tolly Group

Citrix Systems
XenServer Enterprise 4.1.0

Benefits:

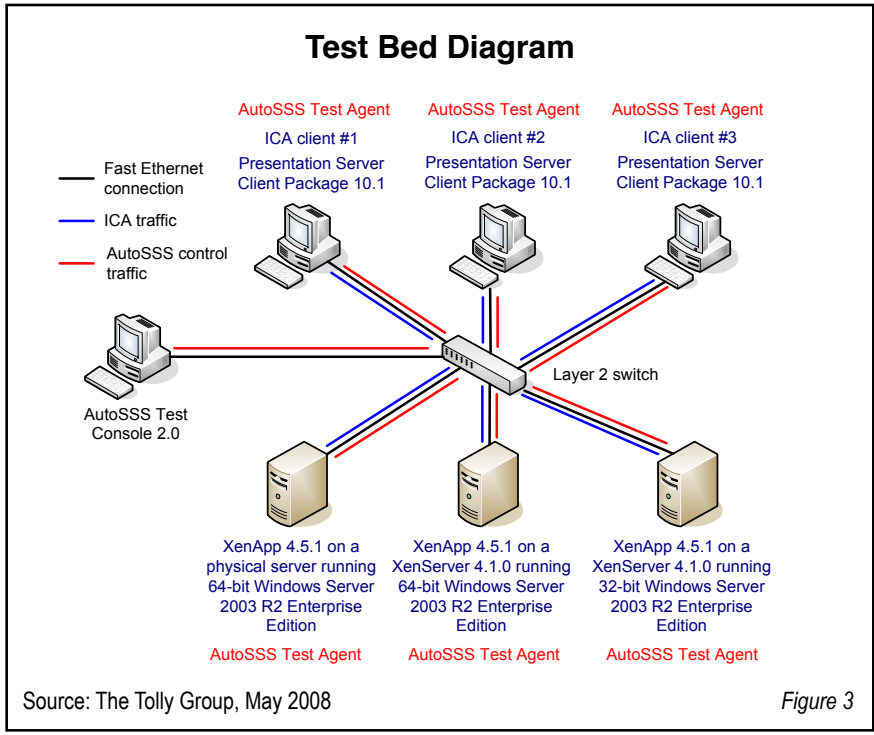
- Citrix XenServer is an enterprise-class solution for virtualizing application workloads across any number of servers in the data center as a flexible aggregated pool of computing resources
- It is the first solution to provision application workloads across physical and virtual servers making the entire data center more dynamic
- Citrix XenServer 4.1 is now optimized for Citrix XenApp™ providing best in class scalability for Citrix XenApp (formerly Presentation Server) workloads

Features:

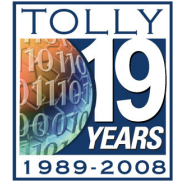
- Supports standard hardware and drivers
- Built to scale
- Windows and Linux guest support
- Based on Industry-Standard Open Source Xen
- Blazing fast performance
- Powerful resource management
- XenCenter Multi-Server Multi-Pool Management
- Enhanced serviceability
- Provides rapid efficient provisioning for physical and virtual servers

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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 Excel 2003 from within the desktop and a subsequent script was then invoked, to perform various editing operations within

Excel, for about eight minutes to mimic the typical core business application workload on XenApp server. There was no pause during the operations.
 Prior to the test, engineers measured the time taken for a single user to complete each script on the target server. This became the baseline task completion time. The AutoSSS test suite was then configured to

ensure that the maximum ICA sessions simultaneously were created before the measured task completion time exceeded the baseline +10%.
 For the virtual environment setting, a single virtual machine was tested and it used all four CPU cores.
 Each test was run three times and the results were averaged to obtain the final result.

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