TCO COMPARISON: DELL POWEREDGE R815 VS. IBM SYSTEM X3850 X5

Dell™ PowerEdge™ R815 server delivered 10% lower TCO than the IBM® System x3850 X5 server

Dell PowerEdge R815 server with
AMD Opteron™ processors Model 6174

IBM System x3850 X5 server with
Intel® Xeon® Processor X7560s

OUR FINDINGS

The Dell PowerEdge R815 server with AMD Opteron processors Model 6174 can provide lower total cost of ownership (TCO) over 3 years than the IBM System x3850 X5 server with Intel Xeon Processor X7560s.[1] In Principled Technologies' tests in our labs, the Dell PowerEdge R815 achieved slightly higher DVD Store Version 2 results while consuming less power on average than the IBM System x3850 X5 server.[2] Cost for hardware and 3-year hardware support on the Dell PowerEdge R815 server is up to 48.2 percent less than the IBM System x3850 X5 server[3]. The lower power costs of the Dell PowerEdge R815, along with much lower hardware costs, provide a TCO advantage over the performance-equivalent IBM System x3850 X5 server.

OUR PROCESS

We used the open-source DVD Store Version 2 benchmark to provide a workload representative of many real-world database applications. With it, we measured the performance and power of the two servers, each of which was running Microsoft® Windows Server® 2008 R2 Enterprise Edition with Microsoft SQL Server® 2008 R2. Each server ran 48 virtual machines (VMs) using Hyper-V™. We calculated the 3-year TCO of the Dell PowerEdge R815 and of the IBM System x3850 X5 using energy cost estimates based on the power measurements in our labs, server and support prices from the Dell and IBM Web sites, and our own cost estimates for provisioning, facilities, software, and server management.

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[1] Source: Principled Technologies, Inc., "TCO comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," an August 2010 report commissioned by Dell Inc. TCO analysis includes hardware, hardware support, and estimated provisioning, energy consumption, data center space, software, software support, and server administration costs. Actual performance will vary based on configuration, usage and manufacturing variability. For details, see http://principledtechnologies.com/clients/reports/Dell/PowerEdge_R815_TCO_0810.pdf.

[2] See our companion report, "Virtualized database performance comparison: Dell PowerEdge R815 vs. IBM System x3850 X5"

[3] Source: Principled Technologies, Inc., "TCO comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," op. cit.

PROJECT OVERVIEW

We tested the following servers and processors:

- Four-socket Dell PowerEdge R815 server with AMD Opteron processors Model 6174
- Four-socket IBM System x3850 X5 server with Intel Xeon Processor X7560s

We estimated costs for a hypothetical enterprise planning to purchase either the Dell PowerEdge R815 or the IBM System x3850 X5. The Dell PowerEdge R815 delivered slightly higher performance in tests in our labs, which we describe in our companion report.[4] The enterprise is seeking a solution that provides the lowest 3-year TCO and hopes to realize savings through lower power consumption, lower hardware costs, and lower data center costs. The analysis in this report considers both acquisition costs and 3-year operating costs of each server.

Figure 1 shows our estimate of 3-year TCO for performance-equivalent configurations of the two servers, a Dell PowerEdge R815 server and an IBM System x3850 X5. The Dell PowerEdge R815 delivers up to 20.6 percent lower TCO in the first year and up to 10.1 percent lower 3-year TCO than the IBM System x3850 X5, a savings of up to $25,720 over 3 years.[5]
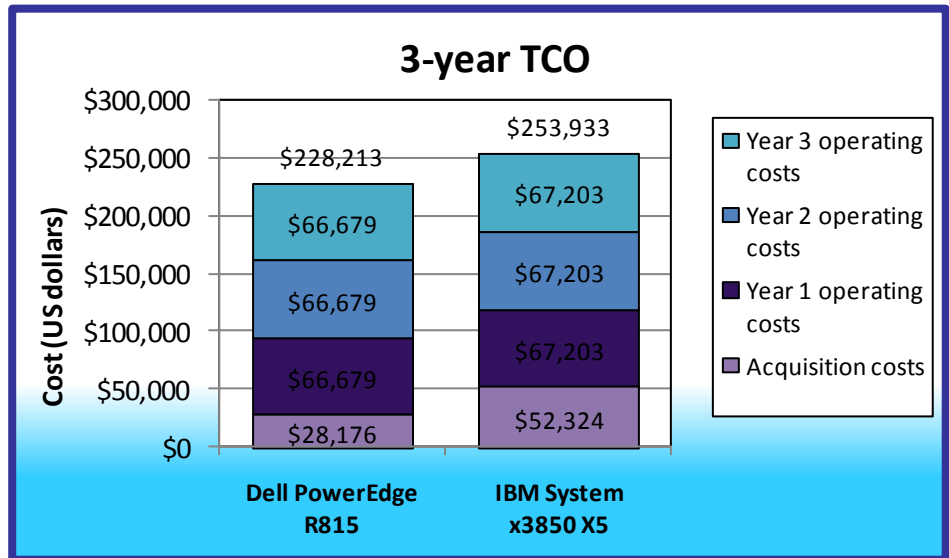

Figure 1: The 3-year TCO for the test servers. Lower numbers are better.

We used the open-source DVD Store Version 2 (DS2) benchmark to measure the database performance of the two servers to verify that the configurations provided equivalent performance. DS2 uses a results metric of orders per minute (OPM).

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[4] Source: Principled Technologies, Inc., "Virtualized database performance comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," an August 2010 report commissioned by Dell Inc.

[5] Source: Principled Technologies, Inc., "TCO comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," an August 2010 report commissioned by Dell Inc. TCO analysis includes hardware, hardware support, and estimated provisioning, energy consumption, data center space, software, software support, and server administration costs. Actual performance will vary based on configuration, usage and manufacturing variability. For details, see http://principledtechnologies.com/clients/reports/Dell/PowerEdge_R815_TCO_0810.pdf.

As Figure 2 shows, the two servers delivered nearly equal performance in our testing. The Dell PowerEdge R815 achieved a score of 418,103 OPM, a 1.7 percent increase over the IBM System x3850 X5's score of 411,224 OPM.[6]

We set up each server as we show in Figure 3. We stored the databases on external storage, using the same storage

Performance-equivalent configurations

Figure 2: Performance-equivalent configurations based on DS2 OPM results. Higher OPM results are better.

arrays in tests with both servers. We do not include the costs for storage in this analysis.

Figure 3 shows the system configuration overview for the two servers. We base the costs we include in the TCO calculations on these configurations. Detailed configuration information about the servers is available in our companion performance report.[7]
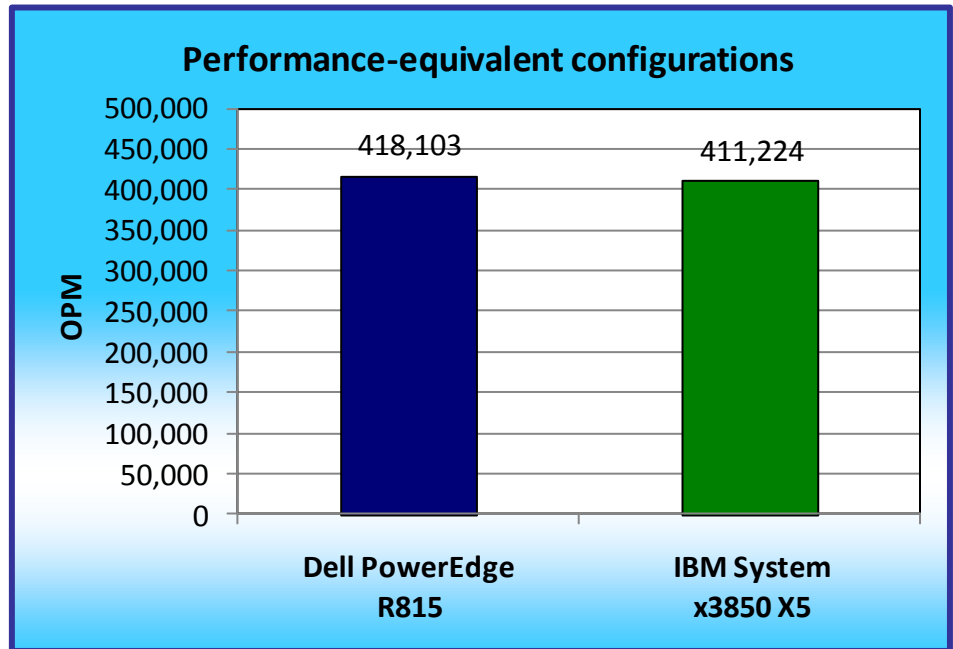
System configuration	Dell PowerEdge R815	IBM System x3850 X5
CPU	AMD	Intel
CPU speed (GHz)	2.2	2.26
Number of processor packages	4	4
Number of cores per processor package	12	8
Number of hardware threads per core	1	2
Memory type	PC3-10600R	PC3-8500R
Total memory (GB)	256	256
Number of VMs	48	48
Number of DB per instance (1 instance per VM)	1	1
DB size (GB)	2.5	2.5

Figure 3: Key specifications of the two servers.

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[6] Source: Principled Technologies, Inc., "TCO comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," an August 2010 report commissioned by Dell Inc. TCO analysis includes hardware, hardware support, and estimated provisioning, energy consumption, data center space, software, software support, and server administration costs. Actual performance will vary based on configuration, usage and manufacturing variability. For details, see http://principledtechnologies.com/clients/reports/Dell/PowerEdge_R815_TCO_0810.pdf.

[7] Source: Principled Technologies, Inc., "Virtualized database performance comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," an August 2010 report commissioned by Dell Inc.

After we defined the system configurations, we gathered price data and measured energy consumption for the two servers.

Figure 4 shows the cost for the server hardware and 3-year hardware support, which we obtained from the Dell and IBM Web sites on July 30, 2010. The Dell PowerEdge R815 cost includes the server and 3-year ProSupport for IT 4HR 7x24
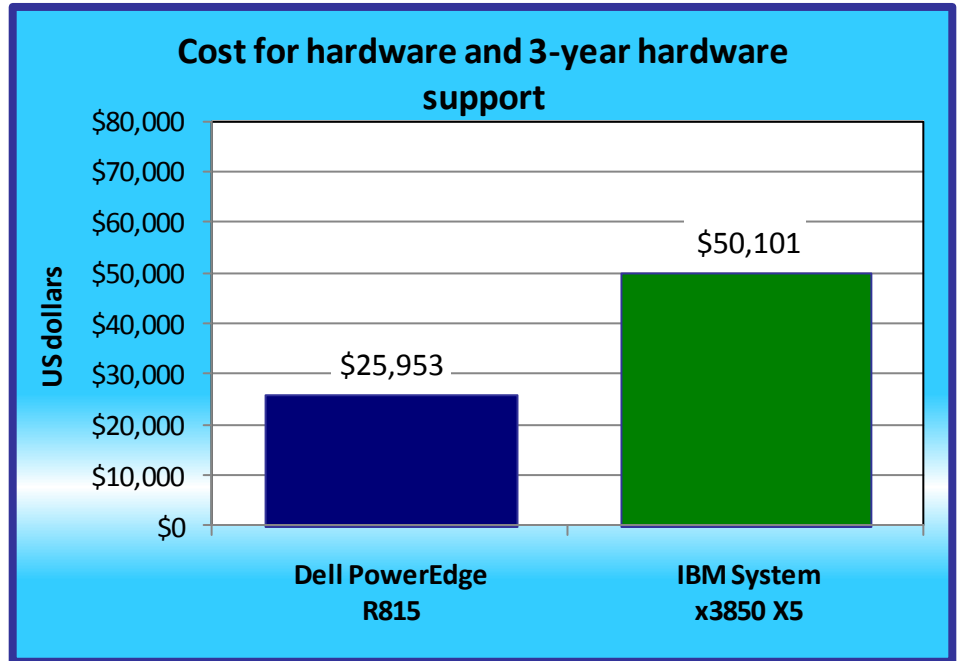

Cost for hardware and 3-year hardware support

Figure 4: Hardware and 3-year hardware support costs for the two solutions.

Onsite: Non-Mission Critical. The price for the IBM System x3850 X5 includes the server and 3-year Onsite Repair 24x7 4 Hour Response. Cost for hardware and 3-year hardware support on the Dell PowerEdge R815 server is up to 48.2 percent less than the IBM System x3850 X5 server. We use list price for all prices in this analysis.

We based energy cost calculations for the TCO analysis on the amount of power the servers used during DS2 benchmark runs. Workload power results measure power consumption when the server is running at peak performance. The idle power workload results show power consumption when the server is booted but not running a benchmark workload. We averaged the workload power and idle power results to create an estimate of typical power usage that we use to project energy costs.

Figure 5 shows our energy usage estimates. We estimate that the Dell PowerEdge R815 uses 35.9 percent less power than the IBM System x3850 X5 in typical power usage, resulting in proportionately lower energy costs.[8] The TCO calculations for the two servers consider acquisition costs including initial hardware and hardware support costs as well as the costs of provisioning the server. They also include ongoing costs over a projected 3-year lifespan of the solution for energy, facilities, software and software support, and server administration.
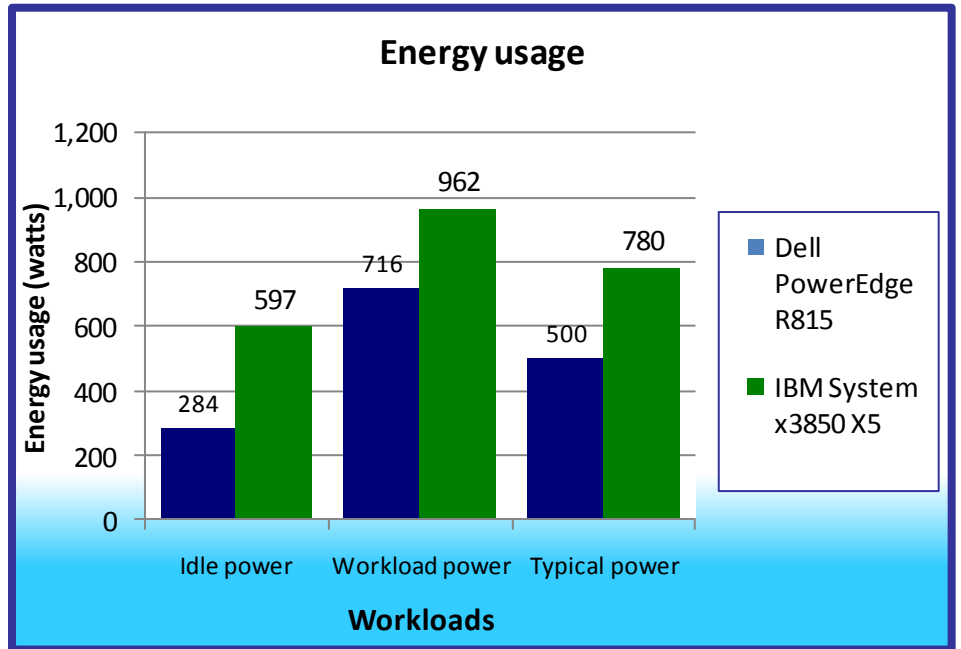

Figure 5: Energy usage, in watts, for the test servers running three different workloads. Lower numbers are better.

WHAT WE FOUND
TCO results

Figure 6 details the results of our TCO analysis of the two servers. The Dell PowerEdge R815 provides 10.1 percent lower 3-year TCO compared to the IBM System x3850 X5 server.[9] Acquisition costs, which include purchase costs plus provisioning costs, for the Dell PowerEdge R815 are 46.2 percent lower than for the IBM System x3850 X5.[10] Further, 3-year operating costs for the Dell PowerEdge R815 are 0.8 percent lower than for the IBM System x3850 X5.[11]

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[8] Source: Principled Technologies, Inc., "TCO comparison: Dell PowerEdge R815 vs. IBM System x3850 X5," an August 2010 report commissioned by Dell Inc. TCO analysis includes hardware, hardware support, and estimated provisioning, energy consumption, data center space, software, software support, and server administration costs. Actual performance will vary based on configuration, usage and manufacturing variability. For details, see http://principledtechnologies.com/clients/reports/Dell/PowerEdge_R815_TCO_0810.pdf.
[9] *Ibid.*
[10] *Ibid.*
[11] *Ibid.*

Costs	Dell PowerEdge R815	IBM System x3850 X5	Percentage savings with the Dell PowerEdge R815
Acquisition costs (hardware, hardware support, and provisioning)	$28,176	$52,324	46.2%
3-year operating costs (energy, data center, software and software support, and server administration)	$200,037	$201,609	0.8%
Total	**$228,213**	**$253,933**	**10.1%**

Figure 6: TCO for the Dell PowerEdge R815 and the IBM System x3850 X5. Lower costs are better. Higher percentage savings are better.

The Dell PowerEdge R815 delivers an estimated 3-year TCO advantage because it has much lower hardware costs and slightly lower facilities and energy costs than an IBM System x3850 X5.

Hardware and hardware support costs

The Dell PowerEdge R815 costs $25,953 for hardware including 3-year ProSupport 4HR 7x24 Onsite Non-Mission Critical, compared to $50,101 for the IBM System x3850 X5 and 3-Year Onsite Repair 24x7 Four Hour Response.

Facilities cost savings

The 2u Dell PowerEdge R815 can save on data center costs because it requires half the data center space of the 4u IBM System x3850 X5. We include minimal data center space costs so the savings are modest.

Energy costs

The Dell PowerEdge R815 saves on energy costs because it uses less energy than the IBM System x3850 X5. We estimate that, under typical load, the Dell PowerEdge R815 uses 500 watts versus 780 watts for the IBM System x3850 X5.

HOW WE CALCULATED TCO

Acquisition costs

Acquisition costs include server purchase costs, 3-year hardware support costs, and provisioning costs.

- **Server hardware and 3-year support cost.** We went to the Dell and IBM Web sites to look up purchase prices for the hardware and support. We include list prices without discounts for both solutions.

- **Provisioning costs.** We used our own estimates for planning time, and relied on our own lab experience of setting up and installing software on Dell and IBM servers. We estimate that each server requires 40 hours provisioning time.

Figure 7 presents the acquisition costs we considered in this analysis.

Acquisition costs	Dell PowerEdge R815	IBM System x3850 X5	Percentage Dell win
Hardware cost (hardware purchase and 3-year hardware support)	$25,953	$50,101	48.2%
Provisioning cost (administrator time to acquire and set up server)	$2,223	$2,223	0.0%
Total	**$28,176**	**$52,324**	**46.2%**

Figure 7: Acquisition costs for the two servers. Lower costs are better. Higher savings are better.

Operating costs

Operating costs include operating system, database software, and Microsoft software assurance agreements, prorated rack space and port costs, energy costs for powering and cooling the servers, and labor costs for the server administrator. Figure 8 shows our estimates of the operating costs for the two servers over 3 years.

Operating costs	Dell PowerEdge R815	IBM System x3850 X5	Percentage Dell win
Software costs (Microsoft Windows Server 2008 R2 and Microsoft Windows SQL Server 2008 R2)	$63,144	$63,144	0.0%
Facilities costs (rack space and port costs)	$173	$217	20.3%
Energy costs (power and cooling)	$862	$1,342	35.8%
Management costs (labor for server administration)	$2,500	$2,500	00.0%
Total	**$66,679**	**$67,203**	**0.8%**

Figure 8: Three-year operating costs for the two servers. Lower costs are better. Higher savings are better

Although both servers have the same costs for software and administration, the Dell PowerEdge R815 presents slight savings in operating costs. Software costs are the same because the servers have the same number of processors and VMs, the two factors that determine license counts for Microsoft Windows Server 2008 R2 and Microsoft SQL Server 2008 R2. We also estimate the same number of system administrators and therefore the same system administration cost for the two servers. The Dell PowerEdge R815 saves on operating costs because it uses less energy and takes up less rack space.

SUMMARY

We calculated the TCO for a hypothetical large-scale enterprise that plans to purchase either a Dell PowerEdge R815 server or an IBM System x3850 X5 server for an active OLTP environment running under

Windows Server 2008 R2 and SQL Server 2008 R2. We used each server's performance running the DVD Store Version 2 benchmark to determine performance-equivalent configurations of the servers and then calculated the cost of those servers.

The Dell PowerEdge R815 had a lower acquisition cost and lower annual costs than the performance-equivalent IBM System x3850 X5. The savings were due to the following key factors:

- The Dell PowerEdge R815 costs 48.2 percent less for hardware and hardware support.
- The Dell PowerEdge R815 uses less than half of the data center space: 2u vs. 4u.
- The Dell PowerEdge R815 uses 35.9 percent less power than the IBM System x3850 X5, 500 watts vs. 780 watts for a typical workload.[12]

We calculate that a Dell PowerEdge R815 saves $24,148 in acquisition costs and $1,572 in operating costs over 3 years compared to the cost of the performance-equivalent IBM System x3850 X5. As a result of these savings, in this analysis, the Dell PowerEdge R815 delivers over 20.6 percent lower TCO in the first year and 10.1 percent lower 3-year TCO.

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[12] The average of idle power usage and power usage under peak load running the DVD Store Version 2 benchmark.

APPENDIX A – ASSUMPTIONS

We used the DVD Store Version 2 benchmark to identify performance-equivalent configurations of the two servers and calculated TCO for those configurations.

We made the following assumptions in creating the TCO estimates in this report, which we organize by cost category following a list of general assumptions.

General assumptions

- Simplifying assumptions include assuming all prices for ongoing costs such as power, data center space, data center ports, and administrator salaries stay the same for the 3-year timeframe of the analysis.
- We include list prices with no discounts for all prices. We used list prices for all purchase costs because discounts vary by buyer and by vendor; this approach provides the most level playing field possible for our comparison. Costs do not include taxes or shipping costs.
- We do not include the costs of the external storage arrays or the cables and switches used to connect the servers to the storage in this analysis. In our tests, the two servers used the same storage arrays. We assume the hypothetical enterprise in this analysis either has the storage arrays in house already or is acquiring them in a separate procurement.

Acquisition costs

- We assume the current server administrator has experience in both Microsoft Windows Server 2008 R2 and Microsoft SQL Server 2008 R2 and does not require additional training on these software packages. We therefore do not include administrator training in the costs.
- The administrator or other similarly compensated staff requires 40 hours for planning, procurement, and setting up either server. We include costs for that time in our provisioning cost estimate.
- Our support prices for the Dell PowerEdge R815 include non-mission critical support available 24 hours a day and 7 days a week with a 4-hour response time. Dell offers a higher-cost mission-critical support that provides additional coverage. The Dell non-mission critical support is a closer match to the support with 24-hour-a-day, 7-day-a-week service with a 4-hour response time that is available from IBM. Under these agreements, the vendor, not the data center staff, does the majority of hardware maintenance. We did not include any additional maintenance costs.
- The enterprise has per-device or per-user client access licenses costs for which are not included in this analysis.

Software costs

- Both servers would run Microsoft Windows Server 2008 R2 Datacenter Edition operating system. We include costs for a license plus annual software assurance costs for each processor. We selected the Datacenter edition for the TCO analysis because it offered savings over the Enterprise edition we used in testing, which would have required one license for each set of 4 VMs. Software costs were the same for the two servers with either edition. Note that we used Microsoft Windows Server 2008 R2 Enterprise Edition in our testing.

- We use Microsoft SQL Server 2008 R2 Enterprise Edition for the database costs in this example. We include costs for a license plus annual software assurance costs for each of the four VMs. For this package, the Enterprise edition, licensed per server, saved over the Datacenter edition licensed per processor. Software costs were the same for the two servers with either edition.

Facilities costs

Facilities costs include rack costs that reflect rack footprint, including clearances and port costs.

We made the following assumptions about facilities costs:

- The data center fills racks to capacity and has adequate power and cooling capacity for those full racks.
- Data center Ethernet port costs average $129 per port per year for the switch hardware and hardware support.
- The data center costs $910 per rack per year for data center space. We based this on a cost of $65 per square foot per year for data center space and an average of 14 square feet per rack, including both the space the rack occupies and the necessary clearances around it.

Energy costs

We made the following assumptions about energy costs:

- The hardware is busy one-half of the time and idle the remaining time, and it runs all day, every day. We average the active and idle power usage measurements to get a power usage value to use in the power cost calculations.
- For each dollar the enterprise spends on electricity for server power, it spends an additional dollar on power to cool the server and to power auxiliary equipment.[13] Data centers may have different proportions of these costs because cooling efficiency and technology, rack densities, and other factors affect cooling costs.
- The data center costs for power and cooling are $0.0986 per KwH.[14] We base this estimate on the Department of Energy's data on average commercial charges for April 2010.

Management costs

- Average annual loaded server administrator cost is $100,000.
- Each system administrator supports 40 servers of either solution.
- We include server administrators but not database administrators. The number of database administrators would be the same for the two solutions, because the two solutions support the same database workload.
- We do not include costs for management software.

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[13]Estimating Total Power Consumption by Servers in the U.S. and the World, Jonathan G. Koomey, PhD, February 15, 2007
http://enterprise.amd.com/Downloads/svrpwrusecompletefinal.pdf
[14] Source: National commercial average for April 2010 as reported in http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html

About Principled Technologies

Principled Technologies, Inc.
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