# Dell™ 2-2-1 solution: 45.8 percent TCO savings versus a non-virtualized configuration

One of the most significant benefits of server virtualization is cost savings. The ability to run your business applications on fewer servers reduces the amount of hardware your business needs. As a result, you can gain savings in the following areas:

- fewer servers to buy, service, and manage
- fewer staff hours devoted to server maintenance and management
- lower electricity bills due to less power usage
- less wasted employee productivity due to server downtime
- reduced likelihood of federal and industry regulatory compliance fines due to lost data

Here, we look at the 3-year total cost of ownership (TCO)—the costs of the solution and the specific savings a growing small business could achieve— when virtualizing with the Dell 2-2-1 solution consisting of two servers, two switches, and SAN storage instead of adding hardware to a non-virtualized setup.

We found that using the Dell 2-2-1 solution could save a small or medium business 45.8 percent ($42,272) in costs over a non-virtualized solution. These findings show that consolidation through virtualization is not just a solution for large enterprises, and that virtualizing with the Dell 2-2-1 solution can bring great benefits to a growing small business looking to consolidate a smaller number of servers.

This paper will help you better understand the kind of savings server virtualization can bring your company. Other reports in this series will introduce you to other aspects of server virtualization, with the benefits video and study being helpful places to start. To view them, just click the tabs at the top of this page.
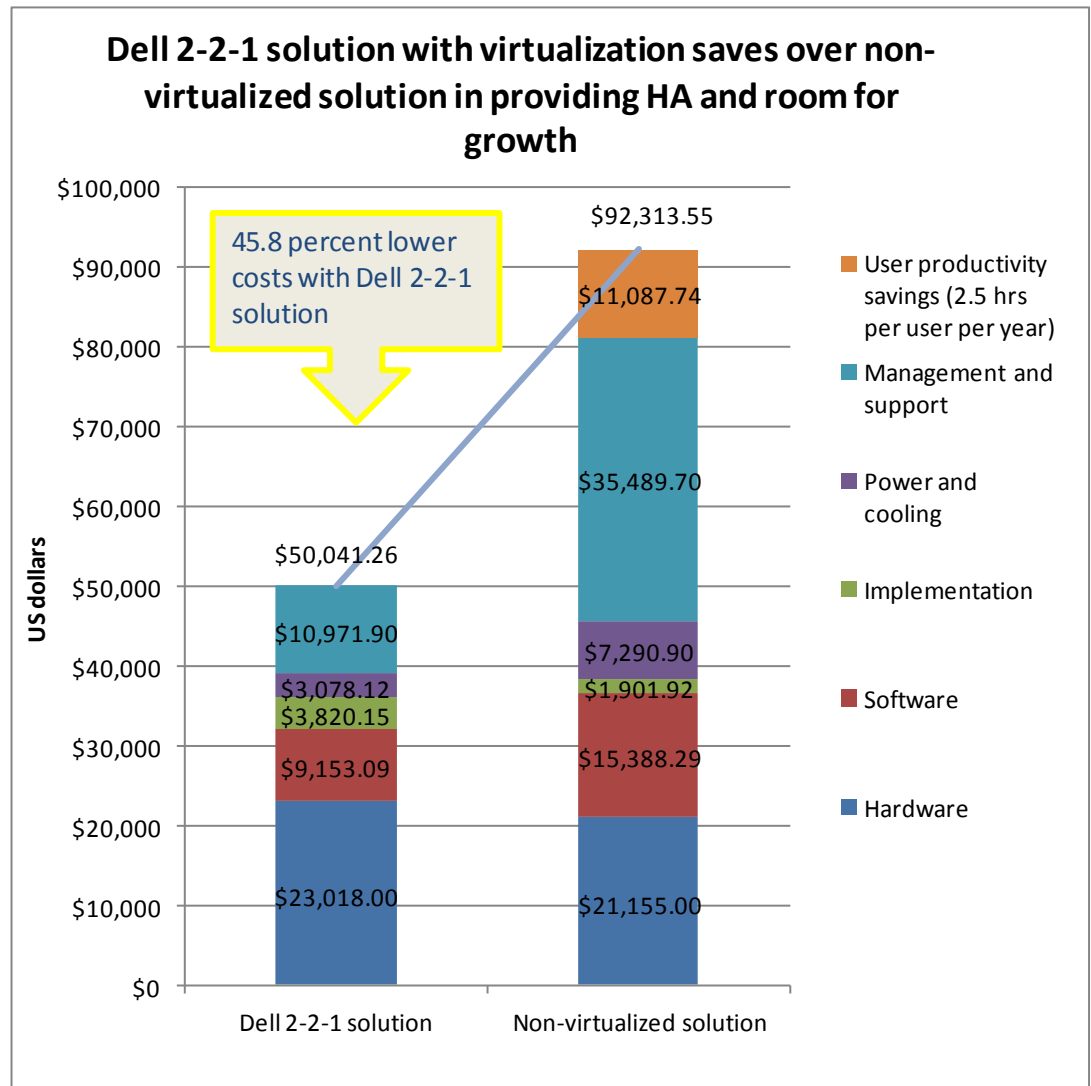
# COST SAVINGS THROUGH SERVER VIRTUALIZATION

Reducing the number of servers your business requires is a great way to improve efficiency and save money. Thanks to virtualization, one new physical server can run multiple applications, each on its own virtual machine (VM), while still providing strong performance and offering headroom to spare.

We compared the 3-year TCO of the Dell 2-2-1 solution with the other option: adding servers to an existing installation, which takes up space, is more difficult to manage, and can suffer large amounts of downtime. A thorough TCO analysis incorporates not only initial costs (i.e., hardware and software purchases), but also includes areas such as power and cooling, implementation and training, and management. We calculated our TCO over a 3-year period based on real-world data.

As Figure 1 shows, we found that the virtualized Dell 2-2-1 solution with virtualization could provide a business with 45.8 percent ($42,272) in savings over the course of 3 years.

**Figure 1. The Dell 2-2-1 solution with virtualization can save 45.8 percent ($42,272) over a non-virtualized solution while providing high availability and room for growth.**



Dell 2-2-1 solution with virtualization saves over non-virtualized solution in providing HA and room for growth

45.8 percent lower costs with Dell 2-2-1 solution

Dell 2-2-1 solution — $50,041.26
- Management and support: $10,971.90
- Power and cooling: $3,078.12
- Implementation: $3,820.15
- Software: $9,153.09
- Hardware: $23,018.00

Non-virtualized solution — $92,313.55
- User productivity savings (2.5 hrs per user per year): $11,087.74
- Management and support: $35,489.70
- Power and cooling: $7,290.90
- Implementation: $1,901.92
- Software: $15,388.29
- Hardware: $21,155.00

# WHAT WE COMPARED

While adding two new application servers and external storage to meet growth demands, our hypothetical business has a choice: add to the existing configuration and experience additional server sprawl, or consolidate using a Dell 2-2-1 solution. We estimated the costs for a 75-person business that is going to either add two servers, a switch, and a storage array to their existing infrastructure, or to virtualize with the Dell 2-2-1 solution, which also provides high availability (HA) and room to grow. Each of four servers runs its own business application, including email (Microsoft Exchange Server 2010), financial and operations management (Microsoft Dynamics® GP 2010), database (Microsoft SQL Server® 2008 R2), and collaboration (Microsoft SharePoint® Server 2010), while a fifth server hosts Active Directory for server management. The current configuration requires significant management time from IT staff, instead of the more automated and centralized approach virtualization enables.

The Dell 2-2-1 solution provides servers, storage, networking, management tools, and deployment services. Two servers, two switches, and one storage array can support multiple VMs and up to 125 users, with room for future growth. These components also ensure that your configuration has no single point of failure; this redundancy ensures high availability of system resources and minimizes downtime. Your environment stays running at all times. If a server goes down, the VMs and applications running on it fail over to the other server and continue running with only a slight interruption, maintaining a nearly seamless experience for users. Furthermore, the Dell 2-2-1 solution with Microsoft System Center Essentials 2010 can provide low-effort manageability over both virtual and physical servers in the infrastructure.

Figure 2 presents components of the two solutions for which we have estimated costs.

| Dell 2-2-1 solution | Non-virtualized solution |
|---|---|
| Decommissioning/repurposing 4 legacy 3-5 year-old servers | Maintaining 4 legacy 3-5 year-old servers |
| 2 Dell PowerEdge™ R410 servers, each with 2 Intel® Xeon® processor E5630s (2.53Ghz), 24 GB of memory, and 2 250GB drives and redundant power supplies | 2 Dell PowerEdge R410 servers, each with 2 Intel Xeon processor E5630s (2.53GHz), 16 GB of memory, 2 250GB drives, and redundant power supplies |
| 2 Dell PowerConnect™ 5524 switches | 1 Dell PowerConnect 5524 switch |
| 1 Dell PowerVault™ MD3200i storage array with 12 500GB NL-SAS drives | 1 Dell PowerVault MD3200i storage array with 12 500GB NL-SAS drives |
| Microsoft Windows Server 2008 R2 Enterprise Edition with Hyper-V<br>Microsoft System Center Essentials 2010<br>Dell OpenManage Subscription Service | Microsoft Windows Server 2008 R2 Enterprise Edition<br>Dell OpenManage Subscription Service |

**Figure 2. Components of the two solutions.**

# WHAT WE FOUND

Figure 3 shows our estimate of the 3-year TCO for the Dell 2-2-1 solution for businesses compared to a non-virtualized solution that supports each application on its own server and adds a network storage device for extra storage. The Dell 2-2-1 solution delivered an estimated 3-year TCO advantage over the non-virtualized solution because its savings in costs for software, power and cooling, management, and server downtime offset its acquisition and setup costs.

| TCO for virtualized and non-virtualized business scenarios | | |
|---|---|---|
| | **Dell 2-2-1 solution** | **Non-virtualized solution** |
| Hardware | $23,018.00 | $21,155.00 |
| Software | $9,153.09 | $15,388.29 |
| Implementation | $3,820.15 | $1,901.92 |
| Power and cooling | $3,078.12 | $7,290.90 |
| Management and support | $10,971.90 | $35,489.70 |
| Lost user productivity (2.5 hours per user per year additional for Non-virtualized solution) | N/A | $11,087.74 |
| **Total** | **$50,041.26** | **$92,313.55** |

Figure 3. Breakdown of 3-year TCO for the two solutions, with the Dell 2-2-1 solution saving 45.8 percent.

# COMPARING THE COSTS

We calculated 3-year TCO for both solutions using cost data from a variety of sources. We measured power consumption while running typical workloads on the servers and base our estimated energy costs for each server on these measurements. The Dell Web site provided the purchase price for the hardware and support prices. The Microsoft Web site provided Microsoft Software Assurance pricing. We used our own cost estimates for migration, facilities, server management, and productivity savings.

## Hardware costs

Figure 4 provides the costs for the hardware.

| **Dell 2-2-1 solution** | | **Non-virtualized solution** | |
|---|---|---|---|
| **Servers** | | | |
| 2 Dell PowerEdge R410 servers, each with 2 Intel Xeon processor E5630s (2.53Ghz), 24 GB memory, and2 250GB drives Dell Open Manage Subscription Service (4 editions) | $7,782.00 | 2 Dell PowerEdge R410 servers, each with 2 Intel Xeon processor E5630s (2.53Ghz), 16GB memory, and 2 250GB drives Dell Open Manage Subscription Service (4 editions) | $7,322.00 |
| **Switches** | | | |
| 2 Dell PowerConnect 5524 switches | $2,806.00 | 1 Dell PowerConnect 5524 switch | $1,403.00 |
| **Storage** | | | |
| 1 Dell PowerVault MD3200i storage array, each with 12 500GB drives | $12,430.00 | 1 Dell PowerVault MD3200i storage array, each with 12 500GB drives | $12,430.00 |
| **Hardware total** | **$23,018.00** | **Hardware total** | **$21,155.00** |

Figure 4. Hardware costs for the two solutions. Prices are as of Oct. 1, 2011.

The new servers we add to the non-virtualized solution are upgraded configurations; they have additional memory, disk drives, and redundant power supplies compared to the older servers. These upgrades accommodate the company's desire to add additional business applications and have room for growth.

We estimated prices for new servers and storage for the non-virtualized solution using costs for a Dell PowerEdge R410 and a new PowerVault MD3200i storage array configured as shown. For both solutions, we quote prices from the Dell online store for small and medium businesses with in-cart discounts.

Hardware prices include 3-year hardware support services. We include 3-Year ProSupport and Mission Critical 4HR 7x24 support for the servers in both solutions. We include 3-Year ProSupport and NBD On-site Service for Dell PowerVault MD3200i storage and Lifetime Limited Hardware Warranty with Basic Hardware for the Dell PowerConnect 5524 switches.

## Software costs

Figure 5 provides the costs for the software.

| Dell 2-2-1 solution | | Non-virtualized solution | |
|---|---|---|---|
| 1 Microsoft System Center Essentials 2010 SQL console license plus Software Assurance | $1,510.80 | 2 Microsoft Windows Server 2008 R2 Enterprise Edition licenses plus Software Assurance for the 2 additional systems* | $8,286.00 |
| 3 Microsoft System Center Essentials 2010 Server License  plus Software Assurance (Open license price) | $540.00 | Software assurance for 4 existing Licenses Windows Server 2008 Enterprise licenses | $7,102.29 |
| Software assurance for four existing licenses Windows Server 2008 Enterprise licenses | $7,102.29 | | |
| **Software total** | **$9,153.09** | **Software total** | **$15,388.29** |

Figure 5. Software costs for the two solutions.

*For the 2-2-1 solution, we assume that the business maintains software assurance plans for the Microsoft operating system and could transfer existing licenses from the legacy servers to cover the two new host servers and VMs.

License counts and software assurance costs for most software would be the same for the two solutions with two exceptions: the Dell 2-2-1 solution includes purchase of the Microsoft System Center Essentials 2010. The non-virtualized competing solution requires purchase of Windows Server 2008 Enterprise for the two servers required for growth. We include these costs in the TCO analysis. License counts for the application software and operating software versions on the older servers would also be the same for the two competing solutions. We omit the application and OS software assurance costs because they would not be affected by the solution choice and would not necessarily be budgeted with the hardware and OS. If the business did not have transferrable licenses, the OS could be included as part of a single Dell solution.

## Implementation costs

Figure 6 provides the costs for the implementation of the solutions.

| Dell 2-2-1 solution | | Non-virtualized solution | |
|---|---|---|---|
| Dell remote advisory costs | $2,299.00 | No remote advisory for this solution | N/A |
| Procurement costs | $800.00 | Procurement costs | $700.00 |
| Setup costs | $721.15 | Setup costs | $1,201.92 |
| **Implementation total** | **$3,820.15** | **Implementation total** | **$1,901.92** |

Figure 6. Implementation costs for the two solutions.

We include costs to plan for and set up the solutions and training costs for the IT staff on Hyper-V and Microsoft System Center Essentials 2010, including the consolidation of the physical servers into virtual machines for the Dell 2-2-1 solution. Those software products save on solution installation time compared to the non-virtualized competing solution. Our configuration guide further explains the install process by providing step-by-step instructions for setting up the Dell 2-2-1 solution.

## Power and cooling costs

Figure 7 provides the costs related to facilities.

| Dell 2-2-1 solution | | Non-virtualized solution | |
|---|---|---|---|
| Power and cooling | $3,078.12 | Power and cooling | $7,290.90 |

Figure 7. Facility costs for the two solutions.

We assume that the existing solution for this small or medium business is not housed in a data center. While typical data center charges for floor space do not apply to this type of setup, the business still faces costs for power and cooling for the servers and for connections to their company infrastructure.

In our labs, we measured the power consumption of the older servers and the hardware in the Dell 2-2-1 solution at idle and while running workloads with the four applications. (Our performance report provides those results.) We estimate that the servers run idle 80 percent of the time and active the remaining time; we multiply those percentages by the idle and active power measurements to get an estimate of typical power. We estimate power for the non-virtualized replacement systems as equal to the power requirements of an individual server in the Dell 2-2-1 solution. We use those estimates to calculate the kWh load of the two solutions. We multiply that load by the US average cost last year per kWh from US Energy Information Administration sources. We double that power cost to get a combined cost for power and cooling.

With fewer servers to power, the Dell 2-2-1 solution saves power and cooling costs.

## Management and support costs

Well-managed servers can save significantly over unmanaged or poorly managed servers. Management software simplifies and automates tasks such as software upgrades and patch distribution. Microsoft System Center Essentials (SCE) 2010 software provides you with a centralized management solution from which you can configure, maintain, modify, and monitor the physical and virtualized servers in your infrastructure. As Figure 8 shows, the management costs for the non-virtualized solution are much higher because server management is not automated, and takes up more of the IT staff's time.

| Dell 2-2-1 solution | | Non-virtualized solution | |
|---|---|---|---|
| System administration | $8,076.90 | System administration | $24,230.70 |
| 3-year support for Dell (Mission critical for servers, ProSupport for storage, and basic for switches) | $2,895.00 | 3-year support for Dell (Mission critical for servers, ProSupport for storage, and basic  for switches) | $2,895.00 |
| | | HP Extended Care for existing servers | $8,364.00 |
| **Management and support total** | **$10,971.90** | **Management and support total** | **$35,489.70** |

Figure 8. Management and support costs for the two solutions.

In addition to the above costs, there are two additional "soft costs" that a high-availability server virtualization solution like the Dell 2-2-1 solution can help you minimize or avoid. Because regulation costs vary based on the type of business, we did not estimate specific dollar costs for regulatory compliance. Nevertheless, improvements in that area will prove helpful to any business, regardless of its size.

## Employee downtime due to server problems

Downtime hurts employee productivity and can impair the business's ability to operate. We estimate that, at a minimum, employee productivity will increase by 2.5 hours per user per year due to the high availability of the Dell 2-2-1 solution and its ability to provide quick recovery from problems that would otherwise cut off employees from their applications and storage access.

The goal of high availability is to approach 100 percent server uptime.  The Dell 2-2-1 solution can yield dramatic downtime reductions thanks to its built-in failover, redundancy, load balancing, and automated management. If one server fails, the other quickly takes over; if one switch fails, the other fills in; a failed VM fails over seamlessly to another host. Even a simple problem, one that a HA solution can react to in minutes, can take IT an hour or longer to troubleshoot and fix in a non-HA solution. When systems are down, user productivity takes a hit. Downtime does not translate directly into lost user productivity – users might not be using their computers or the affected applications when the incident occurs, or might be able to easily switch to other tasks without taking a productivity hit. We estimated that each minute of downtime affects one-quarter of users, so the ratio of minutes of downtime to lost productivity per user is 4:1. Assuming 10 incidents a year causing on average 1 hour longer to resolve, the non-HA solution would see on average 2.5 hours in lost productivity per user per year. Our estimate of just over a day a year is a conservative estimate. One serious hardware failure, requiring replacement hardware not on site, could easily take more than a day.

Downtime hurts the business in other ways that we have not attempted to quantify. It can hurt customer service, perhaps losing business because dissatisfied customers go elsewhere. For businesses where high availability is a regulatory requirement, downtime can result in fines and penalties. A business governed by data retention regulations might find itself in violation for any downtime that results in data loss. We explain the benefits of high availability in more detail in our benefits of server virtualization paper.

In Figure 9, we calculate the cost of the lost productivity based on salary of the affected users. We base the salary on our estimate of an average user salary of $41,000 (we multiply that times 1.4 to add benefits, for a loaded salary of $57,400).

| Dell 2-2-1 solution | | Non-virtualized solution | |
|---|---|---|---|
| User productivity loss | N/A | User productivity loss | $11,087.74 |

Figure 9. Productivity loss costs for the two solutions.

## Regulatory compliance

Because today's servers and storage house large amounts of data and are subject to more stringent management policies, a consolidated environment can make complying with regulatory requirements such as Sarbanes-Oxley and the Health Insurance Portability and Accountability Act (HIPAA) less expensive, easier, and more secure. The savings can range from zero to substantial, depending on the businesses regulatory environment and regulatory challenges a particular business experiences.

### Dell Performance Analysis Collection Kit

To help guide customers through mission-critical IT decisions, the Dell solution experts have developed an innovative new tool, the Dell Performance Analysis Collection Kit (DPACK). Through a simple-to-run program, DPACK produces an output that gives you the knowledge you need to make the right decisions for your business. This free tool will help you make effective IT solution recommendations, whether the goal is reducing wasteful spending or analyzing opportunities for virtualization or datacenter expansion. DPACK gives you a true sense of your current IT environment and helps you identify areas for further optimization.

## SUMMARY

We calculated the TCO for a hypothetical business of 75 people that is considering purchasing a Dell 2-2-1 solution running Microsoft Windows Server 2008 R2 Hyper-V managed with Microsoft System Center Essentials 2010. This solution would consolidate four older HP servers running Microsoft Windows Server 2008 R2 Enterprise Edition and standard business applications, while still maintaining capacity to add additional VMs for new applications in the future. We compare the TCO of the Dell 2-2-1 solution to that of an alternate scenario—that of maintaining the non-virtualized servers in the older server solution and adding newer servers and storage to accommodate business growth, for a total of six servers, one storage array, and one additional switch.

The Dell 2-2-1 solution had lower 3-year costs than the non-virtualized solution for our scenario. The savings were due to the following key factors:

- The Dell 2-2-1 solution saves 40.5 percent in software costs.
- The Dell 2-2-1 solution saves 57.8 percent in power and cooling costs.
- The Dell 2-2-1 solution saves 69.1 percent in management and support costs.
- The Dell 2-2-1 solution saves 2.5 hours of productivity per user per year due to server downtime.

For our example business, we calculate that the Dell 2-2-1 solution, with 3-year total cost of $50,041.26, saves $42,272.29 in TCO over 3 years compared to the 3-year total cost of the non-virtualized solution.

## CONCLUSION

Virtualization greatly simplifies how your company manages its IT infrastructure, saving IT management time and increasing productivity through streamlining and automation. The result is improved service to your company and clients, all while reducing operating costs and capital expenditures.

Dell designed its 2-2-1 solutions with small and medium businesses in mind. The Dell 2-2-1 solution minimizes the risks to you and your IT team and provides an easy growth path that helps your business cope with an ever-changing business environment.

To learn more about other aspects of server virtualization using the Dell 2-2-1 solution, please see our additional papers and video.

# APPENDIX A - POWER CALCULATIONS

We measured the power the solutions used during runs of the benchmark tests reported in the performance report and on the same systems while the systems were idle. Our tests simulated running the four business applications on the legacy hardware and the Dell 2-2-1 solution hardware. We measured the legacy hardware, with each server running one application, and the Dell 2-2-1 solution hardware running the applications on VMs, split between the two servers. We estimate power costs for those servers based on these measurements.

The TCO analysis includes adding two servers, a storage array, and a switch to handle additional applications in the non-virtualized solution. We assume this hardware would be the same as the Dell 2-2-1 solution hardware but with 8 GB less memory per server and one fewer switch, and we estimate its power consumption as being the same as the measured consumption of the similar hardware in the Dell 2-2-1 solution. We measured very little difference between the active and idle loads for the Dell 2-2-1 solution hardware, so we expect that the single application load of the non-virtualized scenario would see similar power consumption. We double the results to provide an estimate of the cost of cooling as well as powering the systems. Figure 10 shows our estimates of power consumption and cooling and power costs. Total kWh per year is based on 8,766 hours per year and calculated as Watts * hours/1,000. We estimate the average cost for power as equal to the US national commercial average for July 2011 as reported by the US Energy Information Administration. Lower numbers are better.

| Annual data center energy cost | Total typical (watts) | Total kWh per year | Total annual power cost | Total annual cost for power plus cooling all units | 3-year power and cooling |
|---|---|---|---|---|---|
| Non-virtualized solution | 1,287.1 | 11,283.7 | $1,215.15 | $2,430.30 | $7,290.90 |
| Dell 2-2-1 solution | 543.4 | 4,763.4 | $513.02 | $1,026.04 | $3,078.12 |

Figure 10. Power consumption and cooling costs for the non-virtualized solution and the Dell 2-2-1 solution. Lower numbers are better.

Figure 11 shows the details of the measured idle and active power consumption and our estimate of typical watts. We measured power three times and report the average of the three measurements for each server, switch, or storage array. Lower numbers are better.

| Legacy servers in the non-virtualized solution hardware load (one load per server) | Idle (watts) | Active (watts) | Typical power (80% idle; 20% active) (watts) |
|---|---|---|---|
| DVD Store | 189.0 | 192.0 | 189.6 |
| Exchange 2010 | 205.0 | 210.0 | 206.0 |
| SharePoint 2010 | 193.0 | 195.0 | 193.4 |
| Dynamics GP | 203.0 | 204.0 | 203.2 |
| **Total** | **790.0** | **801.0** | **792.2** |

| Dell 2-2-1 solution hardware load | Idle (watts) | Active (watts) | Typical power (watts) |
|---|---|---|---|
| Server 1 | 120.0 | 122.0 | 120.4 |
| Server 2 | 122.0 | 126.0 | 122.8 |
| Storage | 203.0 | 204.0 | 203.2 |
| Switches (2) | 97.0 | 97.0 | 97.0 |
| **Total** | **542.0** | **549.0** | **543.4** |

**Figure 11. Idle and active power consumption for the legacy hardware and the Dell 2-2-1 solution hardware. Lower numbers are better.**

Figure 12 shows the calculations for the power for the non-virtualized solution hardware. The power for the legacy servers in the non-virtualized solution is the measured power from our testing for the four legacy servers plus the power for the same components used in the Dell 2-2-1 solution that are added to the non-virtualized solution(the two servers, one switch estimated at half the power of the two switches in the Dell 2-2-1 solution, and the storage array).

| Estimates for the non-virtualized solution | |
|---|---|
| **Component** | **Typical power (watts)** |
| Legacy servers | 792.2 |
| New servers | 243.2 |
| Switch | 48.5 |
| Storage | 203.2 |
| **Total** | **1,287.1** |

**Figure 12. Power calculations for the non-virtualized solution.**

# APPENDIX B - ASSUMPTIONS

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

## Business assumptions

- There is a small or medium business that is ready to grow, with four legacy servers running business applications.
- This company acquired these legacy servers piecemeal as the need arose, and their IT is experiencing server sprawl.
- This company plans to add two additional application servers, a switch, and centralized storage to accommodate growth.

## General assumptions

- We assume an original legacy environment of four servers, each running a unique workload under Windows Server 2008 R2 Enterprise covered by Software Assurance. The Dell 2-2-1 solution replaces those servers; the non-virtualized solution adds to them.
- All prices are in US dollars.

## One-time procurement costs

### Hardware costs

- For the Dell 2-2-1 solution and the new procurement for the non-virtualized solution, we use prices from the Dell on-line store for small and medium businesses with in-cart discounts. (Prices as of Oct. 19, 2011.)
- The new hardware for the non-virtualized solution uses the same hardware and prices as the Dell 2-2-1 solution, but reduces memory from 24 GB to 16 GB per server and omits one of the switches.
- We include the cost of Dell OpenManage Subscription Service (four editions) with each server.
- Hardware prices do not include shipping and handling or tax.

### Software costs

- The Dell 2-2-1 solution required four Windows Server 2008 R2 Enterprise licenses, each supporting up to four VMs on each server. All four licenses would transfer from the legacy environment and the business would continue to pay Software Assurance (SA) for them.
- The non-virtualized solution would purchase two Windows Server Enterprise licenses for two new servers. Prices for these include 3-year SA. This solution would also continue to pay SA for the legacy licenses because those legacy systems would still be in use.
- For the Dell 2-2-1 solution, we include a Microsoft System Center Essentials wSQL console license and 3Microsoft System Center Essentials Server Licenses with three-year SA (2 for the two new servers and one for the Active Directory server)
- We use Open License estimates available on the Microsoft Web site for all Microsoft software.

### Implementation costs

- We include an estimate of $2,299 for Dell remote advisory services to aid with the setup of the Dell 2-2-1 solution.
- We assume procurement costs of $200 per server and storage array and $100 per switch.
- We assume 30 hours setup time for the Dell 2-2-1 solution and 50 hours setup time for the non-virtualized solution. The Dell 2-2-1 solution uses Dell installation support so it saves on staff time; management software also aids installation. The step-by-step instructions in our companion configuration guide also streamline the process.

- The business has one part-time IT staffer who performs other tasks in his or her remaining time. We calculate IT staff time savings based on hours saved from IT tasks by this staff member.
- We assume an average IT administrator salary calculated based on annual salary of $50,000, with hourly salary calculated off a loaded salary of 1.4 times that.
- We assume that the IT staff member does not need any additional training to set up or manage either solution.

## Ongoing costs (calculated for three-years)

### Power and cooling costs

- We base power and cooling costs for the Dell 2-2-1 solution on idle and active measured power, assuming systems run 24x7 and are idle 80 percent of the time. We measured power and used the same calculations for a legacy system in the non-virtualized solution. For the new hardware in the non-virtualized solution, we used measurements for the same hardware from the Dell 2-2-1 solution. We assume the differences due to having 8GB less memory on that new hardware would be minimal.
- We include the cost of cooling the systems as well as powering them. We estimate cooling costs as being equal to power costs.
- We estimate a utility rate of $.1077 per kWh based on June 2011 average commercial as reported by the US Energy Information Administration.

### Management and hardware support costs

- For the servers in the Dell 2-2-1 solution, we include 3-Year ProSupport and Mission Critical 4HR 7x24.
- For new hardware for both solutions, we include 3-Year ProSupport and NBD on-site Service for the Dell PowerVault MD3200i.
- For new hardware for both solutions, we include Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only for the Dell PowerConnect 5524 switches.
- For the legacy servers in the non-virtualized solution, we assume the hardware can continue to be covered by extended vendor support. We used the price of HP Extended Care, specifically the 3-year 6-hour 24x7 Call to Repair ProLiant DL36x Hardware Support at $697 per server per year.

### Productivity costs

- We assume 2.5 hours more productivity per user per year with a high availability solution such as the Dell 2-2-1 solution. We calculate 75 users at an average hourly salary of $19.41.
- We calculated the average user salary based on annual salary of $41,000, with the hourly rate of $19.41 calculated off a loaded salary (adjusted for benefits) of 1.4 times that.

# APPENDIX C - CONFIGURATION COMPARISON

Figure 13 presents highlights of the configurations for the non-virtualized solution and the virtualized solution.

| | Non-virtualized solution | | Virtualized solution |
| --- | --- | --- | --- |
| | **Older servers** | **New servers** | **Dell 2-2-1 solution** |
| Number of servers | 4 | 2 | 2 |
| CPU | Intel Xeon processor 3.40E | Intel Xeon processor E5630 | Intel Xeon processor E5630 |
| CPU speed (GHz) | 3.40 | 2.53 | 2.53 |
| Number of processor packages | 2 | 2 | 2 |
| Number of cores per processor package | 1 | 4 | 4 |
| Total memory (GB) | 4 | 16 | 24 |
| Internal storage | Two servers have 2 x 160GB 7.2 RPM SATA drives<br>Two servers have 2 x 500GB 7.2 RPM SATA drives | 2 x 250GB 7.2 RPM SATA drives | 2 x 250GB 7.2 RPM SATA drives |
| External storage | N/A | PowerVault MD3200i with 12 x 500GB NL-SAS 6Gb, 7.2K drives connected to servers with 1 x PowerConnect 5524 switch | PowerVault MD3200i with 12 x 500GB NL-SAS 6Gb, 7.2K drives connected to servers with 2 x PowerConnect 5524 switches |
| Integrated network adapter | Broadcom® NetXtreme® Gigabit Ethernet dual port | Broadcom BCM5716C NetXtreme II dual port | Broadcom BCM5716C NetXtreme II dual port |
| Additional network adapter | N/A | Intel Gigabit ET Quad Port NIC | Intel Gigabit ET Quad Port NIC |
| Support assumptions | HP Extended Care | Servers: 3 Year ProSupport and Mission Critical 4HR 7x24 Onsite Pack | Servers: 3 Year ProSupport and Mission Critical 4HR 7x24 Onsite Pack |
| | | Storage array: 3 Year ProSupport and NBD On-site Service | Storage array: 3 Year ProSupport and NBD On-site Service |
| | | Switches: Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only | Switches: Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only |
| Embedded management | N/A | iDRAC6 Enterprise | iDRAC6 Enterprise |
| Power supply | 1 x HP DPS-460BBB, 460W | 2 x Dell D500E-S0, Redundant, 500W | 2 x Dell D500E-S0, Redundant, 500W |

| | Non-virtualized solution | | Virtualized solution |
|---|---|---|---|
| | **Older servers** | **New servers** | **Dell 2-2-1 solution** |
| Operating system | Windows Server 2008 R2 Enterprise Edition SP1 | Windows Server 2008 R2 Enterprise Edition SP1 | Windows Server 2008 R2 Enterprise Edition with Hyper-V SP1 |
| Management software | N/A | N/A | Systems Center Essentials 2010 |

**Figure 13. Key system configuration information for the test servers.**

# ABOUT PRINCIPLED TECHNOLOGIES

**Principled Technologies®**

Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

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 our clients assess how it will fare against its competition, its performance, its market readiness, 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.