

- <sup>1</sup> [Login VSI Max corrected performance index rating.](#)
- <sup>2</sup> <http://support.citrix.com/article/CTX124086>
- <sup>3</sup> <http://www.intel.com/technology/quickpath/>
- <sup>4</sup> [http://www.intel.com/p/en\\_US/products/server/processor/xeon7000](http://www.intel.com/p/en_US/products/server/processor/xeon7000)
- <sup>5</sup> [http://www.projectvrc.nl/index.php?option=com\\_docman&task=cat\\_view&gid=39&Itemid=11](http://www.projectvrc.nl/index.php?option=com_docman&task=cat_view&gid=39&Itemid=11)
- <sup>6</sup> <http://www.loginconsultants.com/index.php>
- <sup>7</sup> In *The Citrix Blog*:  
<http://community.citrix.com/pages/viewpage.action?pageId=131334785>

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## Citrix XenDesktop 4 and Microsoft Windows Server 2008 R2 with Hyper-V on the Intel Xeon Processor 5600 and 7500 Series

Triple your Windows 7 desktops —  
on the same server footprint.



## Executive overview

The combination of Citrix® XenDesktop® 4 running on Microsoft Windows Server® 2008 R2 with Hyper-V™ hosted on an Intel® Xeon® processor 5600 or 7500 series-based server is producing breakthrough results for desktop virtualization. These platforms make large-scale deployments of virtualized Windows® 7 desktops simpler, faster, and cheaper. The combination of these three elements radically increases virtual desktop density, which enables the delivery of more virtual desktops per server and thereby reduces TCO—helping you to do more with less.

## Introduction

IT managers increasingly see desktop virtualization as an exciting way to streamline the cost and complexity of desktop deployment.

In particular, as enterprises migrate to Windows 7, the ability to choose from the full spectrum of desktop virtualization options promises a better balance between IT control and end-user flexibility.

Designed to be hypervisor-agnostic, XenDesktop 4 is a leading product for desktop virtualization and is often paired with Hyper-V on Intel Xeon processor-based servers to quickly and successfully deploy Windows virtual desktops across teams, companies, and enterprises.

## Intelligent end points matter

XenDesktop 4 with FlexCast™ delivery technology is a leader in delivering a robust array of alternative desktop virtualization delivery models across the spectrum of enterprise clients including those based on the new 2010 Intel® Core™ i3 processor and Intel® Core™ i5 and Intel® Core™ i7 vPro™ processors.

Citrix HDX™ technology harnesses the intelligence of endpoints with its unique ability to look for, detect, and offload media-rich content to intelligent, rich, and mobile Intel-based clients. This allows end-users to enjoy content such as video, media-rich presentations, and 3-D data, through powerful and mobile endpoints, while providing IT with centralized management and security. Citrix HDX accomplishes this through a process called “adaptive orchestration” that automatically determines the optimal rendering point (server or client) for the media file to produce the most efficient and uncompromising performance results for users.

Citrix Performance and Scalability Test Labs in Bedford, MA recently ran scalability tests of virtualized Windows 7 desktops using XenDesktop 4 and Hyper-V on Intel Xeon processor 5500, 5600, and 7500 series-based servers. The specific intention of the project was to focus on creating benchmarks for Hyper-V with XenDesktop 4 on the Intel Xeon platform and identify parameters that could allow companies to achieve high performance results for XenDesktop 4 in that context. What the testers saw was the greatest virtual desktop density reported to date. When compared to the same software stack running on a previous-generation Intel Xeon processor 5500 series, they found:

- The Intel Xeon processor 7500 series achieved a density of 7.5 virtual desktops per physical core (a 3.5x improvement over the Intel Xeon processor 5500 series).
- The Intel Xeon processor 5600 series showed a 30 percent decrease in processor utilization for the same workload when the workload got heavy.

# Test results

A single quad-socket server equipped with the Intel Xeon processor 7500 series (64 logical CPUs and 256 GB of memory) was able to support an astounding 239 desktops.

The Citrix Performance and Scalability Test Labs team also tested dual-socket Intel Xeon processor 5500 and 5600 series-based servers, each with 72 GB RAM (the maximum possible using 4 GB DIMMs) to see what the differences were between them. Even with the *Heavy* workload, the virtual desktop density results were the same for each, as both were found to be memory-bound in each of the workload tests. However, while the Intel Xeon processor 5500 series-based server ran at close to 100 percent CPU utilization during the *Heavy* workload test, the Intel Xeon processor 5600 series-based server showed a 30 percent decrease in processor utilization for the same workload, protecting against spikes in demand. Each of these systems supported 67<sup>1</sup> virtual desktops.

Based on these tests, servers based on either the Intel Xeon processor 7500 or 5600 series have both proven to be very well-suited as host systems for virtualizing Windows 7 desktops when used with XenDesktop 4 and Windows Server 2008 R2 with Hyper-V.

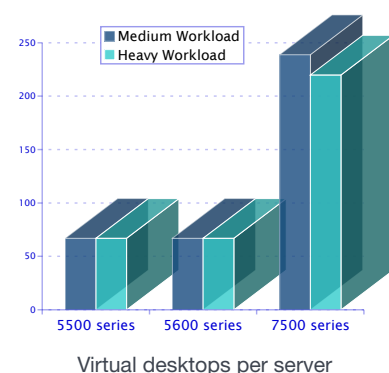
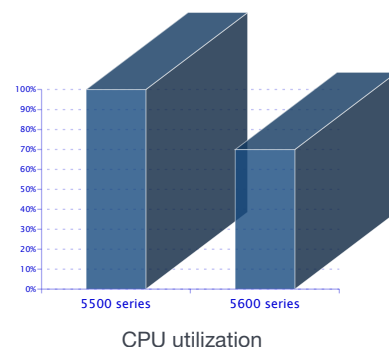


Table 1: Density and Scale: Windows 7 virtual desktops

System Description	Medium workload				Heavy workload			
	Max #	DT/ Core	DT/GB	Max CPU Util (%)	Max #	DT/ Core	DT/GB	Max CPU Util (%)
Intel® Xeon® processor 7500 series, 32 core (64 w/HT), 256GB	239	7.47	0.93	80	220	6.88	0.86	100
Intel® Xeon® processor 5600 series, 12 core (24 w/HT), 72GB	67	5.58	0.93	55	67	8.38	0.93	70
Intel® Xeon® processor 5500 series, 8 core (16 w/HT), 72GB	67	8.38	0.93	80	67	8.38	0.93	100



## What this means

The test results shown in Table 1 demonstrate that provisioning virtual Windows 7 desktops using the combination of XenDesktop 4, Hyper-V, and Intel Xeon processors permits unprecedented levels of virtual desktop density and scale. This combination can support as many as 239 virtual desktops per Intel Xeon processor 7500 series-based server.

This combination is ideal for deployments of Windows 7 because Windows 7 and Hyper-V work very well together. Earlier tests conducted by Citrix Performance and Scalability Test Labs on servers using the Intel Xeon processor 5500 series (running a combination of XenDesktop 4 and XenServer® with Windows XP desktops) demonstrated equally impressive results.<sup>2</sup> Cumulatively, these tests show that Intel Xeon processors continue to provide a leading hardware platform for both Windows XP and Windows 7 virtual desktops using XenDesktop 4. As customers migrate from Windows XP to Windows 7, this capacity will become increasingly valuable.

**“This combination of technology from Intel, Microsoft, and Citrix has produced breakthrough results for desktop virtualization. To my knowledge, this degree of single-server VM density with a real-world workload has not been achieved before.”**

-Simon Crosby,  
CTO, Citrix Datacenter and  
Cloud Division

### Intel Xeon processor 5600 series

This platform provides two-socket configurations for mainstream desktop virtualization. It delivers more processor headroom and therefore should be better able to withstand unexpected demand on processor reserves.

Relative to the quad-core 5500 series, the 5600 series can support up to six cores at similar clock frequencies at the same CPU power levels. This processor allows you to increase your capacity without having to change your cooling and power requirements.

While the system tested was configured with 72GB of RAM (the maximum configuration using 4GB DIMMs), its maximum RAM capacity is 144GB (by using 8GB DIMMs). The Xeon processor 5600 series server is likely to scale the number of DTs even higher when configured with more memory, which was not available at the time of test.

### Intel Xeon processor 7500 series

This platform provides up to eight-socket configurations for the largest-scale desktop virtualization implementation, supporting the largest number of virtual desktops per single-machine server.

In addition, multi-socket Intel Xeon processor 7500 series-based servers scale very closely on a per-core basis to the dual-socket Intel Xeon processor 5500 and 5600 series-based servers, which enables easy calculation of requirements and savings.

# Test platform

## Hardware:

### Processor/Platform:

- Intel Xeon processor 5500 series with 72 GB RAM: This server was a Dell\* PowerEdge\* R710, dual-socket, quad-core Intel Xeon processor X5570 running at 2.93 GHz.
- Intel Xeon processor 5600 series with 72 GB RAM: This server was an Intel whitebox server, with a dual-socket, six-core Intel Xeon processor X5660 running at 2.80 GHz. Although it was tested with the same memory capacity as the Intel Xeon processor 5500 series server, the 5600 series is built using a 32nm manufacturing process, which decreases the power needs while increasing the speed at which it can operate. An integrated memory controller supports three memory channels of 1333 MHz DDR3 SDRAM, as well as a higher total memory capacity (288 GB v. 192 GB), and the implementation of Intel® QuickPath Technology<sup>3</sup> improves the speed at which the cores can access RAM.
- Intel Xeon processor 7500 series with 256 GB RAM: This server was an Intel whitebox server, with a quad-socket, eight-core Intel Xeon processor X7550 running at 2.0 GHz. This four-socket platform can support up to one terabyte (1000 GB) of memory and deliver up to eight times the memory bandwidth and four times the memory capacity of the Intel Xeon processor 7400 series.<sup>4</sup>

### Storage:

- A shared NetApp\* FAS3050 connected using iSCSI and containing one aggregated 1.16 TB drive spread across 23 spindles.

### Network:

- 1 x 1 GbE on clients, 4 x 1 GbE on server.

## Software:

### Virtualization:

- Citrix XenDesktop VDA 4.0.4094

### Hypervisor:

- Microsoft Windows Server 2008 R2 with Hyper-V

## Virtual desktop setup:

- Microsoft Windows 7 with 1 virtual CPU (vCPU) and 1.0 GB RAM

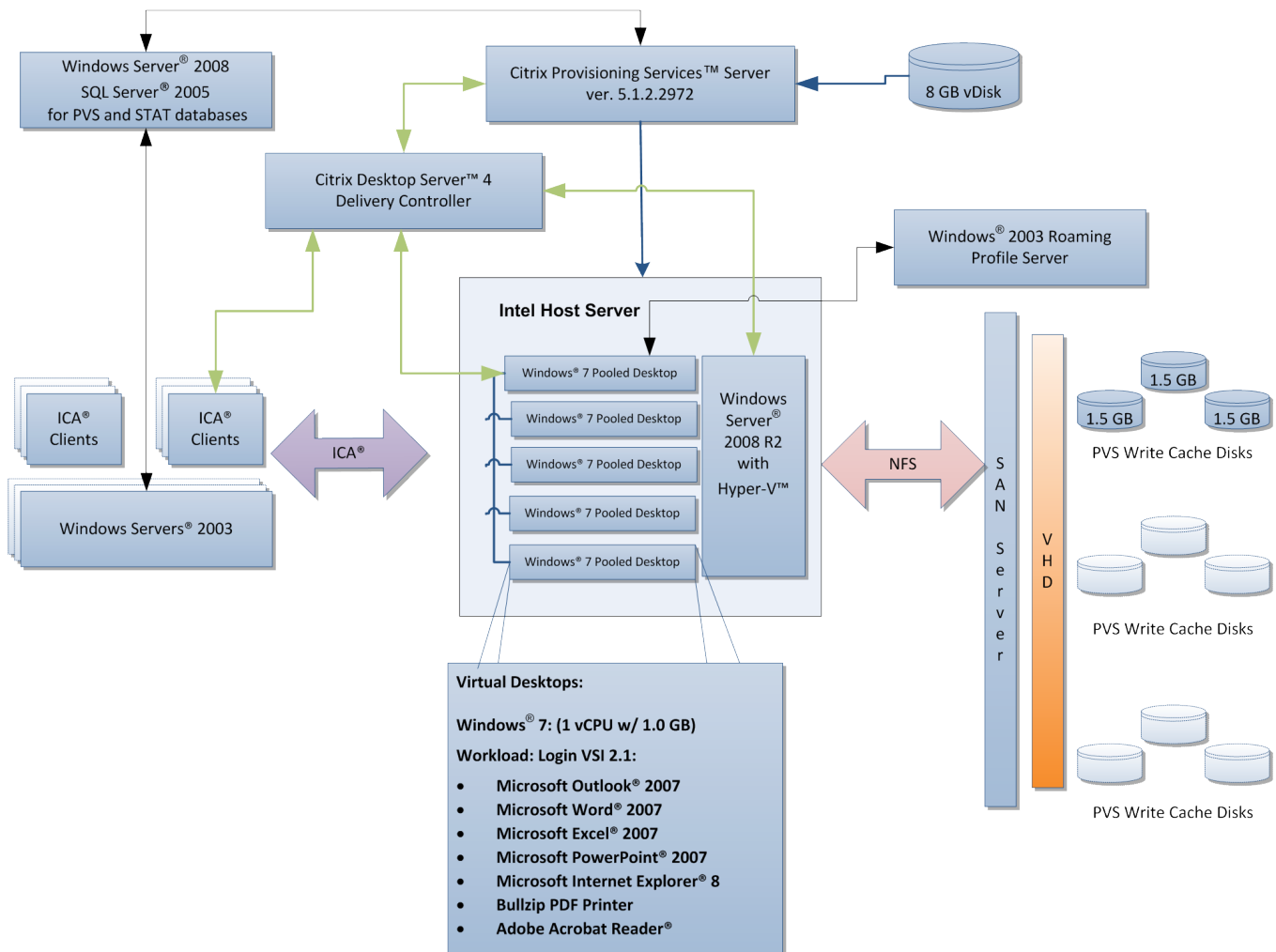
## System setup

All three systems were tuned using all recommended manufacturer settings, and all software was the current update with available patches and service packs installed.

## Test used

The program used for this test was Login Virtual Session Indexer (VSI) 2.1,<sup>5</sup> created by Login Consultants.<sup>6</sup> This test is a widely accepted hypervisor- and platform-agnostic standard for measuring virtual desktop performance that is also regularly used for server-side analysis of virtual desktop performance. Tests were conducted three times for each configuration and the results for each configuration were averaged to produce the final values.

### XenDesktop test environment



## Notes on test results

- These were produced using one set of tests conducted at one time on a single set of systems.
- No testing was done to determine the effects of reducing or increasing the amount of memory provided.
- No testing was performed for operating systems other than Windows 7.
- Given the current limit of eight virtual desktops per core for Microsoft Hyper-V, and the recommended 512 MB memory setting for Windows XP virtual desktops, companies will achieve a lower virtual desktop density using Hyper-V than can be achieved using Citrix XenServer, which currently supports up to 16 Windows XP virtual desktops per core. Because XenServer is 100 percent compatible with Hyper-V, Citrix recommends that customers use XenServer to deploy Windows XP virtual desktops through XenDesktop 4. XenServer can be easily replaced by Hyper-V when Hyper-V increases its support limit of virtual desktops per core to the point that a switch can be justified.
- As Citrix Datacenter and Cloud Division CTO Simon Crosby has observed:<sup>7</sup>  
VM density is but one dimension of the complete equation for desktop virtualization TCO, and one of many measurements to be used when evaluating overall performance. Other factors playing key roles in establishing this TCO are:
  - Scalability (including both the virtual infrastructure platform and management)
  - Hypervisor cost
  - Choice of storage architecture (including scalability and manageability)
  - The end-to-end lifecycle cost of user desktops, including the ability to leverage existing management tools and skill sets.

## Related links

See the links below for more information.

- Citrix XenDesktop  
– <http://www.citrix.com/english/ps2/products/product.asp?contentid=163057>
- Citrix FlexCast and HDX  
– <http://www.citrix.com/English/ps2/products/feature.asp?contentID=1858926>
- Intel Xeon Processor 5600 series  
– [http://www.intel.com/p/en\\_US/products/server/processor/xeon5000](http://www.intel.com/p/en_US/products/server/processor/xeon5000)
- Intel Xeon Processor 7500 series  
– [http://www.intel.com/p/en\\_US/products/server/processor/xeon7000](http://www.intel.com/p/en_US/products/server/processor/xeon7000)
- Intel business clients  
– [http://www.intel.com/itcenter/products/core/core\\_vpro/index.htm](http://www.intel.com/itcenter/products/core/core_vpro/index.htm)
- Microsoft Windows Server 2008 with Hyper-V  
– <http://www.microsoft.com/midsizebusiness/products/Windows-Server-2008-R2-Hyper-V.aspx#Overview>
- Citrix and Microsoft virtualization partnership website  
– <http://www.citrixandmicrosoft.com>
- Citrix and Intel partnership website  
– <http://www.citrix.com/intel>
- Citrix and Intel community website  
– <http://community.citrix.com/citrixready/intel>