

Prepared for Dell, Inc.

February 13, 2009

The Total Economic Impact™ Of Dell's Server Virtualization Solutions

Multi-company Analysis

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Executive Summary

In late 2008, Forrester Research commenced work on a research project commissioned by Dell, Inc., that focused on examining the potential return on investment (ROI) enterprises may realize by adopting Dell's server virtualization solutions in conjunction with VMware's ESX server and virtualization platform.

This study highlights the benefits and costs of deploying Dell's server virtualization solutions across the enterprise of a sample *Organization* (see Appendix A: Sample *Organization* Description). The findings in this study are in large part based on in-depth interviews conducted by Forrester with five organizations currently using Dell's server virtualization products. The study examines the estimated ROI for the sample *Organization* and presents the aggregate findings derived from the interview and analysis process as well as our independent research.

The study found that for the sample *Organization*, the Dell server virtualization solution provided quantifiable benefits and savings in the following areas:

- A reduction in server administration staffing costs.
- A reduction in the number of existing servers
- The ability to forgo the replenishment of the original 150 servers.
- Power and cooling savings.

In addition, three of the five interviewed organizations indicated that their original investment in Dell's server virtualization solutions could provide them with the flexibility and agility to take advantage of the potential savings that a virtualized disaster recovery environment could bring to their organizations.

Purpose

The purpose of this study is to provide readers with a framework to evaluate the potential financial impact on their organizations of Dell's server virtualization solutions in conjunction with VMware's hypervisor software. Forrester's aim is to show all calculations and assumptions used in the analysis. Readers should use this study to better understand and communicate a business case for investing in Dell's server virtualization solutions.

Methodology

Dell selected Forrester for this project because of its industry expertise in server consolidation and virtualization technologies and Forrester's Total Economic Impact™ (TEI) methodology. TEI not only measures costs and cost reduction (areas that are typically accounted for within IT) but also weighs the enabling value of a technology in increasing the effectiveness of overall business processes.

For this study, Forrester employed four fundamental elements of its TEI methodology in modeling Dell's server virtualization:

1. Costs and cost reduction.
2. Benefits to the entire organization.

3. Flexibility.
4. Risk.

Given the increasing sophistication that enterprises have regarding cost analyses related to IT investments, Forrester's TEI methodology serves an extremely useful purpose by providing a complete picture of the total economic impact of purchase decisions. Please see Appendix B for additional information on the TEI methodology.

Approach

Forrester used a five-step approach for this study:

1. Forrester gathered data from existing Forrester research relative to Dell's server virtualization solutions.
2. Forrester interviewed Dell's server virtualization marketing, product management, and sales personnel to fully understand the potential (or intended) value proposition of its virtualization solutions.
3. Using knowledge of the Dell solution, as well as input from existing Forrester research, a Forrester representative conducted in-depth discussions with five of Dell's customers regarding their experiences with Dell's server virtualization solutions.
4. Forrester constructed a financial model representative of data collected in the interviews.
5. Forrester created this study, which represents and examines the estimated value of the findings derived from the customer interview and analysis process and from Forrester's independent research.

Key Findings

Table 1 represents a summary of the ROI the *Organization* expects to realize over a three-year period by deploying Dell's server virtualization solutions in conjunction with VMware's hypervisor software.

Table 1: Three-Year Summary Financial Results — The *Organization*

Summary financial results	Unadjusted (best case)	Risk-adjusted
ROI	124%	102%
Payback period	Within 12 months	Within 13 months
Total costs (PV)	(\$826,088)	(\$826,088)
Total cost savings and benefits (PV)	\$1,851,431	\$1,666,288
Total (NPV)	\$1,025,343	\$840,200

Source: Forrester Research, Inc.

The three-year, risk-adjusted total NPV (net present value) of **\$840,200** represents the net cost savings and benefits attributed to using the Dell solution when compared with the costs of the *Organization's* server environment before consolidation and virtualization (see details below in the Costs, Benefits, Flexibility, and Risks section). In addition, the risk-adjusted ROI was a very favorable **102%**.

Table 1 illustrates the risk-adjusted cash flow for the sample *Organization*, based on data and characteristics obtained during the customer interview process. Forrester risk-adjusts these values to take into account the potential uncertainty that exists in estimating the costs and benefits of a technology investment. The risk-adjusted value is meant to provide a conservative estimate, incorporating any potential risk factors that may later impact the original cost and benefit estimates. For this study, Forrester applied a 10% risk adjustment — i.e., a reduction of 10% — to all benefits to reflect the risks. For a more in-depth explanation of risk and the risk adjustments used in this study, please see the Risk section.

The objective of this study is not to illustrate savings that other enterprises can obtain by deploying the Dell solution but rather to identify savings that the interviewed customers experienced. These results can be used as a guide to allow other enterprises to determine the appropriate benefits for their particular environment.

Disclosures

The reader should be aware of the following:

- The study was commissioned by Dell and delivered by the Forrester Consulting group.
- Dell reviewed and provided feedback to Forrester, but Forrester maintained editorial control over the study and its findings and did not accept changes to the study that contradicted Forrester's findings or obscured the meaning of the study.
- Dell provided the customer names for the interviews.
- Forrester makes no assumptions as to the potential return on investment that other organizations will receive. Forrester strongly advises that readers should use their own estimates within the framework provided in the study to determine the appropriateness of an investment in Dell's server virtualization solutions.
- Forrester does not endorse Dell or its virtualization solutions.
- The study is not a direct or implied market or competitive comparison.

About Dell's Server Virtualization Solutions

According to Dell, virtualization technology helps simplify operations. Virtualization allows organizations to run multiple applications and operating systems independently on a single server. Additionally, administrators can quickly move workloads from one virtual workspace to another — easily prioritizing business needs while maximizing server resources. This flexibility in the allocation of computing capacity allows the consolidation of applications and servers — easing IT management requirements and allowing organizations to focus resources on innovation instead of maintenance.

Dell provides:

- End-to-end virtualization solutions that can be easily tailored for customers of varying size.
- A broad choice of standards-based virtualization optimized technologies that address today's challenges without limiting flexibility tomorrow.
- Services to help customers help themselves. Dell services are designed to simplify transitions and empower customers' staff, not take over their operations.

In addition to operational efficiencies, Dell's virtualization solutions can help organizations:

- Improve utilization with the ability to run multiple applications and operating systems on a single server.
- Simplify operations by quickly moving virtual workspaces between physical server resources.
- More effectively scale by rapidly provisioning new virtual servers to meet changing business priorities.
- Have the ability to streamline test and development environments.
- Develop more affordable and flexible business continuity strategies.

Customer Interview Highlights

Forrester derived its conclusions in large part from information received in a series of in-depth interviews with executives and personnel at five organizations currently using Dell's server virtualization solutions in conjunction with VMware's hypervisor software. The following is a brief description of each of the interviewed organizations, all of which were promised anonymity:

1. One of the fastest-growing county governments in the US, with more than 1,500 employees and \$460 million in revenue-providing public services, such as: transportation, health, public safety, tax collection, and law enforcement to almost 0.5 million residents. This organization has been using Dell's EqualLogic consolidation and virtualization solutions along with VMware for more than two years.
2. This global company has offered traffic management solutions, premise access control, fire detection, surveillance, and intrusion detection services designed to protect facilities in a wide range of industries and enterprises. It operates in more than 25 countries serving 10,000 customers. It has been using Dell's virtualization solutions for more than 18 months.
3. This organization is a leading developer and marketer of online business management software solutions including point-of-sale (POS) and customer relations management (CRM) solutions to small and midsize businesses. It has been using Dell's virtualization solutions since 2006.
4. A European-based university medical center with more than 7,000 staff members focusing on top clinical and highly specialized care for complex medical issues. With patient care and research labs under one roof, patients, doctors, and researchers collaborate to develop new treatment methods. This medical center has been using Dell's virtualization solutions for more than three years.

5. This company provides consultative services in economics, finance, and regulation to corporations, law firms, and governments around the world using a staff of more than 200 people. It has been using Dell's EqualLogic consolidation and virtualization solutions for about three years.

Common Challenges Of Interviewed Organizations

The customers we interviewed had several common server infrastructure challenges prior to implementing Dell's virtualization solutions. As the need for additional physical servers grew, each interviewed organization was purchasing additional servers and found that this growing infrastructure was not easy to manage nor was it cost-effective. The interviewed customers shared some of the following common issues and challenges prior to implementing Dell's virtualization solutions:

- A budget-constrained IT environment.
- Their existing server infrastructure was not scalable; they managed growth by adding more physical servers.
- HVAC, power, and space costs were too high.
- IT faced increasing pressure to deliver more projects, faster:
 - This led to difficulty in meeting the information needs of the lines of business.
 - The business had faster new application service requirements that could not be met by a physical server farm.
- Increasing administrative requirements for managing multiple systems.
- The future need to update and significantly improve disaster recovery infrastructure.

Sample Organization Description

The *Organization* is a \$3 billion-plus multinational manufacturer and service provider headquartered in Europe with operations in North America, Malaysia, Singapore, and China. The remote operating sites have minimal numbers of IT staff and rely on IT staff at headquarters for their support. Prior to implementing Dell's virtualization solutions, it used 500 Intel X86 physical servers to run mission-critical applications, such as eCommerce, email, and financials. The server population was a mix of Windows NT and Windows 2003 operating systems, along with a small number of Linux servers — half of which were at or nearing the end of their warranty period. The *Organization* recently made the strategic decision to implement server virtualization for its 150 file, print, application, and Web servers. It has chosen to keep its large database and Microsoft Exchange infrastructure on physical servers.

Prior to implementing Dell's virtualization solutions, it had a Fibre Channel SAN and was beginning to explore iSCSI as a SAN strategy using Dell's EqualLogic solutions.

As with the organizations that Forrester interviewed, the sample *Organization's* reasons for pursuing a server virtualization strategy were as follows:

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1. It was spending too much time and money managing its 500 servers and associated storage.
2. It needed to have a more flexible and agile infrastructure to respond faster to the needs of the business.
3. Its data center was reaching its space, power, and cooling capacity.
4. The *Organization* wanted to focus on higher availability for its critical business applications.
5. It had insufficient disaster recovery plans and no backup coverage in the event of a disaster.

The *Organization* contacted Dell, its primary server vendor; over several months, it arranged to purchase the following Dell servers and services:

- Dell PowerEdge 2950 two-socket rack servers for remote sites (Malaysia, Singapore, and China).
- Dell PowerEdge M805 blade servers for IT at headquarters (Europe).
- Dell EqualLogic PS5000 iSCSI SAN arrays.
- VMware Infrastructure 3 Enterprise Edition software.
- Dell Global Infrastructure Consulting Services, including virtualization readiness assessment, design and plan, and help with streamlining migration/implementation, and Dell training for VMware software.
- Dell ProSupport post-implementation services.
- Server and storage management tools, including Dell Open Manage and VMware Virtual Center.

Assumptions:

- Prior to implementing Dell's virtualization solutions, the *Organization* had 500 X86 one- and two-socket servers and had plans to virtualize 150 of those running file, print, application, and Web servers.
- The *Organization* has a combination of DAS and SAN storage, totaling 150 TB of data, mostly in its headquarters offices.
- During the first 18 months of this analysis, it will replace 150 physical servers with virtual servers with a projected ratio of nine virtual servers per physical server, culminating in 16 server blades running 150 virtual machines.
- Pre-virtualization server utilization rates averaged 10% to 15%; post-virtualization utilization rates are projected to average 60%.

- The *Organization* will continue to use its existing Fibre Channel SAN for most applications, and will purchase Dell's EqualLogic iSCSI SAN solutions for the other applications.

The Sample Organization Chooses Dell's Server Virtualization Solutions In Conjunction With VMware's Hypervisor Software

Our *Organization* chose Dell for its virtualization solution. Below is a description of the Dell configuration.

Dell Configuration (Total Cost: \$809,388)

- Primary hardware, software, and services (\$442,147):
 - 16 Dell PowerEdge M805 blade servers (16 GB memory per blade) to run 150 virtual machines with three years ProSupport for IT and mission-critical four-hour 24x7 on-site service.
 - 3-5 Terabytes of storage.
 - 16 VMware Infrastructure 3 Enterprise for 2CPUs and one VirtualCenter Management Server with three years of Platinum Support.
 - 2 Dell EqualLogic PS5000E iSCSI Array (Virtualized iCSCI SAN).
- Primary professional services (\$114,750):
 - Assessment, design and plan, and stream migration/P2V/implementation for 150 virtual servers.
- Secondary hardware, software, and services (\$140,797):
 - 3 Dell PowerEdge 2950 rack servers to run 50 virtual machines with three years ProSupport for IT and mission-critical four-hour 24x7 on-site service.
 - 2-3 Terabytes of storage.
 - 3 VMware Infrastructure 3 Enterprise for 2CPUs and one VirtualCenter Management Server with three years of Platinum Support.
 - 1 Dell EqualLogic PS5000E iSCSI Array (Virtualized iCSCI SAN).
- Secondary professional services (\$91,694):
 - Storage resource management (SRM) planning, design, and implementation.
 - 12 VMware Virtual Center Site Recovery Manager for one processor with three years of Platinum Support.
- Training (\$20,000 including travel)
 - VMware Certified Professional (VCP) training for three IT staff.

TEI Framework

Introduction

From the information gathered in the in-depth customer interviews, Forrester has constructed a TEI framework for those organizations considering implementation of Dell's server virtualization solutions in conjunction with VMware's hypervisor software. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that impact the investment decision.

Sample Organization

Based on the interviews with the five existing customers that Dell provided, Forrester constructed a TEI framework, a sample *Organization*, and an associated ROI analysis that illustrates the areas affected financially. The sample *Organization* that Forrester synthesized from these results is described above and in Appendix A.

Framework Assumptions

Table 2 lists the discount rate used in the present value (PV) and net present value (NPV) calculations, the time horizon used for the financial modeling, and other costs.

Table 2: General Assumptions

General assumptions	Value
Discount rate used to compute NPV	12%
Length of analysis	Three years
Annual fully loaded cost of a server administrator	\$75,000
Life-cycle costs (hardware, software, support, and maintenance) of a Windows server	\$15,000 over 3 years annualized to \$5,000/year

Source: Forrester Research, Inc.

Costs

Costs are an important part of the TEI model. Costs, or IT impact, are calculated as a change in costs primarily for IT as a result of the introduction of the technology to the *Organization*. Therefore, the introduction of the virtualization solution affects IT budgets negatively with the purchase of the solution; it also affects it positively, in terms of the potential cost savings and efficiencies created (see the Benefits and Savings section below).

The impact of cost is accrued in two different areas described below: Dell solution costs (see page 10 for details and pricing) and the *Organization's* internal preparation and planning costs, which together amount to **\$826,088**.

Costs For The Dell Solution — \$809,388

- See configuration details and pricing on page 10.

- Dell pricing is based on normal and average discounts off Dell's list price as of January 2009.

Cost For Internal Preparation And Planning Labor — \$16,700

- A readiness assessment that looks at costs, benefits, and risks along with detailed planning is essential for a successful server consolidation and virtualization initiative. Based on interviews with current Dell customers, our *Organization* required one full-time equivalent (FTE) administrator to spend two months of their time — before and during implementation — planning and testing methods (e.g., VMotion) of migrating applications from the legacy servers to and managing them in the virtual server environment.

Benefits And Savings

In addition to the costs associated with the Dell solution, there were positive IT cost savings and benefits with the new consolidated and virtualized server environment. Based on an analysis of the interviews with the participating customers, we could quantify the following benefits as a result of implementing Dell's server virtualization solutions:

Cost Savings: Reduction In Server Administration Staffing Costs — \$374,800

The interviewed organizations reported various reductions in the staff costs for server administrative support as a result of virtualization, even though server administrators still had to perform operating system patching and application monitoring on the virtual machines as well as managing the new virtual infrastructure. However, the interviewed organizations were still able to report a net reduction of server administration costs. Our *Organization* will have 141 (net) fewer physical servers to manage — the original 150 physical servers minus nine virtual host servers — over the first 18 months and beyond of this analysis, resulting in a net reduction of server administration staffing costs as follows:

- **Year 1** — Reduction of 100 (average) servers managed during Year 1, thereby saving an average of 1.33 FTEs during the first year or **\$100,000** savings (assuming a fully loaded cost per server administrator of \$75,000 annually).
- **Year 2** — Reduction of an average of 125 servers managed during Year 2, thereby saving an average of 1.66 FTEs or **\$124,800** savings.
- **Year 3** — Reduction of 150 servers managed during Year 3, thereby saving an average of 2.0 FTEs or **\$150,000** savings.

The total three-year cost savings associated with a reduction in server administration staffing costs is **\$374,800**.

Cost Savings: A Reduction In The Number Of Existing Servers — \$562,500

Upon implementation of Dell's server virtualization solution, each interviewed organization reduced the number of Windows servers and experienced savings associated with server hardware maintenance and licensing. For our *Organization*, we estimate that the savings associated with a reduction in *existing* servers' hardware maintenance and licensing would be \$1,500 per server per year as follows:

- **Year 1** — Reduction of 100 (average) servers during Year 1, thereby saving an average of \$1,500 in hardware maintenance and licensing per server or **\$150,000** in savings.

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- **Year 2** — Reduction of an average of 125 servers during Year 2, thereby saving an average of \$1,500 in hardware maintenance and licensing per server or **\$187,500** in savings.
- **Year 3** — Reduction of 150 servers during Year 2, thereby saving an average of \$1,500 in hardware maintenance and licensing per server or **\$225,000** in savings.

The total three-year cost savings associated with a reduction in server hardware maintenance and licensing costs is **\$562,500**.

Cost Avoidance: Ability To Forgo Replenishment Of Original 150 Servers — \$1,110,000

In the preceding Cost section, we included the new Dell hardware costs associated with the Dell virtualization solution. We also recognized the hardware maintenance and licensing savings from the elimination of 150 original physical servers.

We now need to recognize the cost avoidance of not having to replace the original 150 servers with replenishment servers. Assuming a four-year actual life cycle, the *Organization* would have had to replace 37 servers per year at an annual life-cycle cost of \$5,000 each; the savings are calculated as follows:

- It would have purchased 37 new servers in Year 1 at a server life-cycle cost of \$5,000 per year, or \$15,000 over the remaining three years of this analysis for hardware, Windows server license software, infrastructure, and maintenance costs. Total cost-avoidance savings associated with these 37 servers is **\$555,000** over the remaining three years.
- It would have purchased 37 new servers in Year 2 at a server life-cycle cost of \$5,000 per year, or \$10,000 over the remaining two years of this analysis for hardware, Windows server license software, infrastructure, and maintenance costs. Total cost-avoidance savings associated with these 37 servers is **\$370,000** over the remaining two years.
- It would have purchased 37 new servers in Year 3 at a server life-cycle cost of \$5,000 per year, or \$5,000 over the remaining one year of this analysis for hardware, Windows server license software, infrastructure, and maintenance costs. Total cost-avoidance savings associated with these 37 servers is **\$185,000** over the remaining one year.

The total three-year cost avoidance savings associated with not having to replace the existing server base is **\$1,110,000**.

Cost Savings: Power And Cooling — \$241,440

The *Organization* experienced a net reduction of 141 servers during the three years of this analysis, with the reductions occurring over an initial 18-month period and beyond. Annualized power and cooling savings for 141 servers is \$97,825 or \$693.79 per server (see Table 4 below for annualized calculations). For our *Organization*, we estimate that the savings associated with a reduction in the *existing* servers' power and cooling costs would be \$693.79 per server per year as follows:

- **Year 1** — Reduction of 91 (net average) servers during Year 1, thereby saving an average of \$693.79 in power and cooling per server or **\$63,135** in savings.
- **Year 2** — Reduction of a net average of 116 servers during Year 2, thereby saving \$693.79 in power and cooling per server or **\$80,480** in savings.

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- **Year 3** — Reduction of 141 servers during Year 3, thereby saving \$693.79 in power and cooling per server or **\$97,825** in savings.

The total three-year cost savings associated with reduced power and cooling costs is **\$241,440**.

Table 4: Organization – Annualized Power And Cooling Calculations

Description	Value
Number of Windows servers to be consolidated/eliminated (net)	141
Average power draw (Watts)	400
Average energy cost per KWH	\$0.11
Number of hours in a year	8,760
Cooling factor (1+incremental power needed for cooling)	1.8
Annualized savings	\$97,825

Source: Forrester Research, Inc.

(Calculation is 141 net servers x 400/1000 (KWH) x \$0.11 cost per KWH x 8,760 hours/year x 1.8 cooling factor = \$97,825.)

Table 5 represents the total benefits and cost savings (non-risk-adjusted) of implementing Dell's server virtualization solutions in conjunction with VMware's hypervisor software.

Table 5: Total Benefits And Cost Savings — The *Organization* (Non Risk-Adjusted)

Total benefits and cost savings	Year 1	Year 2	Year 3	Total	NPV
Reduction in server administration staffing costs	\$100,000	\$124,800	\$150,000	\$374,800	\$295,543
A reduction in the number of existing servers	\$150,000	\$187,500	\$225,000	\$562,500	\$443,553
Ability to forgo replenishment of original 150 servers	\$555,000	\$370,000	\$185,000	\$1,110,000	\$922,177
Power and cooling savings	\$63,135	\$80,480	\$97,825	\$241,440	\$190,159
Total benefits and cost savings	\$868,135	\$762,780	\$657,825	\$2,288,740	\$1,851,431

Source: Forrester Research, Inc.

Risk

Risk-adjusted and non-risk-adjusted ROI are both discussed in this study. The *Organization's* individual costs and benefits are quoted in non-risk-adjusted (best-case) terms and before risk adjustments are made. The assessment of risk provides a range of possible outcomes based on the risks associated with IT projects in general and specific risks relative to server consolidation and virtualization projects. In our research, we discovered that implementing server consolidation and virtualization solutions was a relatively low-risk endeavor if organizations took the time to thoroughly plan the transition process.

TEI uses risk factors to widen the possible outcomes of the costs and benefits (and resulting savings) associated with a project. As the future cannot be accurately predicted, there is risk inherent in any project. TEI captures risk in the form of risks-to-benefits and risks-to-costs.

Measurement of risk is a way of incorporating the levels of confidence and uncertainty regarding the cost and benefit estimates of a given investment. Higher confidence that the cost and benefit estimates will be met implies that the level of risk is lower, and the variation between the risk-adjusted and non-risk-adjusted outcomes is minimized.

Forrester considered the following *general* risks in this study:

- A lack of organizational discipline in creating processes and procedures to best take advantage of the benefits.

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- A lack of appropriate training for the IT personnel who will be responsible for optimizing the full benefit potential from consolidating and virtualizing servers and taking advantage of the future simplification of backup and recovery tasks.
- Failures to reduce, transfer, or redeploy IT support headcount made redundant by deploying server consolidation and virtualization solutions.
- The possibility that the benefits will not be measured and quantified in the future; as a result, no TEI benefit would be captured and acknowledged.
- Internal inertia, conflicting priorities, and turnover, reducing the organization's ability to achieve the benefits.
- Once consolidated, each potential point of failure in the server farm will put significantly more data at risk, which is why it's a good practice to pair business-critical applications with non-critical applications on the same physical server — rather than putting multiple business- and mission-critical apps on the same server — to minimize this risk.

The following risk associated with Dell server virtualization solutions was considered in this study:

- The inability of the *Organization* to find, train, and retain administrators fluent in virtualization technologies, such as VMware, to take full advantage of the benefits outlined in this study.

For this study, Forrester applied a 10% risk adjustment — i.e., a reduction of 10% — to all benefits to reflect the risks listed above. We have not risk-adjusted costs as these were primarily fixed quotes from Dell.

Table 6 represents the total costs, benefits, and cost savings (risk-adjusted by 10%) of implementing Dell's server virtualization solutions in conjunction with VMware's hypervisor software.

Table 6: Total Costs And Benefits — The Organization (Risk-Adjusted by 10%)

Total benefits and cost savings	Initial cost	Year 1	Year 2	Year 3	Total	NPV
Costs For The Dell Solution	(\$809,388)				(\$809,388)	(\$809,388)
Cost for internal preparation And planning labor	(\$16,700)				(\$16,700)	(\$16,700)
Reduction in server administration staffing costs	\$0	\$90,000	\$112,320	\$135,000	\$337,320	\$265,988
A reduction in the number of existing servers	\$0	\$135,000	\$168,750	\$202,500	\$506,250	\$399,198
Ability to forgo replenishment of original 150 servers	\$0	\$499,500	\$333,000	\$166,500	\$999,000	\$829,959
Power and cooling savings	\$0	\$56,822	\$72,432	\$88,043	\$217,296	\$171,143
Total net costs and benefits	(\$826,088)	\$781,322	\$686,502	\$592,043	\$1,233,778	\$840,200

Source: Forrester Research, Inc.

If a risk-adjusted ROI still demonstrates a compelling business case, it raises confidence that the investment is likely to succeed as the risks that threaten the project have been taken into consideration and quantified. The risk-adjusted numbers should be taken as “realistic” expectations, as they represent the expected value considering risk. Assuming normal success at mitigating risk, the risk-adjusted numbers should more closely reflect the expected outcome of the investment.

Flexibility

Flexibility, as defined by TEI, represents investing in additional capacity or agility that can be turned into business benefit for some *future* additional investment. We believe organizations that invest in Dell's server virtualization solutions lay the groundwork to take advantage of migrating to a virtualized disaster recovery environment. For some organizations, virtualization is the foundation for simplifying disaster recovery and high availability. In disaster recovery mode, physical servers can be backed up as virtual machines. Virtual machines can be backed up/copied and can be restarted on any available servers without hardware compatibility concerns. This enables IT to have more reliable recovery options; it also allows for more systems to be protected cost effectively by disaster recovery plans, as virtualization reduces the number and strict configuration requirements of physical servers at a disaster recovery site.

Three of the five interviewed organizations indicated they had future plans to invest in EqualLogic PS series auto-replication, VMware and its Site Recovery Manager tools. All five organizations indicated that their original investment in Dell's server virtualization solutions provided them with the flexibility and agility to take advantage of this "option" and the potential savings that a virtualized disaster recovery environment can bring to their organizations. At present, none of the customers Forrester interviewed were currently taking advantage of virtualized DR; therefore, this study will not attempt to quantify its benefits. However, we encourage the reader to learn more about Dell's EqualLogic replication, VMware and its Site Recovery Manager tools to determine the potential quantifiable benefits within their organizations.

The value of flexibility is clearly unique to each organization, and the willingness to measure its value varies from organization to organization. For the purpose of this analysis, we have assumed that the *Organization* sees the future value in being able to reduce future backup storage acquisition costs or achieve longer intervals between storage capacity upgrades using deduplication. The value of the option (when calculated) is based on the Black-Scholes Option Pricing formula. (For additional information regarding the flexibility calculation, please see Appendix B.)

TEI Framework: Summary

Considering the financial framework constructed above, the results of the costs, benefits, risk, and flexibility sections using the representative numbers can be used to determine a return on investment, net present value, and payback period.

Table 7 below shows the summarized risk-adjusted values, applying the risk-adjustment method indicated in the Risks section, which was to apply a 10% risk adjustment — i.e., a reduction of 10% — to all benefits to reflect the risks listed above. No risk adjustments were made to the costs, as these represented fixed quotes from Dell or internal planning costs.

It is important to note that the values used throughout the TEI framework are based on in-depth interviews with five organizations and the resulting sample *Organization* built by Forrester. Forrester makes no assumptions as to the potential return that other organizations will receive within their own environment. Forrester strongly advises that readers use their own estimates within the framework provided in this study to determine the expected financial impact of implementing Dell's server virtualization solutions in conjunction with VMware's hypervisor software.

Key Findings

Table 7 represents a summary of the risk-adjusted costs, benefits, and ROI that the *Organization* expects to realize over a three-year period by deploying Dell's server virtualization solutions in conjunction with VMware's hypervisor software.

Table 7: Sample Organization Costs, Benefits, And ROI, (Risk-Adjusted)

	Initial cost	Year 1	Year 2	Year 3	Total	NPV
Total costs	(\$826,088)	(\$0)	(\$0)	(\$0)	(\$826,088)	(\$826,088)
Total benefits	\$0	\$781,322	\$686,502	\$592,043	\$2,059,866	\$1,666,288
Flexibility	\$0	\$0	\$0	\$0	\$0	\$0
Total	(\$826,088)	\$781,322	\$686,502	\$592,043	\$1,233,778	\$840,200
Return on investment	102%					
Payback period	13 months					

Source: Forrester Research, Inc.

The three-year, risk-adjusted total NPV (net present value) of **\$840,200** represents the net cost savings and benefits attributed to using the Dell virtualization solution in conjunction with VMware's ESX server and virtualization platform when compared with the costs of the *Organization's* legacy server environment (see details above in the Costs, Benefits, Flexibility, and Risks section). In addition, the risk-adjusted ROI was a very favorable 102%.

Study Conclusions

As the data in this study indicates, Dell's server virtualization solutions in conjunction with VMware's hypervisor software have the potential to provide a good return on investment. In addition, the **risk-adjusted ROI of 102%, along with a 13-month payback period** (breakeven point), raises confidence that the investment is likely to succeed, as the risks that may threaten the project have already been taken into consideration and quantified. In this study, risks have been modeled conservatively in the hopes of showing worst-case expectations.

A successful, well-planned implementation will allow benefits and cost savings to accrue to the *Organization* in the following areas:

- A reduction in server administration staffing costs.
- A reduction in the number of existing servers.
- The ability to forgo the replenishment of original 150 servers.
- Power and cooling savings.

In addition, five interviewed organizations indicated that their original investment in Dell's server virtualization solutions could provide them with the flexibility and agility to take advantage of the potential savings that a virtualized disaster recovery environment could bring to their organizations.

Organizations that are likely to achieve a similar ROI have the following characteristics:

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- Midsize to large organizations with multiple Windows servers that are proving difficult to manage and maintain.
- Lots of single-server applications causing servers to proliferate everywhere, resulting in uncontrollable costs and poor utilization of servers.
- The costs of server infrastructure (servers, storage, networks) continue to increase, sacrificing new investment opportunities.
- An IT staff with the requisite skills to manage a virtual server environment, including knowledge of VMware's ESX server and virtualization platform.

For our *Organization*, Dell's server virtualization solutions in conjunction with VMware's hypervisor software carried a low level of risk, **a positive 102% risk-adjusted ROI, and a reasonable 13-month** horizon to recoup the investment.

We make no assumptions regarding the effects of Dell's server virtualization solutions in conjunction with VMware's hypervisor software at other organizations. This study examines the potential impact attributable to the five organizations that participated in our examination and applies the common costs and benefits to a representative sample *Organization*. The underlying objective of this document is to provide guidance to technology decision-makers seeking to identify areas where value can potentially be created based on using Dell's server virtualization solutions.

Appendix A: Sample Organization Description

The *Organization* is a \$3 billion-plus multinational manufacturer and service provider headquartered in Europe with operations in North America, Malaysia, Singapore, and China. The remote operating sites have minimal numbers of IT staff and rely on IT staff at headquarters for their support. Prior to implementing Dell's virtualization solutions, it used 500 Intel X86 physical servers to run mission-critical applications such as eCommerce, email, and financials. The server population was a mix of Windows NT and Windows 2003 operating systems, along with a small number of Linux servers — half of which are at or nearing the end of their warranty period. The *Organization* recently made the strategic decision to implement server virtualization for its 150 file, print, application, and Web servers. It has chosen to keep its large database and Microsoft Exchange infrastructure on physical servers.

Prior to implementing Dell's virtualization solutions, it had a Fibre Channel SAN and was beginning to explore iSCSI as a SAN strategy using Dell's EqualLogic solutions.

As with the organizations interviewed by Forrester, the sample *Organization's* reasons for pursuing a server virtualization strategy were as follows:

1. It was spending too much time and money managing its 500 servers and associated storage.
2. It needed to have a more flexible and agile infrastructure to respond to the needs of the business faster.
3. Its data center was reaching its space, power, and cooling capacity.
4. The *Organization* wanted to focus on higher availability for its critical business applications.
5. It had insufficient disaster recovery plans and no backup coverage in the event of a disaster.

The *Organization* contacted Dell, its primary server vendor and arranged to purchase the following Dell servers and services:

- Dell PowerEdge 2950 two-socket rack servers for remote sites (Malaysia, Singapore, and China).
- Dell PowerEdge M805 blade servers for headquarters IT (Europe).
- Dell EqualLogic PS5000 iSCSI SAN arrays.
- VMware Infrastructure 3 Enterprise Edition software.
- Dell Global Infrastructure Consulting Services including: virtualization readiness assessment, design and plan, and help with streamlining migration/implementation, and Dell training for VMware software.
- Dell ProSupport post-implementation services.

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- Server and storage management tools, including Dell Open Manage and VMware Virtual Center.

Assumptions:

- Prior to implementing Dell's virtualization solutions, the *Organization* had 500 X86 one- and two-socket servers and had plans to virtualize 150 of those running file, print, application, and Web servers.
- The *Organization* has a combination of DAS and SAN storage, totaling 150 TB of data, mostly in its offices at headquarters.
- During the first 18 months of this analysis, it will replace 150 physical servers with virtual servers with a projected ratio of nine virtual servers per physical server, culminating in 16 server blades running 150 virtual machines.
- Pre-virtualization server utilization rates averaged 10% to 15%; post-virtualization utilization rates are projected to average 60%.
- The *Organization* will continue to use its existing Fibre Channel SAN for most applications, and will purchase Dell's EqualLogic iSCSI SAN solutions for the other applications.

Appendix B: Total Economic Impact™ Overview

Total Economic Impact is a methodology developed by Forrester Research that enhances an organization's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps organizations demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

The TEI methodology consists of four components to evaluate investment value: benefits, costs, risks, and flexibility. For the purpose of this analysis, the impact of flexibility was not quantified.

Benefits

Benefits represent the value delivered to the user organization — IT and/or business units — by the proposed product or project. Often product or project justification exercises focus just on IT cost and cost reduction, leaving little room to analyze the effect of the technology on the entire organization. The TEI methodology and the resulting financial model place equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization. Calculation of benefit estimates involves a clear dialogue with the user organization to understand the specific value that is created. In addition, Forrester also requires that there be a clear line of accountability established between the measurement and justification of benefit estimates after the project has been completed. This ensures that benefit estimates tie back directly to the bottom line.

Costs

Costs represent the investment necessary to capture the value, or benefits, of the proposed project. IT or the business units may incur costs in the forms of fully burdened labor, subcontractors, or materials. Costs consider all the investments and expenses necessary to deliver the proposed value. In addition, the cost category within TEI captures any incremental costs over the existing environment for ongoing costs associated with the solution. All costs must be tied to the benefits that are created.

Risk

Risk measures the uncertainty of benefit and cost estimates contained within the investment. Uncertainty is measured in two ways: the likelihood that the cost and benefit estimates will meet the original projections and the likelihood that the estimates will be measured and tracked over time. TEI applies a probability density function known as "triangular distribution" to the values entered. At a minimum, three values are calculated to estimate the underlying range around each cost and benefit.

Flexibility

Within the TEI methodology, direct benefits represent one part of the investment value. While direct benefits can typically be the primary way to justify a project, Forrester believes that organizations should be able to measure the strategic value of an investment. Flexibility represents the value that can be obtained for some future additional investment building on top of the initial investment already made. For instance, an investment in an enterprisewide upgrade of an office productivity suite can potentially increase standardization (to increase efficiency) and reduce licensing costs. However, an embedded collaboration feature may translate to greater worker productivity if activated. The collaboration can only be used with additional investment in training at some future point in time. However, having the ability to capture that benefit has a present value that can be estimated. The flexibility component of TEI captures that value.

Appendix C: Glossary

Discount rate: The interest rate used in cash flow analysis to take into account the time value of money. Although the Federal Reserve Bank sets a discount rate, organizations often set a discount rate based on their business and investment environment. Forrester assumes a yearly discount rate of 12% for this analysis. Organizations typically use discount rates between 8% and 15% based on their current environment. Readers are urged to consult their organization to determine the most appropriate discount rate to use in their own environment.

Net present value (NPV): The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.

Present value (PV): The present or current value of (discounted) cost and benefit estimates given an interest rate (the discount rate). The PV of costs and benefits feed into the total net present value of cash flows.

Payback period: The breakeven point for an investment, or the point in time at which net benefits (benefits minus costs) equal initial investment or cost.

Return on investment (ROI): A measure of a project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits minus costs) by costs.

A Note On Cash Flow Tables

The following is a note on the cash flow tables used in this study (see the Example Table below). The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1. Those costs are not discounted. All other cash flows in Years 1 through 3 are discounted using the discount rate shown in Table 2 at the end of the year. Present value (PV) calculations are calculated for each total cost and benefit estimate. Net present value (NPV) calculations are not calculated until the summary tables and are the sum of the initial investment and the discounted cash inflows and outflows in each year.

Example Table

Category	Initial cost Year 0	Year 1	Year 2	Year 3	Total

Source: Forrester Research, Inc.

Appendix D: About The Project Manager



Bob Cormier
Principal Consultant

Bob is a principal consultant for Forrester's Total Economic Impact™ (TEI) service. He specializes in advising CIO's and technology vendor marketing professionals on the TEI framework — services that help organizations make decisions about the overall financial value of IT strategies and investments.

Bob came to Forrester through its acquisition of Giga Information Group and has more than 25 years experience in the IT and consulting industries. Prior to joining Giga, Bob held senior-level positions at two leading eBusiness consulting firms, ZEFER and Cambridge Technology Partners. Bob has successfully led company efforts to optimize financial, operational, and resource planning activities, incorporating leading-edge professional service automation (PSA) applications and enterprise resource planning (ERP) systems. He has also held senior management positions at Digital Equipment and Anixter International.

Bob earned an M.B.A. from Bentley College and a B.S. in business from the University of New Hampshire. As an adjunct professor, he has taught finance and economics courses for more than 10 years at Southern New Hampshire University and Daniel Webster College.