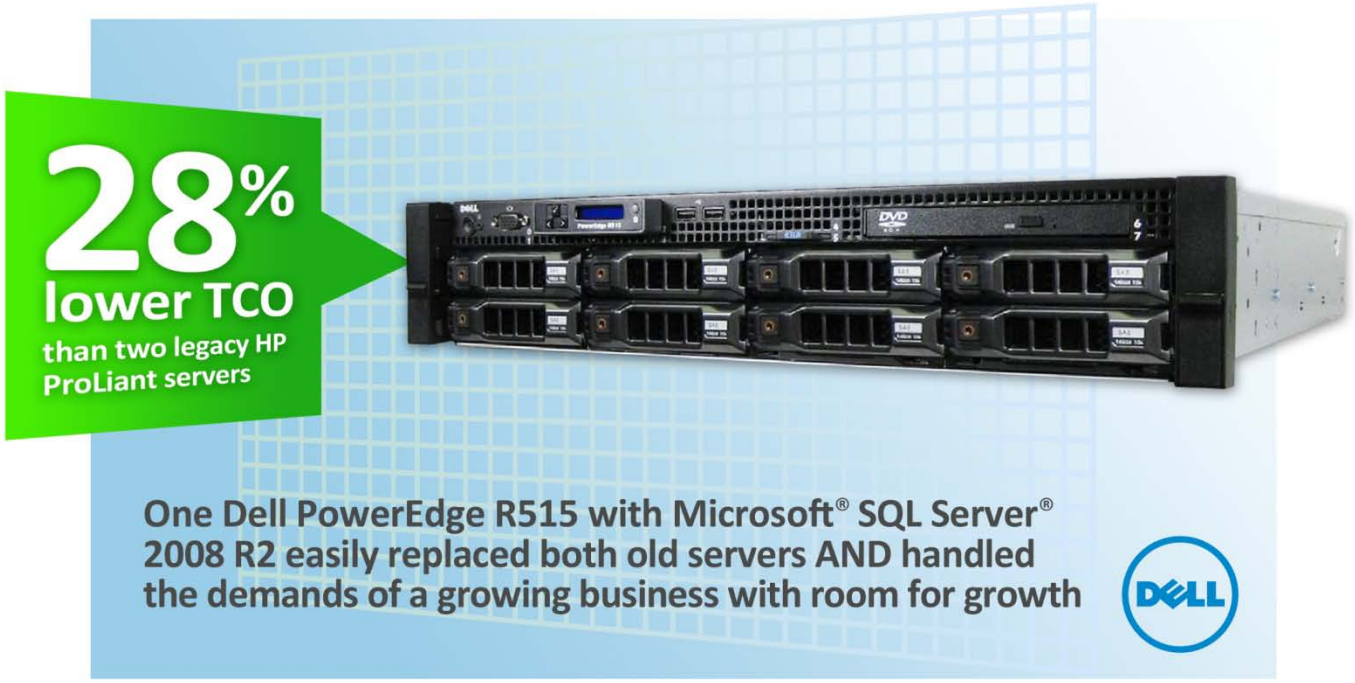
Dell™ PowerEdge™ R515 offers savings over two legacy database servers



OUR FINDINGS

The Dell PowerEdge R515 server can quickly recapture initial investment costs and deliver savings for small to medium businesses (SMBs) replacing multiple legacy servers.[1] We compared two legacy HP servers, one with an external storage array, each running one workload, to the Dell PowerEdge R515 with Microsoft SQL Server 2008 R2 running both workloads in Windows Server® 2008 R2 with Hyper-V™ virtual machines (VMs). Our total cost of ownership (TCO) analysis shows that the new Dell PowerEdge R515, featuring a large internal storage capacity and AMD Opteron™ 4100 Series processors, can provide up to a 28.0 percent 3-year TCO advantage over continued operation of two legacy HP servers running older AMD processors and older versions of SQL Server, and can deliver a return on investment (ROI) payback in 19 months.

OUR PROCESS

We calculated the 3-year TCO of both solutions using server, support, and software prices from vendor sites; performance and power consumption data from tests in our labs; and our cost estimates for migration, facilities, and server management. We then used this data to calculate the TCO savings and ROI payback period of the Dell PowerEdge R515 server.

[1] Source: Principled Technologies, Inc., "Dell PowerEdge R515 offers savings over two legacy database servers," an October 2010 report commissioned by Dell Inc.

PROJECT OVERVIEW

We estimated costs for a hypothetical 500-person SMB planning either to continue operating the two older servers and storage, or to purchase a Dell PowerEdge R515 server. The company is seeking the solution that provides the lowest 3-year TCO and hopes to lower costs in the following areas: hardware support, software, energy, facilities, and management. The analysis in this report compares acquisition costs and 3-year operating costs of the Dell PowerEdge R515 server solution to the 3-year operating costs of the legacy servers and storage array solution.

Our hypothetical SMB replacing multiple older HP servers with a single Dell PowerEdge R515 server running Hyper-V with Microsoft SQL Server 2008 R2 benefits in several ways:

- **Significant performance increase**
- **Total cost of ownership (TCO) and return on investment (ROI) within 19 months**
- **Easy migration process**

This report addresses the TCO and ROI. To learn more about the performance increase, see our performance report. To learn more about the migration process, see our how-to migration guide.

We estimated costs for the following servers:

- New Dell PowerEdge R515 server with AMD Opteron processors Model 4180 running Microsoft Windows Server 2008 R2 with Hyper-V and virtualized Microsoft SQL Server 2008 R2 instances
- Legacy (5-year-old) HP ProLiant DL145 server with AMD Opteron processors Model 250 running SQL Server 2000 on Windows Server 2003 R2
- Legacy (4-year-old) HP ProLiant DL385 server with AMD Opteron processors Model 254 running SQL Server 2005 on Windows Server 2003 R2 and using external HP StorageWorks 30 Modular Smart Array (HP MSA30) for storage

Figure 1 shows our estimate of the 3-year TCO for the Dell PowerEdge R515 solution compared to the two HP servers and one storage array in the legacy HP solution. For the Dell PowerEdge R515, Year 1 costs include the acquisition cost of $14,025. Acquisition cost includes the $11,802 cost of the server and 3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack, and our estimate of $2,223 migration costs. We configured the server with dual AMD Opteron processors Model 4180, eight 600GB 15K RPM Serial-Attach SCSI hard

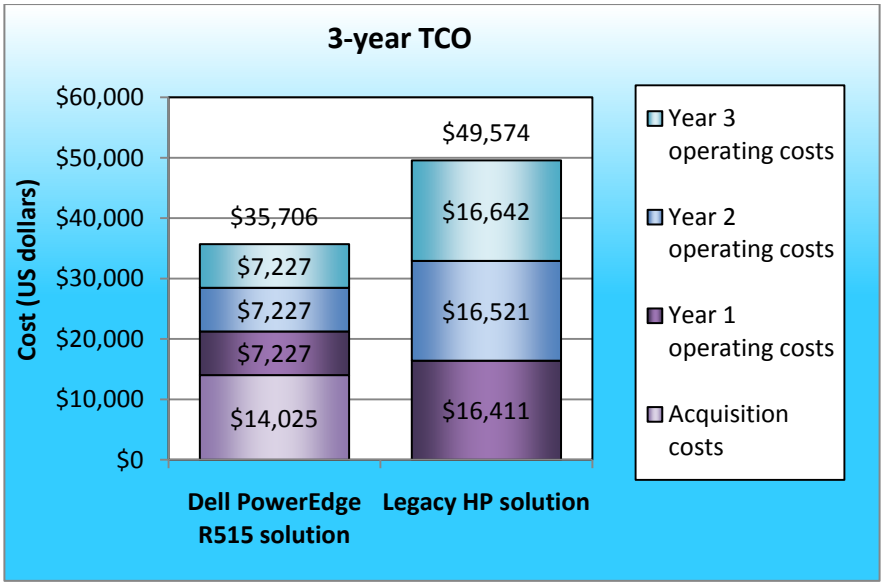


Figure 1: The 3-year TCO for the two configurations. Lower numbers are better.

drives, and 16GB Memory (4x4GB), 1333MHz dual-ranked UDIMMs. Operating costs include energy, data center operations, Microsoft Software Assurance, server administration, and in-house hardware support for the legacy HP solution. The Dell PowerEdge R515 server delivers up to 28.0 percent lower 3-year TCO than the two older HP ProLiant servers and the HP storage array, a savings of up to $13,868 over 3 years. Our analysis shows that the Dell PowerEdge R515 solution would deliver payback in 19 months.

WHAT WE TESTED

We ran tests in our labs to collect both performance and power usage information on the servers. We set up the legacy HP solution as a SMB would likely have done. We created a custom workload based on a customer relationship management (CRM) database and ran this workload on the legacy HP ProLiant DL145 server running SQL Server 2000. We also created a custom workload based on an order entry database, and ran this workload on the legacy HP ProLiant DL385 server and HP MSA30 external storage array, running SQL Server 2005. We did minimal performance tuning on either server. Test results identified the maximum transactions per second each server could support, running 25 virtual users for a fixed 20-minute period.

We then set up the Dell PowerEdge R515 server running Microsoft Windows Server 2008 R2 Standard Edition, enabled the Hyper-V role, created two VMs, installed SQL Server 2008 R2 Standard Edition on each VM, and migrated both the customer and order databases to their respective virtualized SQL Server instances.

Finally, we ran both workloads simultaneously and compared the maximum transactions per second from the new environment to the results from the legacy servers.

Our companion migration guide[2] provides detail on the ease of migration to the Dell PowerEdge R515 running SQL Server 2008 R2 and Hyper-V. Our companion performance report[3] documents the significant performance increase that our hypothetical SMB could achieve with the migration as well as on our specific test scenario.

For this report, we calculated 3-year TCO for both solutions and the ROI payback period for the Dell PowerEdge R515 server using cost data from a variety of sources. We measured power consumption during the workload runs and base our estimated energy costs for each server on these measurements. The Dell Web site provided the purchase price for the Dell PowerEdge R515 server and support. The Microsoft Web site

[2] "Migrating to a Dell PowerEdge R515 from two legacy database servers" http://principledtechnologies.com/clients/reports/Dell/R515_migration_guide.pdf

[3] "Dell PowerEdge R515 outperformed two legacy database servers" http://principledtechnologies.com/clients/reports/Dell/R515_performance.pdf

provided Microsoft Software Assurance pricing. We used our own cost estimates for migration, legacy server support, facilities, software, and server management.

SYSTEM COMPARISON

Figure 2 provides an overview of the system configuration for the three servers we tested. Detailed configuration information about the servers is available in our companion performance report. We base the costs we used in the TCO calculations on these configurations.

Hardware and software specifications	Dell PowerEdge R515	HP ProLiant DL145	HP ProLiant DL385
CPU	AMD Opteron 4180	AMD Opteron 250	AMD Opteron 254
CPU speed (GHz)	2.60	2.40	2.80
Number of processor packages	2	2	2
Number of cores per processor package	6	1	1
Number of hardware threads per core	1	1	1
Memory type	PC3-10600	PC-2700	PC-3200
Total memory (GB)	16	4	4
Internal storage	8 x 600GB 15,000RPM SAS drives	2 x 72GB 10,000RPM SCSI U320 drives	4 x 72GB 15,000RPM SCSI drives
External storage	None	None	MSA30 array with 14 x 146GB 10,000RPM SCSI U320 drives
Operating system	Windows Server 2008 R2 Standard Edition with Hyper-V	Windows Server 2003 Standard Edition R2 with SP2	Windows Server 2003 Standard Edition R2 with SP2
Database software	SQL Server 2008 R2 Standard Edition	SQL Server 2000 Standard Edition	SQL Server 2005 Standard Edition

Figure 2: Key system configuration information for the test servers.

WHAT WE FOUND

Figure 3 details the results of our TCO analysis of the two solutions.

Costs	Dell PowerEdge R515 solution	Legacy HP solution	Percentage savings with the Dell PowerEdge R515 solution
Acquisition costs for the Dell PowerEdge R515 solution (hardware, hardware support, and migration)	$14,025	$0	N/A
3-year operating costs (energy, data center operations, software support, server administration, and hardware support for the legacy HP solution)	$21,681	$49,574	56.3%
Total	**$35,706**	**$49,574**	**28.0%**

Figure 3: TCO for the two server solutions. Lower costs are better. Higher percentage savings are better.

In this analysis, the Dell PowerEdge R515 solution delivered an estimated 3-year TCO advantage over the legacy HP solution because its savings in operating costs over the legacy HP solution offset its acquisition costs.

Figure 4 shows the ROI payback period for the Dell PowerEdge R515 solution. The Dell PowerEdge R515 delivers payback in 19 months. Payback occurs at the point that the Dell PowerEdge R515 solution's accumulated cost (acquisition plus operating costs) is lower than the accumulated operating cost of the legacy server solution. After that point, the Dell PowerEdge R515 delivers savings in combined acquisition and operating costs compared to the operating costs of the alternative of continuing operation of the legacy database servers.

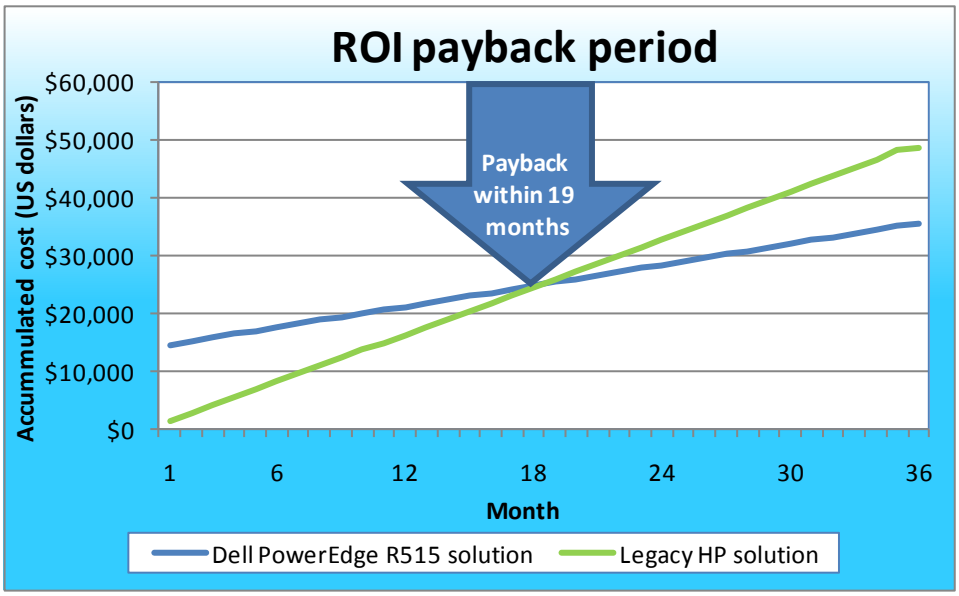


Figure 4: ROI payback period for the Dell PowerEdge R515 solution. Lower costs are better.

HOW WE CALCULATED TCO

Acquisition costs

Figure 5 presents the acquisition costs we considered in this analysis. Acquisition costs include server purchase and migration.

Acquisition costs	Dell PowerEdge R515 solution
Server hardware (hardware with 3-year Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite)	$10,702
Hardware support - 3-year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack [Included in price]	$1,100
Total server hardware and hardware support cost	$11,802
Migration (administrator time to acquire and set up server and migrate the workloads)	$2,223
Total	**$14,025**

Figure 5: Acquisition costs for the Dell PowerEdge R515 solution. Lower costs are better.

- **Server hardware and hardware support.** We gathered prices for the Dell PowerEdge R515 hardware and support on October 12, 2010 from the Dell Web site. We include list prices without discounts, taxes, or shipping costs.
- **Migration.** We estimated migration costs for server acquisition, migration planning, server setup, and database migration, basing estimates on our own lab experience setting up and installing software on the Dell PowerEdge R515 and migrating the customer and order databases. We estimate that the Dell PowerEdge R515 migration requires 40 hours of system administrator time at an hourly rate of $55.56. We do not include time for migration of the SMB's software applications for the order and customer databases.

For the legacy solution, we assume that the SMB would continue to use those servers for the full 3 years of this analysis; consequently, our analysis of costs for that configuration includes no acquisition costs, but does show escalating support costs as the hardware ages. See Appendix A for a list of the assumptions on which we based our analysis.

Operating costs

Operating costs include legacy server hardware support, Microsoft Software Assurance agreements, prorated rack space and port costs, energy for powering and cooling the servers, and labor for the server administrator. Figure 6 shows our estimates of the operating costs for the two solutions over 3 years.

Operating costs	Dell PowerEdge R515 solution	Legacy HP solution	Percentage savings with the Dell PowerEdge R515 solution
Hardware support (in-house support for the HP servers and storage array)	$0	$3,626	N/A[4]
Software (Microsoft Windows Server 2008 R2 and Microsoft SQL Server 2008 R2)	$11,850	$16,866	29.7%
Facilities (rack space and port costs)	$1,101	$2,334	52.8%
Energy (power and cooling)	$1,230	$4,248	71.0%
Management (labor for server administration)	$7,500	$22,500	66.7%
Total	**$21,681**	**$49,574**	**56.3%**

Figure 6: Three-year operating costs for the two server solutions. Lower costs and higher savings are better.

Hardware support costs

We use our own estimates of the costs of in-house support for the HP servers and storage array. We assume that the SMB originally purchased 3- or 4-year HP Care Pack Service hardware support packages, which provided 4-Hour 24x7 Same Day Hardware Support for the legacy servers and 24x7 24 hour Call to Repair for the storage array, and moved to in-house support at the end of the coverage period. We estimate the in-house support costs based on annualized costs of HP Care Pack Service hardware support packages, increasing the support for the 5-year old server by 10 percent each year and for the 4-year old server and storage by 10 percent for each of Years 2 and 3 to account for additional breakage for the aging equipment. We do not include the cost of lost user productivity due to hardware downtime. We do not include hardware support for the Dell PowerEdge R515 solution as operating costs; those costs are covered by the 3-year ProSupport 4HR 7x24 Onsite Mission Critical for the Dell server in the acquisition costs.

Software and software support costs

In this analysis, we include costs for Microsoft Windows Server 2008 R2 Standard Edition licensed per server and Microsoft SQL Server 2008 R2 Standard Edition licensed per processor for the Dell server, and older software versions with the same licensing plans for the legacy servers. For all servers, we include costs for Microsoft Software Assurance agreements but no license costs. We assume that the SMB purchased licenses for Windows Server and Microsoft SQL Server for each of the legacy servers when they originally bought the servers, has maintained Microsoft Software Assurance (SA) agreements for them, and would be able to

[4] The 3-year cost of $3,626 that we estimate for the in-house support of the Legacy HP solution is 69.7 percent higher than the $1,100 cost of the ProSupport 4HR 7x24 Onsite Mission Critical for the Dell server included in the acquisition costs.

transfer licenses from the legacy servers to the Dell PowerEdge R515 server, use SA upgrade rights to upgrade to newer software versions, pay the higher SA agreement costs of the newer software versions, and terminate any expired or unnecessary agreements immediately.

Windows Server 2008 R2 Standard Edition permits one physical instance plus one virtual instance per server license. The SMB could transfer both of the Windows Server Standard Edition per-server licenses on the legacy servers to the Dell PowerEdge R515 server, one for each of its two VMs.

SQL Server 2008 R2 requires one per-processor license for each of the VMs, which use two virtual CPUs each, far fewer than the server's CPU capacity. The hypothetical SMB could transfer and upgrade two of the four Microsoft SQL Server per-processor licenses from the legacy servers to the Dell PowerEdge R515 server and terminate the other two.

Facilities costs

We estimate two sources of facility costs: rack costs, based on number of rack units in the solution, and port costs, based on the number of servers in the solution. The Dell PowerEdge R515 solution saves on both because it uses less rack space, 2u compared to 6u for the two servers and storage array in the Legacy HP solution and includes one server rather than two. We estimate $22 per rack unit for rack costs and $323 per server for port costs.

Energy costs

Our power measurements indicate that the Dell PowerEdge R515 server uses significantly less power and therefore incurs lower energy costs than the two legacy HP servers and the HP storage array. In our tests, the Dell PowerEdge R515 server used 67.2 percent less power than the legacy HP solution when active and 75.2 percent less power when idle. For more details, see our companion performance comparison report.

Management costs

We estimate server administration costs at a fixed $2,500 per server or storage array and multiply that by the number of servers and external arrays in each configuration.

SUMMARY

We calculated the TCO for a hypothetical SMB of 500 or more people that is considering purchasing a single Dell PowerEdge R515 server running Microsoft Windows Server® 2008 R2 with Hyper-V and virtualized Microsoft SQL Server 2008 R2 instances to replace two older HP servers, one using an external storage array and both running older versions of Microsoft SQL Server.

The Dell PowerEdge R515 solution had lower annual costs than the legacy HP solution for our migration scenario. The savings were due to the following key factors (summarized from Figure 6 above):

- The Dell PowerEdge R515 solution saves 69.7 percent in hardware support costs.
- The Dell PowerEdge R515 solution saves 29.7 percent in OS and database software costs.
- The Dell PowerEdge R515 solution saves 52.8 percent in facility costs.
- The Dell PowerEdge R515 solution saves 71.0 percent in energy costs
- The Dell PowerEdge R515 solution requires 66.7 percent less management time, which we allocate on a per-server and per-storage array basis.

We calculate that the Dell PowerEdge R515 server, with an acquisition cost of $14,025, saves $27,893 in operating costs and $13,868 in TCO over 3 years compared to the operating cost of the legacy HP servers and storage array that our benchmark test results show it could replace. Because of these savings, in this analysis, the Dell PowerEdge R515 server delivers up to 28.0 percent lower 3-year TCO and delivers ROI payback in 19 months.

APPENDIX A – ASSUMPTIONS AND CALCULATIONS

We made the following assumptions in creating the TCO estimates in this report:

General assumptions

- Simplifying assumptions includes assuming prices for ongoing costs such as power, data center space, data center ports, and administrator salaries remain constant for the 3-year timeframe of the analysis.
- We assume that support prices for the legacy HP servers and storage rise each year these servers age beyond the HP warranty period.
- We include list prices with no discounts for all prices. We use 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 tax or shipping costs.
- All prices are in US dollars.

Acquisition costs

- We assume that the current server administrator has experience in both Microsoft Windows Server 2008 R2 with Hyper-V and Microsoft SQL Server 2008 R2 and requires no additional training on these software packages. We therefore do not include administrator training in the costs.
- We assume that the administrator or other similarly compensated staff requires 40 hours for planning, procuring, and setting up the Dell PowerEdge R515 server. We include costs for that time in our provisioning cost estimate. Our estimate includes the following: 4 hours for planning/ordering hardware and software, 16 hours for hardware setup and software installation, 16 hours for database migration planning, and 4 hours for the database migration. Larger databases and more complex installations would take longer.
- We do not include migration of the hypothetical SMB's software applications for the order and customer databases.
- For the legacy solution, we assume that the SMB would continue to use those servers for the 3 years of this analysis; consequently, our analysis of costs for that configuration includes no acquisition costs, but does show escalating support costs as the hardware ages.
- Dell support is 3-Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack priced at $1,100.

Hardware support costs

- We assume that the target SMB selects 3-year support packages from hardware vendors providing 7x24 on-site support with 4-hour response time for servers and 24-hour response time for storage and takes over support in-house after that time period. We estimate support costs at $225 for the HP ProLiant DL145, $425 for HP ProLiant DL385, and $445 for MSA30 storage array in Year 1. We estimate in-house support costs as equal to vendor support, but increasing by 10 percent each year to account for additional breakage for the aging equipment. We base these costs on annualized costs for HP Care Pack, 5 Years, 4 Hours, 24x7, Hardware for the servers and HP 5 year 24x7 24 hour Call to Repair MSA30/20/50 Hardware Support for the storage array; we increase the cost for the 5-year old server by 10 percent. We raise the costs for both servers and the storage array 10 percent higher in Years 2 and 3. For our support cost estimates, see Figure 7.

- We include support prices for the Dell PowerEdge R515 within the acquisition costs for the solution.
- We do not include the cost of lost user productivity due to hardware downtime.

Year 1				Year 2	Year 3	
HP ProLiant DL145	HP ProLiant DL385	HP MSA30 storage array	Total	Total	Total	3-year total
$225	$425	$445	$1,095	$1,205	$1,326	$3,626

Figure 7: Support cost estimates for the Legacy HP solution. Lower costs are better.

Software costs

- We assume the hypothetical SMB purchased licenses for Windows Server and Microsoft SQL Server for each of the legacy servers when it originally bought the servers, has maintained Microsoft Software Assurance (SA) agreements for them, and would be able to transfer licenses from the legacy servers to the Dell PowerEdge R515 server, use SA upgrade rights to upgrade to newer software versions, pay the higher SA agreement costs of the newer software versions, and terminate any no longer needed agreements immediately.
- We assume that both server configurations would run Microsoft Windows Server Standard Edition operating system licensed using the Server/Client Access License (CAL) software licensing model. We include annual Microsoft Software Assurance costs for each server. The legacy servers each had one license, both of which transfer to the newer server, which requires one license for each of the two VMs. We do not include the costs of CAL licenses in this analysis.
- We include costs for annual Microsoft Software Assurance coverage for Microsoft SQL Server Standard Edition for each server licensed using the per-processor licensing model. We assume that the hypothetical SMB chose the per-processor licensing model rather than the Server/Client Access License (CAL) for the following reasons:
  - Per-processor licensing is the more appropriate SQL Server licensing model for servers with external-facing Web applications such as the hypothetical SMB's orders application.
  - The SA costs under the Server and CAL model would be more expensive than under the per-processor model for the number of users in this SMB.
- Each legacy server requires two Microsoft SQL Server licenses each, one for each physical processor, so we include SA costs for two licenses.
- For the Dell PowerEdge R515, Microsoft requires one SQL Server 2008 R2 Standard Edition license per processor for each of the VMs based on their usage of two virtual CPUs each, far fewer than the server's virtual CPU capacity. The SMB could transfer and upgrade two of the four Microsoft SQL Server licenses from the legacy servers to the Dell PowerEdge R515 server and terminate the other two.
- We consider only OS and database software for this scenario and do not include other software the SMB might want on the server for virus protection, backup, management, or other purposes.
- Prices are estimates of pricing for a company purchasing a small number of Processor or Server licenses through Microsoft Volume Licensing. The Microsoft Web pages we consulted for pricing of the older Windows Server SQL Server costs listed license costs but not Software Assurance costs; in those cases calculated Software Assurance at one-fourth the license cost, the same formula used for the newer software versions.

Figure 8 summarizes the license costs.

Software Assurance agreements	Annual Software Assurance cost per license	Number of licenses required		License costs	
		Dell PowerEdge R515 solution	Legacy HP solution	Dell PowerEdge R515 server	Legacy HP solution
SQL Server Standard					
SQL Server 2000 Standard Software Assurance	$1,196	0	2	$0	$2,392
SQL Server 2005 Standard Software Assurance	$1,435	0	2	$0	$2,870
SQL Server 2008 R2 Standard Software Assurance	$1,793	2	0	$3,586	$0
Total SQL Server 2008 Software Assurance cost (annual)				**$3,586**	**$5,262**
Windows Server Standard					
Windows Server 2003 Software Assurance	$180	0	2	$0	$360
Windows Server 2008 R2 Software Assurance	$182	2	0	$364	$0
Total Windows Server Software Assurance total cost (annual)				**$364**	**$360**
Software assurance agreement totals					
Total annual software license costs				**$3,950**	**$5,622**
Total 3-year software license costs				**$11,850**	**$16,866**

Figure 8: Software license costs for the two solutions. Lower costs are better.

Facilities costs

- Facilities costs include rack costs that reflect rack footprint, including clearances and port costs.
- We assume that the data center fills racks to capacity and has adequate power and cooling capacity for those full racks.
- We assume that data center Ethernet port costs average $323 per port per year for the switch hardware and hardware support. We attested with and estimated costs for a 24-port Dell PowerConnect™ 8024 10Gb Ethernet switch
- We assume that the data center charges $910 per rack per year for data center space. We based this on our estimates of 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.

Figure 9 shows the facility cost calculations

Facility costs	Dell PowerEdge R515 solution	Legacy HP solution
Port costs		
Number data center ports	1	2
Total annual port costs	$323	$646
Data center space costs		
Number of rack units used	2	6
Total annual data center space costs	$44	$132
Total annual data center costs	$367.00	$778.00
Three-year facility costs	$1,101	$2,334

Figure 9: Facility cost calculations. Lower costs are better.

Energy costs

- We assume that the hardware is busy one-half of the time and idle the remaining time, and runs all day, every day. We measured for the servers when idle and when running the peak benchmark workload during the tests we document in the companion performance comparison. We estimate power usage for 50 percent utilization by averaging the idle and workload power measurements.
- We assume that, 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.[5] Data centers may have different proportions of these costs because cooling efficiency and technology, rack densities, and other factors affect cooling costs.
- We assume that the data center costs for power and cooling are $0.0993 per KwH.[6] We base this estimate on the United States Department of Energy's data on average commercial charges for the year ending August 2010.

Figure 10 shows the energy cost calculations.

[5] 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

[6] Source: National commercial average for August 2010 as reported in http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html

Energy costs	Dell PowerEdge R515 solution	HP ProLiant DL145	HP ProLiant DL385	HP MSA30 storage array	Legacy HP solution
Workload power	271.053	248.505	318.000	261.000	827.505
Idle power	198.000	226.000	310.000	262.000	798.000
Typical power	235	237	314	262	813
Annual KwH	2,060	2,078	2,753	2,297	7,127
Annual energy cost for power	$205	$206	$273	$228	$708
Annual energy cost for power and cooling	$410	$412	$546	$456	$1,416
Three-year energy cost for power and cooling	$1,230	$1,236	$1,638	$1,368	$4,248

Figure 10: Energy cost calculations for the two solutions. Lower costs are better.

Management costs

- We assume that the average annual fully burdened server administrator cost is $100,000. We estimate based on the U.S. national average system administrator total compensation reported by salary.com in October 2010 for system administrators of $101,744, which we round down to $100,000.
- For hourly staff costs, we estimate 1,800 billable hours per year for the system administrator, yielding an hourly system administrator cost of $55.56. This rate includes only administrator compensation not overhead, travel, or other highly variable costs.
- Based on our experience, we estimate that each server or storage array in both solutions requires 1/40th of a system administrator's time, for an annual administration cost of $2,500 based on a $100,000 system administrator cost. 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 would support the same database workloads.
- We do not include costs for management software.

Figure 11 shows the management cost calculations.

Management costs	Dell PowerEdge R515 solution	Legacy HP solution
Number servers and storage arrays in solution	1	3
Annual management costs ($2,500 times number servers and storage arrays)	$2,500	$7,500
Three-year management costs	$7,500	$22,500

Figure 11: Management cost calculations for the two solutions. Lower costs are better.

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies, Inc.
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