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## Green Means Datacenter Savings

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*The following article was originally published as "Green Means Data Centre Savings" in the February 2009 edition of Voice & Data ([www.voiceanddata.com.au](http://www.voiceanddata.com.au)), Volume 7, Number 12. It updates the original article with supplemental charts and new data.*

Green IT is on every IT infrastructure professional's hot topics list – if not already on their current priority one projects list – and the datacenter is in the cross hairs with a big bright spotlight on it.

In 2007, green IT was typically seen as a vendor play with "green washing" of product announcements, and it was something for organizations to start worrying about after the current high-priority issues and projects were dealt with. In 2008, green IT became a mainstream issue, although often for the pragmatic need to reduce datacenter and general IT costs. Expectations for 2009 were that green IT would become an even broader issue, driven by climate change and IT sustainability agendas, and would move

from being just an IT issue to an issue discussed in the boardroom.

But with the current global economic crisis, will the green IT agenda retreat to a short-term cost-cutting focus by necessity?

Maybe, possibly, probably ... but in spite of the doom-and-gloom global economic outlook there is good news for the environment coming out of the datacenter. There is a direct correlation between reducing electricity costs and carbon emission reductions. So, if the agenda does retreat to cost cutting, so be it. Focus on the pragmatic where you need to and you will win both ways. Armed with that fact, now the question is: Where do I start, and start quickly?

*[Continued on page 2]*

### IN SUMMARY . . .

- » Cost saving and carbon emission reduction can go hand in hand and server consolidation is a high pay back area on which to focus the datacenter green IT drive.
- » There is a multiplier effect of greater than 2x for every dollar saved through server power reduction in the datacenter.
- » You can achieve very significant benefits while staying within your existing server platform environment, and the consolidation from old servers to new servers is where big wins are.
- » Virtualization provides the icing on the cake and enables you to have the most efficient platform outcome for the future.
- » The server consolidation ratio is the key to maximizing both power cost and carbon emission reduction.
- » Making good use of the analysis and data available in quality modeling tools with carbon calculators is a great aid and productivity benefit in planning green IT projects.

**[Green Means . . . continued from page 1]  
Analysis**

There are a number of factors that contribute to overall datacenter efficiency, and the ideal place to start is with an analysis of the current situation. Standard problem-solving techniques should apply. Get all the relevant information and plot a course of action. But this is often the first major hurdle. Sure, you have an equipment asset register of some form, a good handle on which are your older assets, and an expectation that older means less efficient. But is that enough?

IT management rarely has visibility on the power costs for the datacenter as the datacenter power costs are rolled up in the overall power costs for a location. Even if you do have the datacenter costs broken out, you are now staring at a big number without the breakdown of what contributes to that number.

However, there is more good news: There is a clear path forward. A critical eye cast over your server population is the next

best place to start. Why? Firstly, IT equipment typically consumes 50% of total data-center power, with the other 50% going into cooling that equipment, UPS, power reticulation, and lighting. In terms of datacenter IT equipment, the server population is the largest consumer of electrical power. Secondly, every dollar you save in server power has a flow-through effect to most other power consumption points in the data-center – most notably, cooling electricity costs. Typically, for every dollar you spend on electricity running a server, you will spend between \$0.80 and \$1.20 on electricity cooling it. Straight forward server technology updates are also likely to provide the shortest ROI period.

Now, at this point you probably run into some other questions, such as: Must I change my hardware supplier? Must I go to a blade server implementation? Do I even need to contemplate a change of operating system?

Well, the answers are no, no and NO.

**Consolidation**

Let's take a look at some consolidation scenarios to evaluate the answers to these questions in detail.

The starting assumption is 50 installed four-year-old x86 servers, branded Vendor A, running at an average 10% utilization. The plan is to consolidate these to new virtualized servers running at 35% average utilization and factor in 10% overhead for the virtualization software. The performance goal is for the new servers to match or exceed the utilized compute capacity of the old servers.

- » **Scenario 1:** Consolidate to the latest model of the same x86 rack server from Vendor A.
- » **Scenario 2:** Consolidate to new x86 blade servers, also from Vendor A.
- » **Scenario 3:** Consolidate to new equivalent x86 rack servers from a competing Vendor B.
- » **Scenario 4:** Consolidate to new RISC rack servers from competing Vendor C.

*[Continued on page 3]*

**Table 1. Consolidation from 50 Four-Year-Old x86 Servers to Virtualized New Servers**

	Number of New Servers	Utilized Power Reduction	Electricity Cost Reduction*(\$/yr)	CO2-e Emission Reduction (tonnes/yr)	Carbon Footprint Reduction
Vendor A Rack	4	89%	\$31,900	355	89%
Vendor A Blade	4	93%	\$33,400	372	93%
Vendor B Rack	4	92%	\$33,100	368	92%
Vendor C Rack	4	91%	\$32,800	365	91%

\* Includes allowance for cooling electricity at 80% of server electricity consumption; based on 0.08c per kWh

\*\* Based on the kg CO2-e/kWh conversion factor published by the Australian Government Department of Climate Change

**Table 2. Consolidation from 50 Four-Year-Old x86 Servers to Non-Virtualized New Servers**

	No. of New Servers	Utilized Power Reduction	Electricity Cost Reduction*(\$/yr)	CO2-e Reduction (tonnes/yr)	Carbon Footprint Reduction
Vendor A Rack	14	66%	\$23,700	264	66%
Vendor A Blade	14	80%	\$28,700	320	80%
Vendor B Rack	13	77%	\$27,800	309	77%
Vendor C Rack	13	73%	\$26,100	291	73%

\* Includes allowance for cooling electricity at 80% of server electricity consumption; based on 0.08c per kWh

\*\* Based on the kg CO2-e/kWh conversion factor published by Australian Government Department of Climate Change

**[Green Means . . . continued from page 2]**

For the x86 solutions in scenarios 1, 2, and 3, the same Xeon processor model is used, and in all four scenarios the new servers are four rack units with eight processor cores. The modeling is carried out using Ideas International's Server CAR server consolidation planning tool.

The outcome may surprise. Each of these four scenarios has the potential to reduce electrical power consumption and carbon footprint in the range of 89 to 93%, while saving over \$30,000 in electricity costs per annum.

Now that's not to say there isn't a variance in the target solution benefits, there is – as shown in Table 1 (previous page). The variations in power, electricity cost, and CO<sub>2</sub>-e reduction seen in the target solutions should not be ignored and the modeling tool makes it easy to ascertain the best case scenario. This would become even more significant in a larger server consolidation project. But the point here is that any variance in target vendor or server

type is swamped by the benefits of going from the old servers to new virtualized servers.

### Virtualization

It's then interesting to consider the benefit that virtualization contributes to these outcomes. If the target servers were not virtualized and were running at the same 10% utilization as the original servers, the modeling shows that you would still reduce electrical power consumption and carbon footprint in the range of 66 to 80%, while saving well over \$20,000 in electricity costs annually (see Table 2, previous page). Note that this model assumes the necessary application level consolidation was possible.

Virtualization certainly kicks the benefit numbers up to a higher level, but the most noticeable difference virtualization makes in these scenarios is in the number of new servers needed to replace the old servers. Without the benefit of virtualization driving up utilization, you would need over three times as many new servers, lengthening

your return on investment and tripling your new state power costs and carbon footprint.

So, while virtualization is the (thick) icing on the cake, the major share of these benefits comes from the transition and consolidation of older server technology to new.

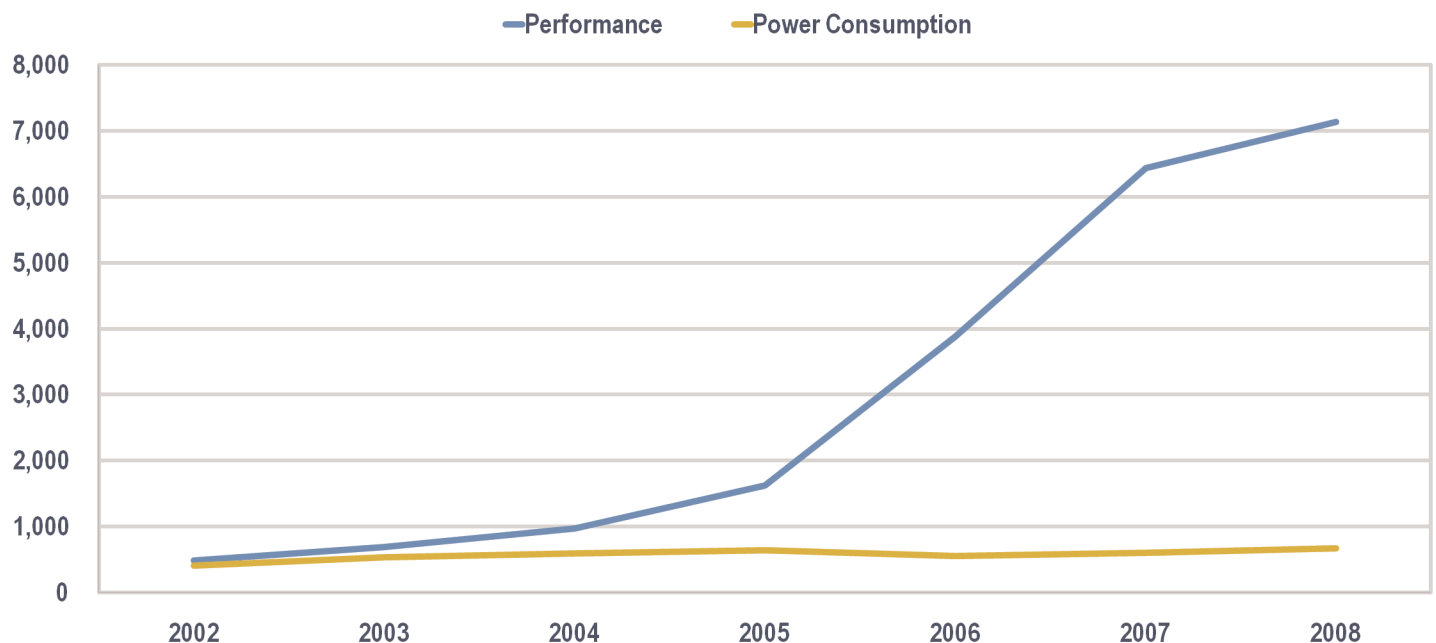
### Power vs. Performance

To get a better understanding of what is behind this outcome, let's look at the trend in server performance versus power consumption that is driving it. Take the example of a popular two-socket industry-standard server that has been marketed consistently since the year 2002. Plotting the performance versus power consumption over time tells quite a dramatic story (see Chart 1, below).

The steep rise in performance versus power consumption coincides with the introduction of multicore processors, and in this particular case, the Intel Xeon processor. A similar story applies for AMD Opteron and

*[Continued on page 4]*

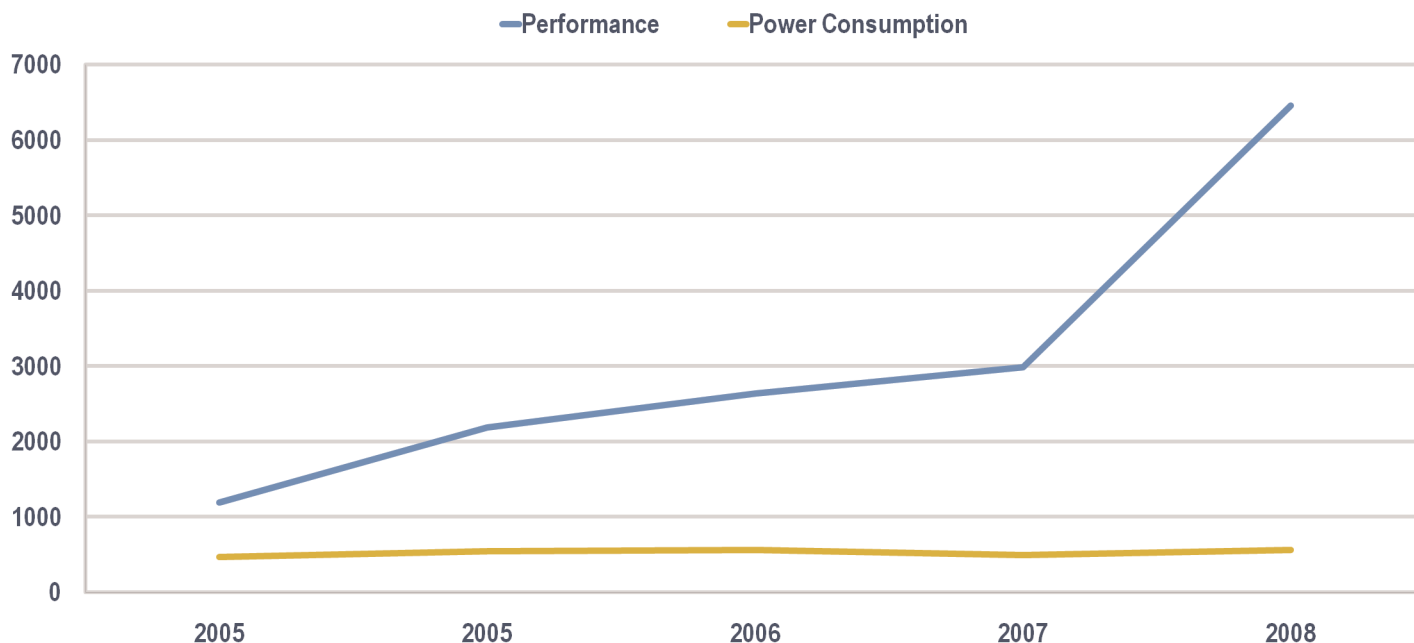
**Chart 1. Typical Two-Socket Xeon Server Performance vs. Power Consumption (2002 - 2008)**



Performance values are Ideas International's server relative performance estimates (RPE2)

Power consumption in watts is from the vendor's power calculator tool

Chart 2. Typical Two-Socket Opteron Server Performance vs. Power Consumption (2005 - 2008)



Performance values are Ideas International's server relative performance estimates (RPE2)

Power consumption in watts is from the vendor's power calculator tool

RISC processors. Note in Chart 2 (above) the equivalent AMD Opteron servers from the same vendor, marketed from 2005.

At the time the first multicore processors were developed, the processor and server manufacturers began placing much greater focus on the power and heat characteristics of servers. While the majority of the performance versus power consumption improvement is directly attributable to the processor technology, other factors such as power supply efficiency also now play a part. There is a strong industry drive for more efficient power supplies in servers since the power supplies, along with the processors, contribute most to the power consumption and hence efficiency of the server. Other power efficiency benefits are in state-of-the-art server management tools with advanced power management features, and these benefits are in addition to the increased server efficiency depicted in the chart.

Now a quick reality check. Sliding out your old faithful rack server and sliding in a shiny new super-efficient model will surely

blow the cobwebs off any processor performance bottlenecks you may have; but for all your effort, you will likely now be holding a larger power bill for the new server than for the old server. No green IT lapel badge here. Server efficiency improvement is being driven by performance increasing much faster than the power consumption required to achieve it, not the absolute power consumption itself. Looking at Chart 1 again, power consumption for the 2008 server (670 watts) is up by some 68% over the year 2002 server (400 watts), but in that same period, performance increased by a factor of nearly 15 compared to the 1.68 increase in power consumption. To reap these benefits, it is necessary to reduce the number of servers, and the significant gains only come with significant consolidation ratios. In the scenarios presented earlier, the consolidation ratio achieved with virtualization was twelve to one in all four scenarios. ■

#### About Server CAR

*Ideas International's (IDEAS) web-based Server CAR (Consolidation Analysis Resource) is an online tool that rapidly analyzes server consolidation scenarios with a key focus on deriving and quantifying footprint, energy, and carbon emissions reductions.*

*For more information, e-mail [info@ideasinternational.com](mailto:info@ideasinternational.com).*

# Dell Tops TPC-C Price/Performance

Dell has eclipsed its own TPC-C price/performance record with a new result for the PowerEdge 2900 III server. This new record of \$0.60/tpmC was achieved by configuring the PowerEdge 2900 III with a single 2.83 GHz Xeon E5440 quad-core processor and 32 GB of memory.

## New vs. Old

This is the fifth TPC-C result to be released for this system and the fourth to come under the \$1/tpmC mark. The table below compares these sub-\$1/tpmC results.

**Table 1. PowerEdge 2900 III TPC-C Results Compared†**

Date	Configuration	tpmC	\$/tpmC	DB	Total Cost
Feb 09	1 x 2.83 GHz Xeon E5440 (1ch/4co)	104,492	\$0.60	2	\$62,567 NEW
Jun 08	1 x 2.83 GHz Xeon E5440 (1ch/4co)	97,083	\$0.68	2	\$65,910
Mar 07	1 x 2.33 GHz Xeon E5345 (1ch/4co)	69,564	\$0.91	1	\$66,455
Jun 06	1 x 3.0 GHz Xeon 5160 (1ch/2co)	65,833	\$0.98	1	\$64,512

† Extracted from Competitive Profiles, an Ideas International service

### Database Key:

- 1 - Microsoft SQL Server 2005 Standard x64 Edition
- 2 - Oracle Database 11g Standard Edition One

While the total cost of ownership for all three systems is similar, the better performance of this latest result greatly enhances the price/performance ratio. It is worth noting that this latest result, as well as the one released in June 2008, was configured with 32 GB of memory (in contrast to the 24 GB used in the previous tests) and used Oracle Database 11g as opposed to Microsoft SQL Server.

Interestingly, this latest result improves upon the performance of the June 2008 result by 7.6%, even though both results used the same back-end hardware and software. The primary differences between the two results lie in the client hardware used and the type of PowerVault external disk enclosures employed. This latest result utilized a PowerEdge 2900 III client and four PowerVault MD1120 external disk enclosures, while the June 2008 result employed the PowerEdge SC1430 client and six PowerVault MD1000 enclosures.

## Top Ten

This latest result has claimed the top ranking in the TPC-C price/performance top ten, narrowly displacing the previous best result held by the same system (see Table 2, right). ■

## RESULT SUMMARY (ALL PRICES IN USD)

Date:	February 22, 2009
TPC-C:	PowerEdge 2900 III
Company:	Dell
tpmC:	104,492.00
\$/tpmC:	\$0.60
Database:	Oracle Database 11g Standard Edition One
Operating System:	Microsoft Windows Server 2003 Standard x64 Edition SP1
Availability Date:	20-Feb-09
DB Server Config:	PowerEdge 2900 III (1 x 2.83 GHz Xeon E5440 processor [1ch, 4co] with 2 x 6M B L2 cache, 32 GB memory)
Client Config:	1 x PowerEdge 2900 III (2 x 1.8 GHz Xeon E5205 processors (2ch, 4co) each with 6 MB L2 cache)
Cost of Ownership:	\$62,567
Total Storage:	6,536.00 GB
Benchmark Rev:	5.10

**Table 2. TPC-C Overall Price/Performance Top Ten†**

Configuration	tpmC	\$/tpmC	DB
1 Dell PowerEdge 2900 III (1ch/4co)	104,492.00	\$0.60	1 NEW
2 Dell PowerEdge 2900 III (1ch/4co)	97,083.00	\$0.68	1
3 HP ProLiant ML350 G5 (1ch/4co)	102,454.00	\$0.73	1
4 HP ProLiant ML350 G5 (1ch/4co)	100,926.00	\$0.74	2
5 HP ProLiant ML350 G5 (1ch/4co)	82,774.00	\$0.84	3
6 Sybase PowerEdge 2950 III (1ch/4co)	20,705.00	\$0.85	4
7 Dell PowerEdge 2900 III (1ch/4co)	69,564.00	\$0.91	3
8 HP ProLiant DL585 G5 (4ch/16co)	579,814.00	\$0.96	5
9 HP ProLiant DL580 G5 (4ch/24co)	639,914.00	\$0.97	1
10 Dell PowerEdge 2900 III (1ch/2co)	65,833.00	\$0.98	3

† Extracted from Competitive Profiles, an Ideas International service

### Database Key:

- 1 - Oracle Database 11g Standard Edition One
- 2 - Oracle Database 10g Standard Edition One
- 3 - Microsoft SQL Server 2005 Standard Edition
- 4 - SQL Anywhere 11
- 5 - Microsoft SQL Server 2005 Enterprise Edition



MARCH BLOG BITE (From IDEAS Insights: <http://www.ideasint.blogs.com>)

“Dell is filling in its virtualization portfolio at a critical time, just as customers are starting to ponder the implications of applying virtualization across the data-center, an endeavor in which I/O infrastructure virtualization will play a key role . . .”

From “Dell Extends Virtualization to Managed I/O with Xsigo Alliance” | Tony Iams | March 10, 2009  
<http://ideasint.blogs.com/ideasinsights/2009/03/dell-extends-virtualization-to-managed-io-with-xsigo-alliance.html>



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