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The importance of system memory in relation to improved applications performance

Server memory performance testing whitepaper

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Introduction

There is a general belief that server systems are automatically rendered obsolete by the latest applications, operating systems, hardware technologies or increased usage demand. Often the obsolescence of older servers is unnecessary and wasteful, both in environmental and budgetary terms. The common rationale behind the purchase of new servers is often to realise extra applications performance. It is a fact that most servers are purchased with a base system memory specification with little thought being given to the importance of correctly matching the memory capacity to the needs of the applications or processor(s) installed in the machine.

It has long been an accepted theory that additional system memory has a marked effect on system performance, but just how big an effect? What benefits do applications receive from additional memory capacity? Is it possible to increase the useful life and therefore the ROI of a server without increasing its TCO? The purpose of this white paper is to verify, from a credible independent source, just how server applications benefit from differing levels of system RAM.

Real-world testing

To test the theory that additional memory helps a system to operate at its optimum levels Kingston Technology commissioned VeriTest to conduct a number of real life tests on a typical server application. The promise of significantly improved server application performance proved to not be an empty one.

VeriTest provides an independent testing environment where a critical, unbiased viewpoint is achieved. All benchmarks used are designed to test real world usage, providing results that actually mean something to you and your organisation. Many manufacturers claim landmark speed records, or ground breaking performance figures, but they never translate these into day-to-day benefits. As an example, the VeriTest benchmarks provide the ability for us to see how a server application performs with a number of physical real life PC clients accessing it, as opposed to a laboratory simulation using software based virtual clients. With the testing conducted by VeriTest, Kingston Technology is able to demonstrate how increasing memory in a server can lead to tangible business benefits.

Many vendors claim that adding additional processors or increasing disk storage both improve systems performance. However, through this testing, Kingston has proved that memory should always be the first upgrade applied to any server as it can bring the biggest increase in performance compared to other upgrades.

Testing methodology

An isolated network test bed was configured consisting of sixty load-generating client systems along with two server systems supplied by VeriTest as Web servers.

Two servers were tested independently;

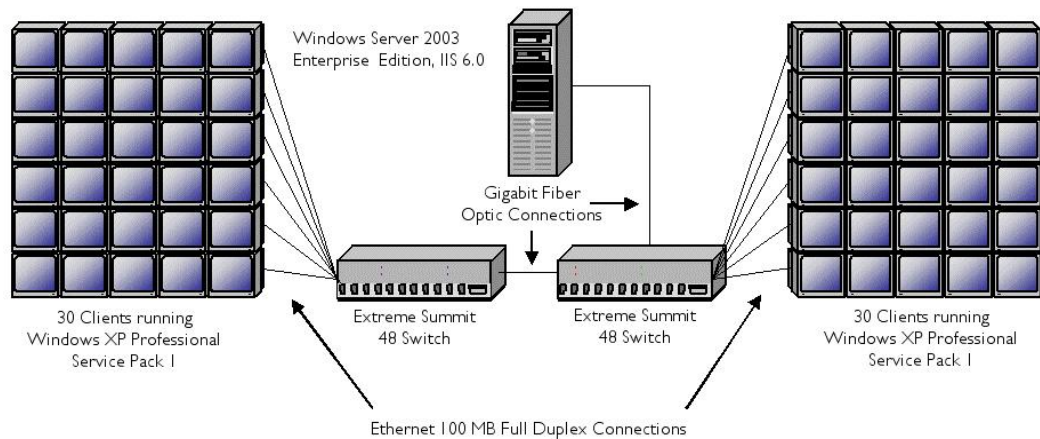
- Server 1 was a Dell PowerEdge 4400 equipped with dual Intel 1GHz Xeon processors and an Intel Pro/1000 fiber optic gigabit Ethernet adapter.
- Server 2 was an HP DL380 equipped with dual Intel Xeon 2.8GHz processors, and an Intel Pro/1000 fiber optic gigabit Ethernet adapter.

Both servers were configured with Microsoft Windows Server 2003 Enterprise Edition with the latest Windows Updates and Microsoft IIS 6.0 Web server software.

Sixty Dell PowerEdge 350 WebBench client systems equipped with a single Pentium III/866MHz processor, 256MB RAM, and an Intel Ether Express Pro 100+ network adapter, all running Microsoft Windows XP Professional Service Pack 1 were networked together using two Extreme Networks Summit48 10/100 Mbps switches, cascaded together with a gigabit fiber optic backbone connection.

Figure 1 below shows a graphical representation of the network test bed used.

Figure 1



PC Magazine's WebBench 4.1 benchmark was used to generate the HTTP requests for the performance tests. WebBench measures Web server performance by using large numbers of physical test clients to generate an HTTP based workload against a Web server under test. These test clients make a series of HTTP 1.0 requests for static based content. As the Web server under test responds to the client requests, each WebBench client records the number of HTTP requests made and the amount of data moved during the test. Once a test is completed, WebBench reports the test results in requests per second and throughput in bytes per second.

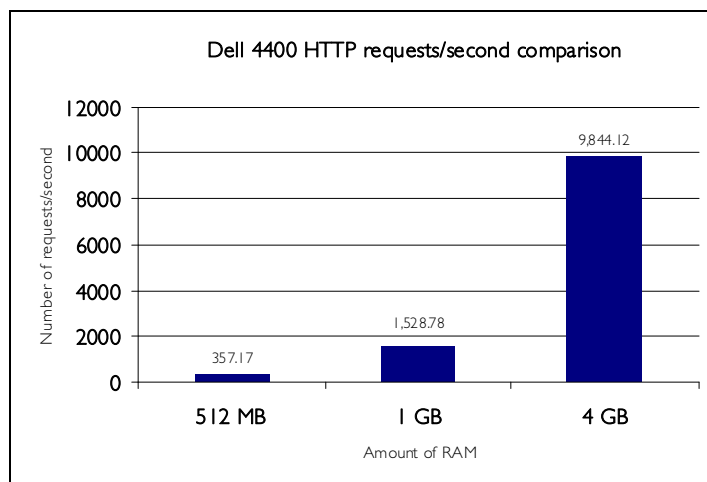
Test results

Dell PowerEdge 4400

The Dell PowerEdge 4400, produced the following WebBench results for 512MB, 1GB, and 4GB test configurations.

- The 512MB configuration reported an average of 357.2 requests per second.
- The 1GB configuration reported an average of 1,528.8 requests per second, an increase of 328% over the results with 512MB.
- When the amount of RAM was increased to 4GB, the performance levels increased to an average of 9,844.1 requests per second, an increase of 2,657% over the results with 512MB.

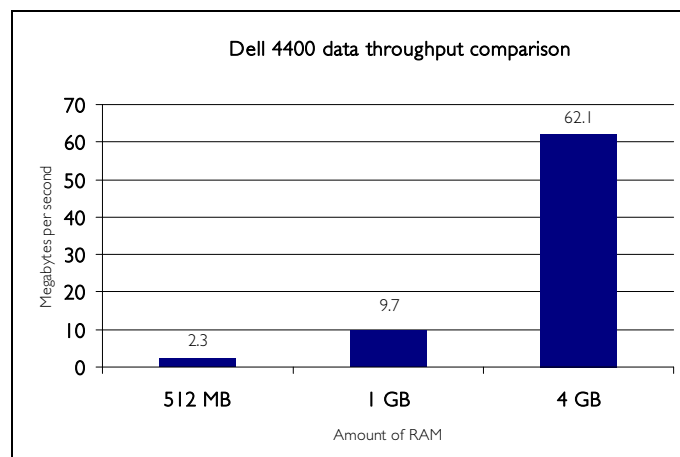
Figure 2: graphical representation of the increases in performance



The data throughput results when using the three different memory configurations for the Dell 4400 Web server were as follows:

- The 512MB configuration reported an average throughput of 2.3Mbps.
- The 1GB configuration reported an average throughput of 9.7Mbps, an increase of 322% over the results with 512MB.
- When the amount of RAM was increased to 4GB, the performance levels increased to an average throughput of 62.1Mbps, an increase of 2,600% over the results with 512MB.

Figure 3: graphical representation of the increases in performance

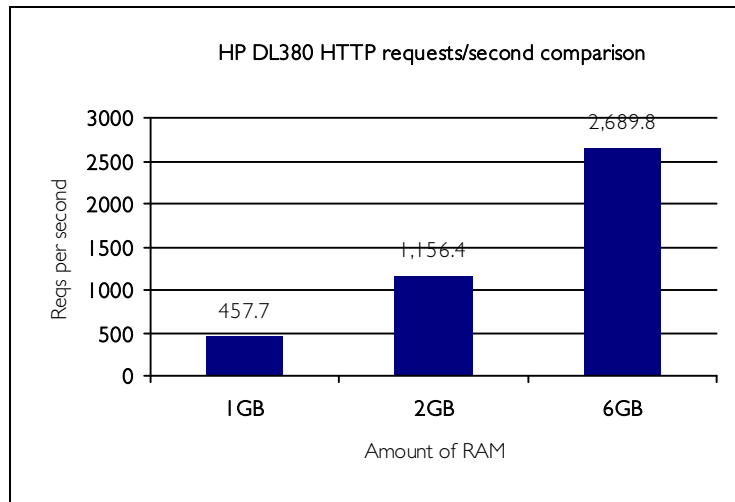


HP DL380

The HP DL380, produced the following WebBench results for 1GB, 2GB and 6GB test configurations.

- The 1GB configuration reported an average of 457.7 requests per second.
- The 2GB configuration reported an average of 1,156.4 requests per second, an increase of 153% over the results with 1GB.
- When the amount of RAM was increased to 6GB, the performance levels increased to an average of 2,689.8 requests per second, an increase of 488% over the results with 1GB.

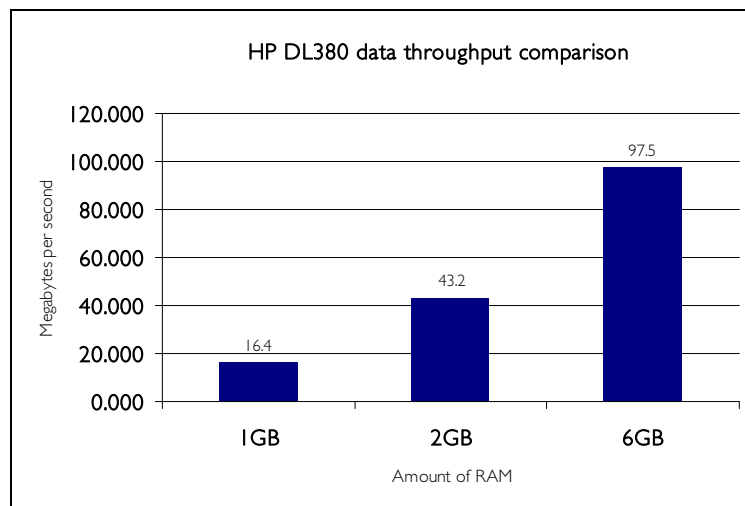
Figure 4: graphical representation of the increases in performance



The data throughput results when using the three different memory configurations for the HP DL380 Web server were as follows:

- The 1GB configuration reported an average throughput of 16.4Mbps.
- The 2GB configuration reported an average throughput of 43.2Mbps, an increase of 163% over the results with 1GB.
- When the amount of RAM was increased to 6GB, the performance levels increased to an average throughput of 97.5Mbps, an increase of 495% over the results with 1GB.

Figure 5: graphical representation of the increases in performance



Analysis of results

It is important to note that different systems will always produce different results. There is no magic percentage figure that will scale across multiple platforms. Different systems will contain different internal components, such as motherboards; chipsets, processors and FSBs (Front Side Bus), and each system will be configured in a different way in its specific motherboard and BIOS settings. The results generated by each server system under test are not intended for comparison because of these differences.

The purpose of the testing was to explicitly show the effect of additional system memory on a specific application. In addition to achieving excellent results that justify the theory that additional memory significantly boosts application performance, overall processor efficiency was also considerably improved. Not only did additional memory enable the web server application under test to respond to a higher number of client requests by generating or serving more data, the actual throughput of the overall system improved, enabling the extra data workload to be handled and transmitted efficiently.

Converted into business benefits it is easy to see the effect additional memory could have on the number of requests for information served to a web sites users, or the number of transactions conducted through the web server. The expectations of today s computer users are very high and are continually increasing. It may have been acceptable to wait for thirty to forty seconds for a web page to appear a few years ago, but now, if the page does not appear instantly the visitor will move on and will consider your site or company unresponsive. In practice you have around eight seconds for your page to load or the visitor is gone, probably for good. Your own remote users, (an ever increasing number for many organisations) utilising Microsoft Terminal Services or Citrix connectivity, demand remote access to their applications and data as if they were on the local office network. Ensuring that your web servers are operating at their optimum levels can be critical to your business growth.

When considering how to upgrade a server to obtain the best possible performance, memory should always be considered first. Providing applications with as much memory as they can address enables them to hold their tables, data sets and buffers in a super fast medium that is thousands of times faster than disk based storage. Providing processors with the maximum amount of memory enables them to operate at their intended optimal level. A fast processor can be strangled by a lack of system RAM.

Other system upgrades such as increasing disk space, or adding an additional processor, should only be considered once an applications hunger for memory is fully satisfied. No other upgrade could have such a marked effect on performance, as all data, regardless of its source or destination, will move through the system memory at some point in its processing cycle.

Commit to memory

Kingston Technology has demonstrated that there is a strong case for system memory upgrades. Not only would this strategy extend the life of your existing equipment, it would make a direct impact on productivity and performance, which in turn leads to a greater ROI with little financial outlay. In addition, your TCO for these ageing systems can drop as you are installing fully tested system RAM, with a one hundred per cent compatibility guarantee confidently backed by KingstonCare (our comprehensive on-site service and support program) and a robust lifetime warranty; both offered free of charge.

Providing a server with room to breathe has been proven to be advantageous. Clearly adding additional system memory to a server can improve its overall efficiency, by allowing the hardware components and the all-important applications to operate more effectively. With the optimum amount of memory installed, your servers could run applications faster, process more transactions per second, serve more media-rich content to your web users, or simply enable both your internal and remotely-located employees to do their job in less time and become more productive.

Breathing new life into potentially obsolete systems can also ensure that you are more socially responsible as a company, generating less waste and actually recycling potentially defunct systems. But the key benefit of adding more system memory has to be the effect on your business growth. It's your customers and employees increasingly demanding expectations that you need to meet and exceed.

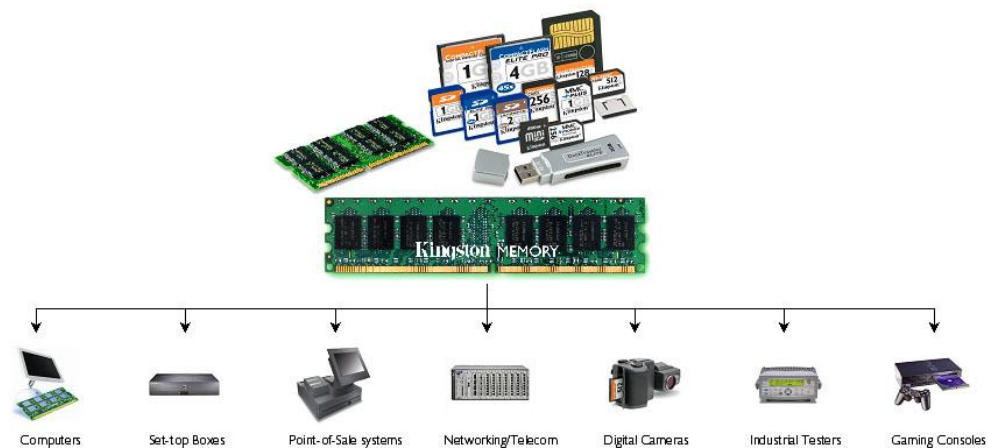
The basic business principle of giving people what they want when they need it also applies to the world of computing. How can your business grow when your customers both internal and external can't get what they want from you when they need it the most? The question to ask yourself is whether your systems are operating at their best? Are they simply ticking over or do they have the ability to actually perform and assist in your business growth?

Choose Kingston Technology

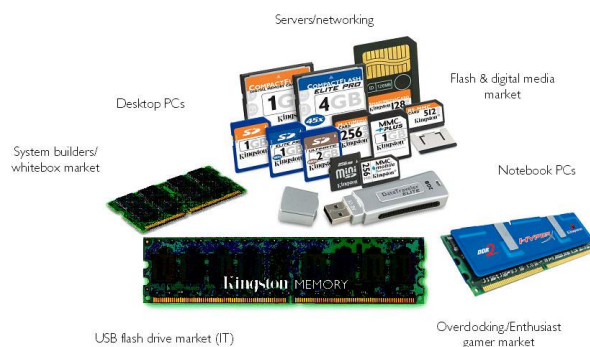
Founded in 1987, Kingston Technology is the world's largest independent manufacturer of memory products. A global company whose revenue exceeded \$2.4 billion in 2004, Kingston Technology offers an extensive line of computer memory and digital memory products. With global headquarters in Fountain Valley, California and European headquarters near London, United Kingdom, Kingston Technology employs more than 2,400 people worldwide.

Unlike many system vendors who are juggling multiple technologies and server components, Kingston Technology's sole focus is designing and manufacturing memory products. More than two thousand memory products are available to support over ten thousand computer systems, from PDAs, digital cameras and smartphones, to notebooks, desktops and workstations through to low, medium and high-end server systems. The manufacturing ability and capacity to ship up to seven million modules per month coupled with a keen focus on quality and reliability has ensured that Kingston Technology remains a market leader at the very top of its industry with a greater turnover than its next four competitors combined.

In fact it is so well known in the industry for its design and manufacturing expertise that it has a very successful OEM manufacturing division, designing and producing memory products covering multiple technologies and multiple capacities for a wide range of companies in a huge variety of industries.



Kingston Technology's computer-specific memory is sub-divided into seven distinctive market sectors as shown below:



Kingston server-specific memory undergoes stringent quality and compatibility testing. Unique, patented technologies such as the unique Server burn-in process and the back up of KingstonCare and a lifetime warranty, ensures that all Kingston system-specific Branded memory modules are sold with confidence and a one hundred per cent compatibility guarantee.

About VeriTest

VeriTest (www.VeriTtest.com), the testing division of Lionbridge Technologies, Inc., provides outsourced testing solutions. VeriTest created the suite of industry-standard benchmark software that includes WebBench, NetBench, Winstone, and WinBench. Twenty million copies of these tools have been distributed and are in use at every one of the 2001 Fortune 100 companies. Under its former names of ZD Labs and eTesting Labs, and now as part of LionBridge since July of 2002, VeriTest has delivered rigorous, objective, independent testing and analysis for over a decade.



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