

Enabling Server Consolidation with 64-Bit Citrix Presentation Server

Deploying 64-bit technology can allow organizations to significantly reduce the number of servers required to support their user base by enabling increased density and resource utilization. This article discusses the advantages of running the 64-bit version of Citrix Presentation Server™ software for Microsoft® Windows Server® 2003 x64 Editions on Dell™ PowerEdge™ servers.

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The limitations of 32-bit technology, particularly its restrictions on the amount of memory that can be directly addressed, can prevent software from taking full advantage of powerful multi-core processors. The introduction of 64-bit hardware and software has helped reduce or eliminate these limits, enabling significant scalability and performance benefits. The 64-bit version of Citrix Presentation Server 4 is designed to take advantage of these benefits on multi-core servers running Microsoft Windows Server 2003 x64 Editions.

The capabilities of the 64-bit version of Citrix Presentation Server 4 along with Windows Server 2003 x64 Editions can enable a compelling return on investment¹

while helping reduce total cost of ownership through data center server consolidation. Enterprises can now take advantage of servers with four or more processor cores, such as Dell PowerEdge 2950 servers, in 64-bit Citrix Presentation Server 4 environments.

Advantages of 64-bit technology

In 32-bit Microsoft Windows® operating systems, memory is limited to the 32-bit address space, thus limiting the amount of virtual memory that can be directly addressed to 4 GB. This 4 GB is divided into two equal parts: 2 GB for application processes and 2 GB for the OS, which is used for the kernel memory, system cache, and drivers.

¹ For more information, see "Reduce IT Costs Using Citrix Presentation Server 4," by Citrix Systems, October 2005, www.citrix.com/site/resources/dynamic/salesdocs/PresentationServer4.0x64BusinessCaseWhitepaper01DEC2005.pdf.

	32-bit	64-bit
Total physical memory	64 GB	1 TB
Total virtual memory (based on a single process)	4 GB	16 TB
Virtual paged pool	470 MB	128 GB
Virtual non-paged pool	256 MB	128 GB
Virtual page table entry	660 MB to 900 MB	128 GB

Figure 1. Physical and virtual memory limits for 32- and 64-bit versions of Windows Server 2003 Enterprise Edition

	Server	Client
Model	Dell PowerEdge 2950	Dell PowerEdge 1750
Processors	Two dual-core Intel® Xeon® 5160 processors at 3.0 GHz	One Intel Xeon processor 80532K at 2.8 GHz
Cache	Four 2 MB L2 caches (one per core)	One 512 KB L2 cache
Frontside bus	1,333 MHz	533 MHz
Memory	16 GB	1 GB
Hard drives	<ul style="list-style-type: none"> Two Serial Attached SCSI (SAS) 73 GB, 15,000 rpm drives in a RAID-1 configuration One SAS 73 GB, 15,000 rpm drive for the page file 	One Ultra320 SCSI 18 GB, 15,000 rpm drive
RAID controller	PowerEdge Expandable RAID Controller (PERC) 5/i	N/A
Network interface	Broadcom NetXtreme II Gigabit* Ethernet adapter	Broadcom NetXtreme Gigabit Ethernet adapter

*This term does not connote an actual operating speed of 1 Gbps. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

Figure 2. Hardware configuration used in the test environment

	32-bit environment	64-bit environment
OS	Microsoft Windows Server 2003 Enterprise Edition with Service Pack 1 (SP1)	Microsoft Windows Server 2003 Enterprise x64 Edition with SP1
Citrix software	Citrix Presentation Server 4 (32-bit)	Citrix Presentation Server 4 (64-bit)
Applications	Microsoft Office Professional Edition 2003 suite (Excel, Access, and PowerPoint)	

Figure 3. Software used in the test environment

A key advantage of using the 64-bit version of Citrix Presentation Server 4 with each of the Windows Server 2003 x64 Editions is the increased virtual address space compared to the 32-bit versions: the Windows Server 2003 x64 Editions can address 16 TB of virtual memory, divided into 8 TB for application processes and 8 TB for the OS (see Figure 1). This increase in available user and kernel memory enables Citrix Presentation Server to be highly scalable and avoid the limitations of 32-bit architectures.

Performance testing of 64-bit Citrix Presentation Server 4

In September 2006, Citrix engineers used Citrix® ICAMark 3.0 to test the user scalability of the 32- and 64-bit versions of Citrix Presentation Server 4. ICAMark is an internal benchmarking tool based on the Citrix Server Test Kit that tracks the number of client sessions that can be connected to a server running Citrix Presentation Server while still maintaining acceptable performance. It measures the user capacity based on the session response time and calculates a score to help determine the server scalability.

An increase in available user and kernel memory enables Citrix Presentation Server to be highly scalable and avoid the limitations of 32-bit architectures.

The test simulates users performing various actions using Microsoft Excel 2003, Microsoft Access 2003, and Microsoft PowerPoint® 2003 software. In the tests described in this article, all applications run with ICAMark 3.0 were 32-bit.² All tests were run until the resource thresholds were met or the end-user experience degraded below a defined threshold. (It is important to remember that server scalability is not always determined by hard system bottlenecks; application responsiveness and user experience should be regarded as the limiting factors.)

Figures 2 and 3 summarize the hardware configuration and software used in the test environment.

Test results

The increase in available kernel memory in 64-bit environments enabled the 64-bit version of Citrix Presentation Server to use multi-core processing power much more effectively than it could in 32-bit environments: in the Citrix tests, the PowerEdge 2950 server running the 32-bit versions of Windows Server 2003 and Citrix Presentation Server 4 supported 211 users, while the PowerEdge 2950 server running the 64-bit versions of Windows Server 2003 and Citrix Presentation Server 4 supported 385 users—an increase of 82 percent.

²Windows Server 2003 x64 Editions are designed to execute 32-bit applications by running them inside the Windows on Windows 64 (WOW64) execution layer.

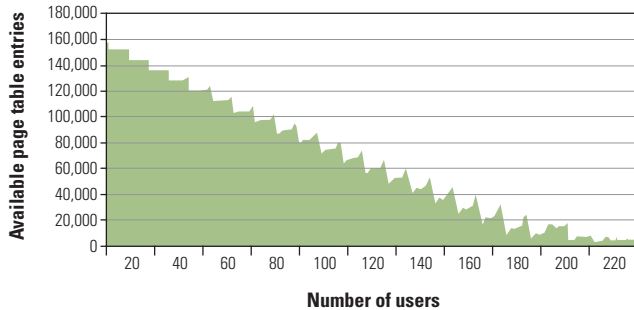


Figure 4. Available page table entries during a test of the 32-bit version of Citrix Presentation Server 4

Figures 4 and 5 illustrate the effect kernel memory can have on performance. Figure 4 shows the available page table entries for the 32-bit version of Citrix Presentation Server 4. At 211 users, only 1,361 page table entries were available, which is below the recommended value of at least 3,000—and at this point, Citrix Presentation Server began experiencing session launch failures, which can be attributed to a lack of kernel memory resources, and particularly a lack of available page table entries. The bottleneck in this system was caused by the memory management limitations in the 32-bit Windows Server 2003 OS.

The 64-bit version of Citrix Presentation Server, meanwhile, was constrained not by available page table entries but by processing power. Figure 5 shows the average processor utilization for the 64-bit version of Citrix Presentation Server. The system maintained acceptable performance until the number of users reached 385, which was when the large number of users simultaneously requesting resources caused the user experience to degrade because of high contention for resources and increased context switching. At that point, the average processor utilization was consistently above 50 percent, with prolonged spikes at 100 percent, while the other server subsystems—including available kernel memory and page table entries—remained within acceptable limits.

Scalability and cost-effectiveness with 64-bit Citrix Presentation Server 4

One of the key advantages of scaling up by deploying 64-bit technology with multi-core servers is the reduced number of servers required to support end users—for example, the test results indicate that a data center supporting 10,000 users in an environment identical to the one used in the Citrix benchmark tests would need to purchase and maintain 48 servers to run the 32-bit versions of Citrix Presentation Server 4 and Windows Server 2003, but only 26 servers to run the 64-bit versions.

While the kernel memory restrictions of 32-bit architectures severely limit the ability of Citrix Presentation Server to take

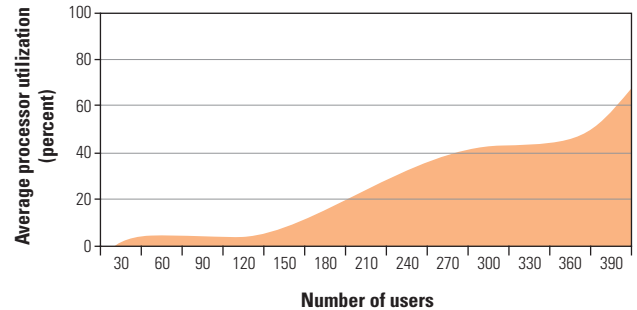


Figure 5. Average processor utilization during a test of the 64-bit version of Citrix Presentation Server 4

advantage of multi-core processing power, the 64-bit version of Citrix Presentation Server 4 and Windows Server 2003 x64 Editions can overcome these restrictions, allowing significantly increased scalability and user density. Because utilizing fewer servers typically requires less space, power, and supporting infrastructure; fewer administrators; less time to manage and deploy hot fixes, service packs, and other updates; and fewer software licenses than would otherwise be necessary, deploying 64-bit technology can also ultimately help reduce deployment, operations, and maintenance costs in enterprise data centers. [↔](#)

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FOR MORE INFORMATION

Citrix Presentation Server:

www.citrix.com/English/ps2/products/product.asp?contentID=186

Microsoft Windows Server 2003 x64 Editions:

www.microsoft.com/windowsserver2003/64bit/x64/default.msp