Principled Technologies®

WHITE PAPER
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Total cost of ownership (TCO) of Dell PowerEdge M610 and HP ProLiant BL465c G5 blade solutions

TCO comparison

Dell Inc. (Dell) commissioned Principled Technologies (PT) to compare the total cost of ownership (TCO) of two half-height blade solutions, which we list in alphabetical order:

- Dell PowerEdge M610 server
- HP ProLiant BL465c G5 server

TCO includes hardware, support, management software, IO virtualization, power, cooling, network ports, and data center space. We examined the TCO of these blade solutions at acquisition and at 1, 3, and 5 years. We compared costs by rack, by chassis, and by blade.

KEY FINDING

- In TCO comparisons by rack, by chassis, and by blade, the Dell™ PowerEdge™ M610 blade solution had a lower TCO and yielded significant cost savings over the HP ProLiant BL465c G5 blade solution.[1]
- Dell's lower cost for management software and I/O virtualization software for the PowerEdge M610 blade solution contributes significantly to Dell's cost savings over the HP ProLiant BL465c G5 blade solution.

We also factored into our analysis the results of performance tests of these solutions that we detail in two other reports on these blade solutions.[2]

Dell TCO savings per rack, chassis, and blade

Figures 1 through 3 estimate acquisition costs and 1-, 3-, and 5-year TCO for similar configurations of each solution.

	Savings per rack	
	Dell over HP	
Acquisition costs	$129,788	14%
TCO for 1 year	$131,476	13%
TCO for 3 years	$134,852	13%
TCO for 5 years	$102,244	9%

Figure 1: Dell offers significant savings per rack over HP in acquisition costs and 1-, 3-, and 5-year TCO.

	Savings per chassis	
	Dell over HP	
Acquisition costs	$32,447	14%
TCO for 1 year	$32,869	13%
TCO for 3 years	$33,713	13%
TCO for 5 years	$25,561	9%

Figure 2: Dell offers significant savings per chassis over HP in acquisition costs and 1-, 3-, and 5-year TCO.

The TCO analysis we present in Figures 1 through 3 draws on the power utilization from the performance studies we cited earlier. In these studies, we found the Dell PowerEdge M series blades used 7.7 and 8.5 percent less power while active per blade than did the HP ProLiant BL series blades in our two performance studies.

We based our choice of blade server configurations on the configurations we tested for the two performance reports. Those reports compare benchmark performance and power utilization for the two blades solutions using virtualized Exchange and virtualized OLTP workload performance tests run on a single blade server paired with a storage solution. For those tests, we paired the HP server with HP EVA 4400 storage and the Dell server with Dell EqualLogic storage. To obtain the best performance from the HP StorageWorks, we connected it to the server via Fibre Channel. To obtain the best performance from the Dell EqualLogic, we connected it to the server via iSCSI. While we do not include the costs of

[1] TCO includes hardware, support, management software, IO virtualization, power, cooling, network ports, and data center space.

[2] *Virtualized OLTP workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400 storage* and *Virtualized Exchange workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400*.

	Savings per blade	
	Dell over HP	
Acquisition costs	$2,028	14%
TCO for 1 year	$2,054	13%
TCO for 3 years	$2,107	13%
TCO for 5 years	$1,598	9%

Figure 3: Dell offers significant savings per blade over HP in acquisition costs and 1-, 3-, and 5-year TCO.

the storage in this TCO comparison, we do include the costs of the Fibre Channel and iSCSI connections.
We adjust the configurations used in the performance analyses to include a full rack of servers and to include I/O virtualization. We assume the storage arrays are already in place and do not include their costs. Figure 4 summarizes the configurations used for this TCO analysis.

The Dell PowerEdge M610 solution had two 2.4GHz Intel Xeon E5530 processors and 72 GB of RAM while the HP ProLiant BL465c solution had two 2.7GHz AMD Opteron 2384 processors and 64 GB of RAM. The difference in the quantity and speed of RAM in the systems was due to the difference in system architectures and was not a factor in performance in our performance comparisons as each virtual machine (VM) was limited to 4 GB of RAM and we tested with at most 11 VMs.

Configurations		
	Dell	**HP**
Four 10u enclosures in a 42u rack	Each PowerEdge M1000e blade server chassis included two pairs of M6220 redundant Ethernet switches and a FlexAddress module.	Each HP BladeSystem c-Class c7000 enclosure included one HP 1/10Gb Virtual Connect Ethernet Module for c-Class BladeSystem and two HP 4Gb Virtual Connect Fibre Channel Modules for c-Class BladeSystem.
16 half-height blades per enclosure	Each blade included two 2.4GHz Intel Xeon E5530 processors, two 72GB 15,000 RPM disk drives, 72 GB (6x8 GB plus 6x4 GB) RAM, and an Onboard Broadcom 5709 Dual Port GbE NIC, with TOE, and a Broadcom 5709 Dual Port GbE I/O Card for M-Series Blades..	Each blade included two 2.7GHz Quad-Core AMD Opteron™ Processors Model 2384, two 72GB 15,000 RPM disk drives, 64 GB (8x8 GB) RAM, one QLogic QMH2462 4Gb FC HBA for HP c-Class BladeSystem, two embedded NC373i Multifunction Gigabit Network Adapters and one embedded NC326i Dual Port Gigabit NIC
Management software	We included Dell Open Manage, which Dell includes at no additional cost with each enclosure, and added the costs of Altiris Deployment Solution for each enclosure.	We include costs for HP c-Class Insight Control Environment for BladeSystem licenses for each enclosure and HP Virtual Connect Enterprise Manager v1.0.

Figure 4: Comparison configurations.

I/O virtualization adds components to each configuration. Dell's FlexAddress enables seamless replacement of blades while maintaining network identifiers for both the Ethernet data network and the iSCSI SAN. FlexAddress operates through the Chassis Management Controller (CMC) of the PowerEdge m1000e; thus, it works with all I/O modules including Dell Ethernet modules. Because the CMC controls FlexAddress, there is no additional management layer, but is instead a seamless integration of FlexAddress into the network and server management in use in data centers today. To support FlexAddress on four ports per enclosure, we include two redundant Ethernet modules per enclosure and the Broadcom 5709 2-port onboard NIC and 2-port I/O card per blade, plus the FlexAddress module.

HP's Virtual Connect also enables seamless replacement of blades while maintaining network identifiers for both the Ethernet data network and the FC SAN. In this configuration, Virtual Connect required a pair of HP 1/10Gb-F Virtual Connect FC modules for the FC SAN connections, an 4Gb FC HBA, and an HP 1/10Gb- Virtual Connect Ethernet for the 1Gb Ethernet data network. We also included HP Virtual Connect Enterprise Manager 1.0 to enable management of multiple enclosures.

We provide the details that support this TCO analysis in Appendix A.

Another perspective on TCO: Performance equivalents

An enterprise seeking a solution that will deliver a desired level of performance may size its blade solutions to meet that goal. This sizing process can result in solutions that vary greatly in size, complexity, and cost. Because the solution with the highest-performing blades requires the fewest blades, enclosures, and racks, it also costs the least for space, power, and cooling, and it thus requires fewer management software licenses and support agreements.

This section examines TCO from the perspective of configurations that deliver comparable performance. We used our benchmark results from the two performance analysis studies we cited earlier to estimate the size of the HP solution that would deliver performance equal to a single rack of the Dell solution.

At peak load of Microsoft Exchange LoadGen 2007, each blade in the Dell solution delivered 25 percent greater performance than the HP solution.[3] At peak load of the DVD Store Version 2 (DS2) test tool that we used to gauge OLTP performance, each blade in the Dell solution delivered 22.5 percent greater performance than the HP solution.[4] These differences in scores translate into a significant difference in the number of individual blades a company needs to achieve comparable performance. The difference thus also accounts for major differences in overall configuration size and cost.

Each configuration includes one rack filled to maximum blade capacity, i.e., four 42u enclosures, each holding 16 blades. For the HP solution, we also added the additional blades it needed to be able to match the performance of the single Dell rack. We rounded our results up to the nearest blade. The performance-equivalent configurations in Figure 5 are the same based on the 25 percent performance difference for the Exchange workload performance and the 22.5 percent difference for the OLTP workload performance. We base the performance-equivalent configurations in Figure 6 on the 22.5 percent difference for the OLTP workload performance.

[3] *Virtualized Exchange workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400*.

[4] *Virtualized OLTP workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400 storage*.

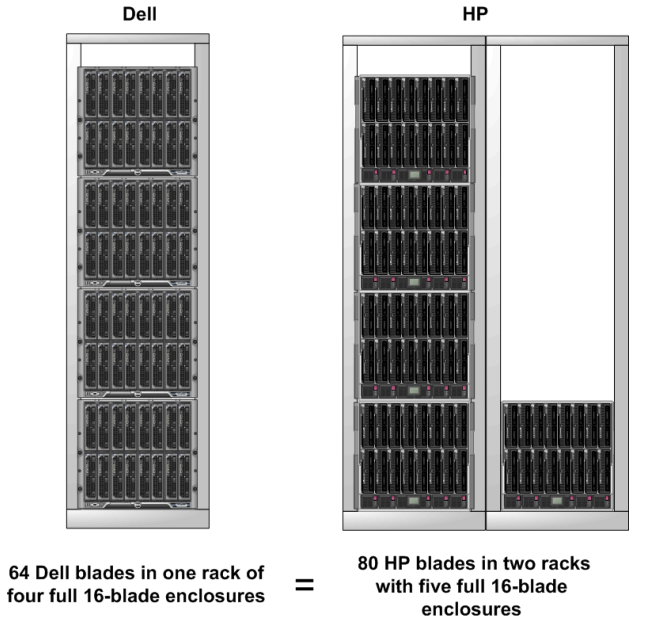

Figure 5: Estimated size of solutions needed to deliver the performance equivalent of one rack of the Dell solution. We base estimates on ratios of the results of our virtualized Exchange workload performance tests, which we conducted using single blades. Smaller solutions are better.

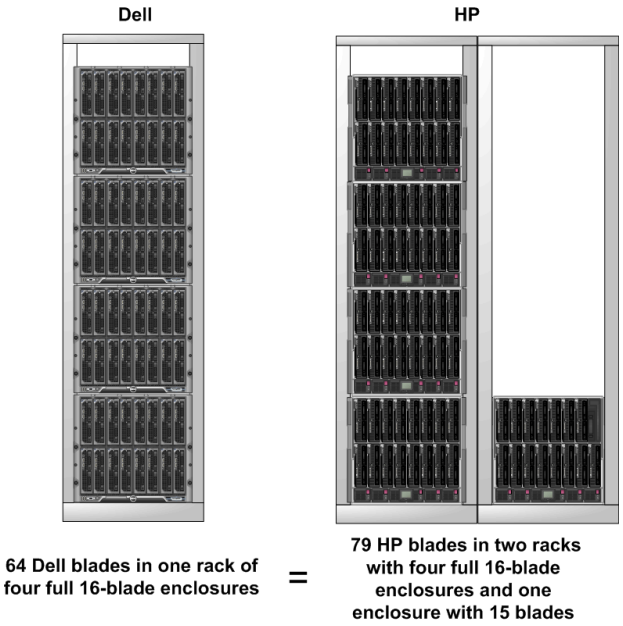

Figure 6: Estimated size of solutions needed to deliver the performance equivalent of one rack of the Dell solution. We base estimates on ratios of the results of our virtualized OLTP workload performance tests, which we conducted using single blades. Smaller solutions are better. The performance equivalent HP configuration based on this OLTP comparison has one fewer blade than the Exchange workload-based performance-equivalent comparison.

As Figures 7 and 8 show, the HP solution that delivers performance equivalent to one rack of the Dell blades has a significantly higher TCO than the Dell solution.

	Savings over Exchange workload-based performance-equivalent configurations	
	Dell over HP	
Acquisition costs	$366,207	31%
TCO for 1 year	$375,933	31%
TCO for 3 years	$395,384	30%
TCO for 5 years	$396,618	27%

Figure 7: Dell offers significant savings over performance-equivalent configurations from HP in acquisition costs and 1-, 3-, and 5-year TCO. We base costs on the costs of a rack of Dell servers and a performance-equivalent number of HP servers. We base estimates on ratios of the results of our virtualized Exchange workload performance tests.

	Savings over OLTP workload-based performance-equivalent configurations	
	Dell over HP	
Acquisition costs	$351,431	30%
TCO for 1 year	$360,654	30%
TCO for 3 years	$379,101	29%
TCO for 5 years	$378,219	26%

Figure 8: Dell offers significant savings over performance-equivalent configurations from HP in acquisition costs and 1-, 3-, and 5-year TCO. We base costs on the costs of a rack of Dell servers and a performance-equivalent number of HP servers. We base estimates on ratios of the results of our virtualized OLTP performance tests.

We provide details of this analysis in Appendix B.

Summary

Enterprises of all sizes are deploying or considering deploying blade systems as a way to consolidate resources and lower their total cost of ownership. These solutions tend to be easier to deploy and manage than traditional rack servers and offer lower energy consumption for both server power and cooling.

We calculated the total cost of ownership (TCO) for the Dell PowerEdge M610 and the HP ProLiant BL465c. Our 1-, 3-, and 5-year TCO estimates included costs for hardware, support, management software, power, cooling, data center costs, and out-of-box setup.

We provided TCO comparisons using two methods of sizing solutions. Both use one rack of Dell blades as the basis of comparison:

- Same quantity – The first comparison compares one full rack of 64 blades for each solution. This comparison provides views of per-rack, per-chassis, and per-blade TCO.
- Same performance – The second comparison uses performance scores to size the HP solution so that it has the number of blades that would provide the same performance as one rack of Dell blades. In this case, the number of HP blades was 69 for the OLTP workload-based comparison and 70 for the Exchange workload-based comparison.

In our comparison, the Dell PowerEdge M610 blade solution had the lowest TCO and thus delivered significant savings over the HP ProLiant BL465c blade solution.

Appendix A – TCO details for per-rack, per-chassis, and per-blade TCO

Our TCO analysis focuses on four key categories that vary among the blade solutions and for which we can provide test results or other hard data:

- hardware and support costs for the blade, enclosure, and rack
- costs for system management software
- facilities costs, including per-rack space costs, power costs, cooling costs, and Ethernet costs
- costs for out-of-box setup

We base power utilization and out-of-box setup costs on our hands-on comparisons of the blade solutions. Other cost data comes from vendor quotes or our experience.

Figure 9 shows the costs for a full rack of servers. We divide those costs by 4, the number of chassis in a rack, to get the per-chassis costs and by 64, the number of blades in a rack, to get the per-blade costs we present in the body of this paper.

Acquisition costs include the costs to purchase the blades, enclosures, and racks, as well as the one-time setup costs. The 1-, 3-, and 5-year costs include the acquisition costs, support costs, plus annual facilities costs. Facilities costs include rack costs that reflect rack footprint, including clearances, power and cooling, and Ethernet and Fibre channel port costs.

	Dell	HP
Acquisition costs		
Hardware and support	$810,193	$898,861
Management software	$5,596	$46,496
Out-of-box setup	$100	$320
Acquisition cost total	$815,889	$945,677
1-year costs		
Facilities costs	$30,462	$32,150
1-year total (includes acquisition costs)	$846,351	$977,827
3-year costs		
Facilities costs	$91,386	$96,450
3-year total (includes acquisition costs)	$907,275	$1,042,127
5-year costs		
Facilities costs	$152,310	$160,750
Blade and enclosure support costs	$107,052	$71,068
5-year total (includes acquisition costs)	$1,075,251	$1,177,495

Figure 9: Per-rack TCO for hardware, support, management software, facility, and setup, organized by acquisition costs and 1-, 3-, and 5-year costs.

To calculate TCO for rack, chassis, and blades, we made the following assumptions about the target business environment:

- The data center has management servers in place that administrators could use to deploy management software.
- The data center fills racks to capacity and has adequate power and cooling capacity for those full racks.
- The Dell EqualLogic storage or the HP StorageWorks EVA 4400 storage solution is in place and is not a part of this cost analysis.

The rest of this section describes the individual cost categories and the cost assumptions we made specific to each of them.

Cost categories

Hardware and support costs

We configured and got cost data for the blade systems from the Dell Web site and from other vendor Web sites. We used list prices for all systems, because discounts vary by buyer and by vendor; this approach provides the most level playing field possible for our comparison.

The acquisition costs include 3-year support for blades and enclosures. Our 5-year TCO includes additional costs for 5-year support.

We calculated support costs based on 24-hour-a-day, 7-day-a-week hardware support agreements with a 4-hour response time. Under these agreements, the vendor, not the data center staff, does the majority of hardware maintenance. We did not include any additional maintenance costs.

Our prices for the Dell solution 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 the other vendors.

We included no operating system or application software costs in our analysis, because these costs would vary widely among enterprises.

Management software costs

We include costs available on each vendor's Web site for standard management software. We added the Altiris Deployment Solution to the Dell management solution, because it is a typical add-on to the standard management package. We priced the following management software:

- Dell Open Manage plus Altiris Deployment Solution for Servers for the Dell solution
- HP Insight Control Environment system management software for the HP solution, which includes Rapid Deployment Pack

To avoid having to estimate future software costs, we assumed buyers would purchase the software as a one-time cost and would not pay for software upgrades during the solution's 3-to-5-year life cycle.

We also included costs for I/O virtualization software in our overall costs. Among other features, these products allow users to quickly change a failed blade without changing LAN or SAN addresses. Each of the vendors offers I/O virtualization software:

- Dell FlexAddress SD card
- HP Virtual Connect (includes Virtual Connect Kit and HP Virtual Connect Enterprise Manager)

Facilities costs

We include costs for space, power, and cooling. We use power consumption data from the two performance white papers we cite earlier and on HP BladeSystem Power Sizer tool[5] calculations.

Our power measurements in the performance studies included a single blade and enclosure. To estimate power utilization for a full enclosure of HP blades, we used results from the HP BladeSystem Power Sizer tool for the same blades and enclosure configurations for which we provide cost data. We estimated the Dell power utilization by applying the proportion of HP to Dell power from our benchmark tests to the HP estimate from the Power Sizer tool.

[5] http://h71019.www7.hp.com/ActiveAnswers/cache/347628-0-0-0-121.html

We made the following assumptions about facilities costs:

- The blade servers are busy one-third of the time and idle the remaining time, and they run all day, every day. We use power measurements we took during periods of peak performance on benchmark tests to estimate costs for the busy periods and power measurements we took while the servers were idle to estimate costs during idle times. We used idle and 100 percent utilization measurements from the HP BladeSystem Power Sizer tool.
- For each dollar the business spends on electricity for server power, it spends an additional dollar on power to cool the server and to power auxiliary equipment.[6] 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 $0.11 per KWh. We base this estimate on the Department of Energy's data[7] on average commercial charges for October 2008, of $0.1049; we have rounded up this rate because of rising costs and because data centers are often in regions and cities with above-average rates.
- 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.

We include Ethernet and Fibre channel switch costs in our data center costs. These costs, which include switches, cables, support, and service, can be significant. We calculate switch acquisition costs based on the costs of switches divided by the number of supported ports and include an estimate of annual costs for the switches.

Businesses can potentially save significantly on port costs by installing switches rather than pass-through modules on the enclosures. Switches aggregate network traffic and, as a result, reduce both the number of cables per chassis and the number of costly ports the solution requires. In some enterprises, however, compatibility issues between the internal switches and the existing external infrastructure, security issues, or quality of service (QoS) needs eliminate this option. The choice is often a tradeoff between cost and performance.

Out-of-box setup costs

To conduct the database and Microsoft Exchange performance tests that we report in the performance reports, we acquired a single blade and an enclosure for each solution. To get out-of-box setup costs for an entire enclosure of blades, we used time measurements from a December 2007 PT study[8] that measured the out-of-box setup times for Dell and HP blade systems. For that study, we received an HP and Dell enclosure and a full set of blades in the manufacturer's original packaging and measured the amount of time it took to set up each system. In this TCO report, we use data from that report on the amount of time it takes to unbox individual blades and install them in enclosures. We calculated the setup costs based on a $100-per-hour cost and multiplied our results for one enclosure by four to get costs for out-of-box setup for the four enclosures in a full rack of blades. Vendors or third-party suppliers offer a range of deployment services for a fee that are an alternative to these out-of-box setup costs. We do not include time to setup software on the blades in our out-of-box-setup costs.

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[6] 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)

[7] Energy Information Association: Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html

[8] Out-of-Box Comparison between Dell, HP, and IBM servers (http://www.principledtechnologies.com/Clients/Reports/Dell/DellHPIBMbladeserverOOB1207.pdf)

Appendix B – TCO details for performance-equivalent TCO

The solutions from different vendors or product lines that deliver comparable performance vary in size, complexity, and cost.

For our performance measure, we used results from March 2009 of virtualized Exchange workload performance testing with Microsoft Exchange LoadGen 2007 and virtualized OLTP workload performance testing with DVD Store Version 2.

For the virtualized Exchange workload testing,[9] we used Microsoft Exchange LoadGen 2007, a Microsoft-provided tool for benchmarking an Exchange Mail Server. We defined the peak number of VMs per server as the maximum number of concurrent VMs under load where each VM had acceptable performance.

The Dell PowerEdge M610 ran 10 such simultaneous VMs, while the HP ProLiant BL465c ran eight such simultaneous VMs. Each VM contained 4,000 users, for a total of 40,000 users on the Dell PowerEdge M610 and 32,000 users on the HP ProLiant BL465c. Thus, the Dell PowerEdge M610 solution had a 25 percent performance advantage over the HP ProLiant BL465c solution.

Figure 10 summarizes our results for tests with a single blade; see the original report for the detailed results VMware requires.

Dell	HP
10	8
The Dell score was 25% percent better than the HP score.[10]	

Figure 10: Peak number of virtual machines running the virtualized Exchange performance testing workloads that each server ran with acceptable performance. Higher numbers of VMs are better.

For the virtualized OLTP performance testing,[11] we used the DVD Store Version 2 (DS2) test tool. DS2 is an open-source simulation of an online e-commerce DVD store, where customers log in, browse, and order products. Each server under test ran multiple Microsoft SQL Server 2008 workloads, one per VM. Our testing goal was to find the peak number of virtual machines running the database workload that each server ran with acceptable performance. The Dell PowerEdge M610 ran 11 such simultaneous VMs, while the ProLiant BL465c G5 ran nine such simultaneous VMs. Thus, the Dell PowerEdge M610 solution had a 22.2 percent performance advantage over the HP ProLiant DL385 G5 solution. (For more details about the DS2 tool, see http://www.delltechcenter.com/page/DVD+Store.)

Figure 11 summarizes our results for tests with a full chassis of blades; see the original reports for the detailed results VMware requires.

Dell	HP
11	9
The Dell score was 22.2% percent better than the HP score.[12]	

Figure 11: Peak number of virtual machines running the virtualized OLTP performance testing workloads that each server ran with acceptable performance. Higher numbers of VMs are better.

This difference in VMs translates into a significant difference in the number of individual blades a company needs to achieve comparable performance and in overall configuration size and cost.

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[9] For more information about these tests, see *Virtualized Exchange workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400*,

[10] *Ibid.*

[11] For more information about these tests, see *Virtualized OLTP workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400 storage*.

[12] *Ibid.*

We used our percentage comparisons of the performance testing results to estimate the number of blades each solution would require to deliver comparable performance. We used a full rack of Dell blades as the basis for our comparison. Because the Dell score on the virtualized Exchange performance testing workload was 25 percent better than the HP score, our performance-equivalent comparison for that benchmark included 25 percent more blades for the HP solution. We rounded our results up to the nearest blade and show those results in Figure 12.

Dell	HP
64 blades	80 blades
25% percent more HP blades than Dell blades.[13]	

Figure 12: Estimated size of the HP solution needed to deliver performance equivalent to one rack of the Dell solution. We base estimates on ratios of the results of our Microsoft Exchange LoadGen 2007 virtual machine results for the virtualized Exchange performance testing, which we conducted using a single blade. Fewer blades are better.

Because the Dell score on the virtualized OLTP performance testing workload was 22.2 percent better than the HP score, our performance-equivalent comparison for that benchmark included 22.2 percent more blades for the HP solution. We rounded our results up to the nearest blade and show those results in Figure 13. With rounding to the nearest blade, both these comparisons result in 40 blades for the HP solution.

Dell	HP
64 blades	79 blades
22.2% percent more HP blades than Dell blades.[14]	

Figure 13: Estimated size of the HP solution needed to deliver performance equivalent to one rack of the Dell solution. We base estimates on ratios of the results of our DS2 virtual machine results for the virtualized OLTP performance testing, which we conducted using a single blade. We rounded up the fractional result and present the result as whole numbers of blades. Fewer blades are better.

We used our average TCO-per-blade values from Appendix A to estimate the TCO for the blade counts we show in Figures 12 and 13. As Figures 14 and 15 show, the HP solution delivering equivalent performance to one rack of the Dell blades costs significantly more than the Dell solution.

[13] *Virtualized Exchange workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400*.

[14] *Virtualized OLTP workload performance comparison of end-to-end solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c G5 with HP StorageWorks EVA 4400 storage*.

Costs based on Exchange workload-based performance-equivalent configurations		
	Dell	**HP**
Acquisition costs		
Hardware and support	$810,193	$1,123,576
Management software	$5,596	$58,120
Out-of-box setup	$100	$400
Acquisition cost total	$815,889	$1,182,096
1-year costs		
Facilities costs	$30,462	$40,188
1-year total (includes acquisition costs)	$846,351	$1,222,284
3-year costs		
Facilities costs	$91,386	$120,563
3-year total (includes acquisition costs)	$907,275	$1,302,659
5-year costs		
Facilities costs	$152,310	$200,938
Blade and enclosure support costs	$107,052	$88,835
5-year total (includes acquisition costs)	$1,075,251	$1,471,869

Figure 14: TCO for performance-equivalent configurations with costs for hardware, support, management software, facility, and setup organized by acquisition costs and 1-, 3-, and 5-year costs. Rack costs are for configurations that have the Exchange workload-based performance equivalence of 64 blades, the number in the Dell solution.

Costs based on OLTP workload-based performance-equivalent configurations		
	Dell	**HP**
Acquisition costs		
Hardware and support	$810,193	$1,109,532
Management software	$5,596	$57,394
Out-of-box setup	$100	$395
Acquisition cost total	$815,889	$1,167,320
1-year costs		
Facilities costs	$30,462	$39,685
1-year total (includes acquisition costs)	$846,351	$1,207,005
3-year costs		
Facilities costs	$91,386	$119,055
3-year total (includes acquisition costs)	$907,275	$1,286,376
5-year costs		
Facilities costs	$152,310	$198,426
Blade and enclosure support costs	$107,052	$87,725
5-year total (includes acquisition costs)	$1,075,251	$1,453,470

Figure 15: TCO for performance-equivalent configurations with costs for hardware, support, management software, facility, and setup organized by acquisition costs and 1-, 3-, and 5-year costs. Rack costs are for configurations that have the OLTP workload-based performance equivalence of 64 blades, the number in the Dell solution.

About Principled Technologies

`We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.
When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help you assess how it will fare against its competition, its performance, whether it's ready to go to market, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.

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