A Forrester Total Economic Impact™ Study Commissioned By Nexenta

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The Total Economic Impact Of A Nexenta-Based Storage Solution

A Case Study Focused On Software-Defined Enterprise Storage

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ABOUT FORRESTER CONSULTING

Forrester Consulting provides independent and objective research-based consulting to help leaders succeed in their organizations. Ranging in scope from a short strategy session to custom projects, Forrester's Consulting services connect you directly with research analysts who apply expert insight to your specific business challenges. For more information, visit forrester.com/consulting.

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Executive Summary

In December 2013, Nexenta commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying Nexenta-based storage solutions to enterprise storage environments. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of NexentaStor on their organizations.

To better understand the benefits, costs, and risks associated with deploying NexentaStor, Forrester interviewed a current Nexenta customer and the applicable Nexenta premium partner. This customer has deployed NexentaStor on systems purchased from the premium partner, who provided the build, configuration, and integration services.

"We have a variety of different (storage) systems and looked at three or four architectures before deciding on ZFS and NexentaStor."

~Storage systems manager, top 20 US university (as ranked by US News & World Report)[1]

NEXENTA'S SOFTWARE-DEFINED STORAGE RESULTS IN MATERIAL COST SAVINGS AND AVOIDANCE AND SCALABLE BUSINESS BENEFITS

Our interview with an existing Nexenta customer and subsequent financial analysis found that the interviewed customer experienced the risk-adjusted ROI costs and benefits shown in Table 1.[2] (See Appendix A for a description of the interviewed customer organization.)

Customer data points to benefits of $275,473 versus costs of $151,911, adding up to a net present value (NPV) of approximately $123,562 and a ROI of 81% over three years after adjusting for risk.

Readers should note that, although there is an initial capital expenditure (capex) for this investment, the payback period is less than one month largely due to the material hardware cost savings and avoided incremental investments, which exceed the actual cost of the solution at initiation.

TABLE 1
Three-Year Risk-Adjusted ROI

ROI	Payback period	Total benefits (PV)	Total costs (PV)	Net present value
81%	<1 month	$275,473	($151,911)	$123,562

Source: Forrester Research, Inc.

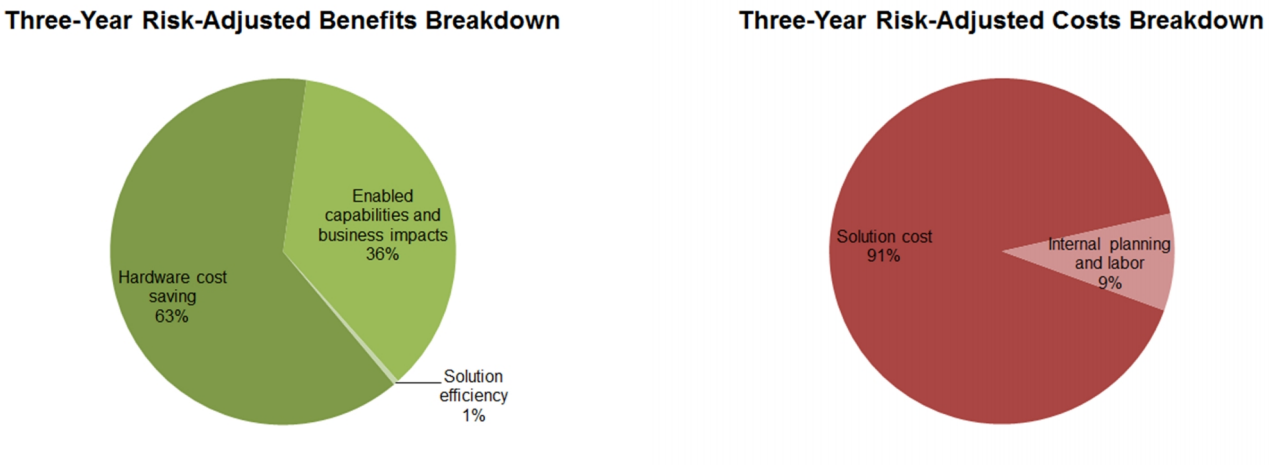
› **Benefits.** The interviewed customer experienced the following benefits:

- **Hardware cost savings.** This benefit focuses on coupling NexentaStor with nonproprietary hardware that can reduce the total hardware cost and give the customer more flexibility in the market.
- **Enabled capabilities and business impact.** This benefit details the different cost avoidances in incremental technology and capacity. Furthermore, the customer also speaks to their experience in leveraging NexentaStor for their virtualization initiative.
- **Solution efficiency.** This benefit centers on the efficiencies of provisioning storage and maintaining the overall solution.

› **Costs.** The interviewed customer experienced the following costs:

- **Solution costs.** This cost focuses on the overall cost for hardware, software, and configuration services.
- **Internal planning and labor costs.** This cost details the time and effort to both decide on engaging Nexenta and the ongoing effort to manage the solution.

FIGURE 1
Three-Year Risk-Adjusted Cost/Benefit Breakdown



Source: Forrester Research, Inc.

Disclosures

The reader should be aware of the following:

- The study is commissioned by Nexenta and delivered by Forrester Consulting.
- Forrester makes no assumptions as to the potential return on investment that other organizations will receive. Forrester strongly advises that readers use their own estimates within the framework provided in the report to determine the appropriateness of an investment in NexentaStor.
- Nexenta reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.
- The customer names for the interviews were provided by Nexenta.

TEI Framework And Methodology

INTRODUCTION

From the information provided in the interviews, Forrester constructed a TEI framework for organizations considering the deployment of NexentaStor. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision.

APPROACH AND METHODOLOGY

Forrester took a multistep approach to evaluate the impact that NexentaStor can have on an organization (see Figure 2). Specifically, we:

- Interviewed Nexenta marketing, sales, and consulting personnel and Forrester analysts to gather data relative to NexentaStor and the marketplace for software-defined storage (SDS).
- Interviewed one organization currently using NexentaStor to obtain data with respect to costs, benefits, and risks.
- Interviewed Area Data Systems, the customer's Nexenta premium partner.
- Constructed a financial model representative of the interviews using the TEI methodology. The financial model is populated with the cost and benefit data obtained from the interviews.

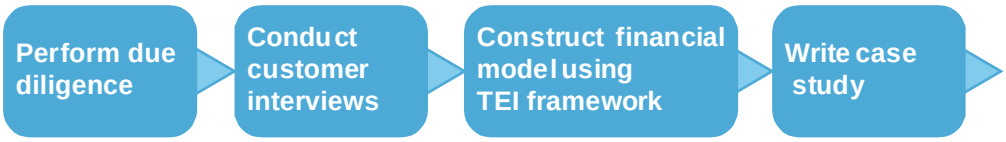
Forrester employed four fundamental elements of TEI in modeling NexentaStor's service:

- Costs.
- Benefits to the entire organization.
- Flexibility.
- Risk.

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

For all data tables in this case study, the subscript "py" denotes "prior year" and "t" denotes "total."

FIGURE 2
TEI Approach



Source: Forrester Research, Inc.

Analysis

INTERVIEWED CUSTOMER DESCRIPTION

The customer interviewed for this case study is a top-tier private US university with an annual endowment of more than $4.2 billion. The customer has the following high-level characteristics:

- A heterogeneous storage environment, with at least four legacy vendors and support for multiple operating systems.
- An IT infrastructure team of 20 people, including three managers.
- It considered various file systems, including Waffle, NTFS, WFS, EXT3, and ZFS and connection types including iSCSI, NFS, Fibre Channel, Fibre Channel over Ethernet (FCOE), and ATA over Ethernet (AoE), before deciding to trial NexentaStor using NFS.
- It trialed NexentaStor's free community version before making a formal purchase decision with the partner.

The customer set the following plan and goals:

- Start the engagement with relatively low visibility and in a less critical environment, such as a tier two backup.
- If the pilot was successful, scale the solution out to other tier one storage use cases requiring high availability.
- Scale up in storage capacity for each use case as needed.
- Leverage NexentaStor for both capex flexibility and virtualization enhancement.

We worked carefully with Area Data Systems to configure the SSD-accelerated system to use NFS, which reduced connectivity costs by about 70%.

~Storage systems manager, top 20 US university (as ranked by US News & World Report)

INTERVIEW HIGHLIGHTS

The customer interview uncovered the following themes:

- **Adopting SDS and NFS creates opportunities to use nonproprietary hardware and avoids "built-in" markups from legacy storage providers.** The customer estimated that it reduced hardware costs by 70%; the premium partner's estimate was between 50% and 60%. Not only does this allow the customer to source hardware more competitively, the customer also gets the flexibility to upgrade to the highest-end storage as needed. In an environment where CIO budgets are shrinking with increasing expectations, these cost savings and flexibility are the key reasons the customer deployed NexentaStor.
- **NexentaStor's enterprise features built over the ZFS file system and the reduction in hardware markups can help avoid costs.** While NexentaStor offers enterprise storage features like snapshots, deduplication, and replication, the customer did not utilize all these tools. However, the customer was able to avoid incremental capacity investment due to a 15% compression efficiency. Furthermore, the customer was able to combine the power of ZFS and affordable solid-state drives (SSDs) with its existing infrastructure without making an incremental investment in Fibre Channel equipment.
- **Be meticulous at the beginning, run a pilot, start small, and spend marginally more time managing the solution.** The customer recognized the material cost savings that could be achieved with NexentaStor but also understood the potential risks and perception of reliability compared with legacy storage vendors. With this in mind, the customer worked closely with the partner to configure the systems and spent 25% more time in the first year managing the solutions after deployment. After a satisfactory trial and successful deployment of a 144 terabyte (TB) tier two backup system, the customer expanded NexentaStor's footprint with a 48 TB high availability (HA) pair of tier one storage.

BENEFITS

The interviewed customer experienced three benefits in this case study:

- Hardware cost savings.
- Enabled capabilities and business impact.
- Solution efficiency.

Hardware Cost Savings

The introduction of nonproprietary hardware on NexentaStor as an option in the customer's environment created more competitive pricing. The customer was able to avoid the "built-in" markups of legacy storage vendor components while also gaining flexibility in upgrade cycles.

The customer acknowledged but then rejected the perceived risk of no single vendor support if they moved away from a legacy vendor. The reality is that Nexenta's premium partner becomes the first point of contact for system issues. The customer found that the process of troubleshooting, tuning, and configuring the system was about the same, as the premium partner was the first point of contact rather than a legacy vendor's support desk in a traditional environment.

The customer's purchases from the partner include all hardware, software (NexentaStor), and relevant services. While the customer reported cost savings of up to 70%, the partner provided more conservative figures of 50% to 60%.

For the purposes of this case study, we use a 60% cost saving. Based on the solution cost for the customer's 144 TB tier two backup solution and the 48 TB tier one HA solution, the cost savings on a $130,000 capex for two systems is $195,000 over three years before adjusting for risk, as shown in Table 2.

The customer did not note any pending or planned future purchases from the premium partner using NexentaStor. However, readers should consider the potentially exponential growth of storage environments when forecasting out-year purchases.

TABLE 2

Hardware Cost Savings

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
A1	Solution cost	Customer reported	$60,000	$70,000	-	-
A2	Cost saving	Customer reported	60%	60%	60%	60%
A3	Estimated cost of a tier one storage OEM for a similar solution	A1/(1-A2)	$150,000	$175,000	-	-
At	**Hardware cost savings**	**A3-A1**	**$90,000**	**$105,000**	**$0**	**$0**

Source: Forrester Research, Inc.

Enabled Capabilities And Business Impact

The hardware cost savings gave the customer access to more options and flexibility in its architecture. By deploying a nonproprietary storage solution that reduced the overall solution cost, the customer was able to purchase high-performance SSDs that met the organization's I/O requirements and budget.

Coupled with the ZFS file system's robustness, the performance and affordability of the solution meant that the customer could avoid making an incremental investment in a Fibre Channel storage area network (SAN). The customer estimated that it avoided a total incremental investment of $100,000 in Fibre Channel; this includes both hardware purchases and the acquisition of new skills and resources.

This customer also highlighted the incremental benefit that compression has given it in the backup environment. A reported compression efficiency ratio of 15% has helped the customer avoid capacity enhancements, even as storage needs have grown by 15% to 20% each year.

Finally, the business impact of the customer's first deployment of NexentaStor in its tier two backup environment was notable, as it proved NexentaStor to be a reliable storage option and achieved viability in more critical and front-line use cases. The customer's second deployment of NexentaStor included a 48 TB HA pair that advanced the customer's virtualization plans.

As the customer attributes much of the effort to run 500 virtual machines (VMs) to its virtualization software, the customer did not quantify the value of NexentaStor's role in the virtualization initiative. To do this, the customer could examine the steps and effort needed to set up VMs with and without NexentaStor to get a clear idea of the difference in required resources.

Readers are urged to consider what use cases they might deploy NexentaStor for. If the use case is an enhancement to the environment, then readers should consider any incremental revenue, retention, or increase in customer satisfaction that may be affected by the enhancement. If the use case is for maintenance or refresh, then readers should consider user productivity gains, asset protection, and security benefits that may be affected by the refresh project.

The total quantified benefit as shown in Table 3 is $117,981 over three years before adjusting for risk.

TABLE 3

Enabled Capabilities And Business Impact

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
B1	Fibre Channel investment avoidance	Customer reported	$100,000	-	-	-
B2	Backup compression efficiency	Customer reported	-	15%	15%	15%
B3	Allocated storage capacity(TB)	Year 1: customer reported Year 2-3: $B3_{py}$*(1+B5)	-	81.5	93.7	112.5
B4	Utilized storage capacity (TB)	B3*(1-B2)	-	69.3	79.7	95.6
B5	Annual capacity growth	Assumption	-	15%	20%	20%
B6	Price per TB	$A1_{initial}$/144	-	$417	$417	$417
B7	Saved	(B3-B4)*B6	-	$5,094	$5,858	$7,029
Bt	Enabled capabilities and business impact	Initial: B1 Year 1-3: B7	$100,000	$5,094	$5,858	$7,029

Source: Forrester Research, Inc.

Solution Efficiency

The ZFS file system and the enterprise-level features that Nexenta has added to NexentaStor should lead to efficiency gains in solution management. However, as the customer has engaged with several different legacy vendors, enterprise-level features such as snapshots, deduplication, and replication are expected benefits, not incremental benefits. The only exception is in the aforementioned example of compression as an incremental benefit, as the customer's previous backup solution had no compression capabilities.

The customer did highlight provisioning efficiency, but also mentioned that for its specific use case, it only spent a material amount of time on provisioning at initiation. The customer did experience a 75% efficiency gain; this will translate into a larger benefit value for readers with higher provisioning demands.

Despite this efficiency gain and enterprise features similar to legacy storage vendor offerings, the customer noted an overall yet marginal increase in solution management effort. The customer noted a reasonable increase in attention, as the solution is still relatively new at the university and lacks the time-tested quality of legacy deployments. If the customer budgets 20% of annual work hours to maintenance, the NexentaStor deployment has slightly increased the maintenance allocation to 25% of annual work hours.

As the customer becomes more comfortable with the solution, the maintenance effort should decrease. At that point, the customer may even recognize the efficiencies and time saved when provisioning storage and setting up additional VMs, which would be quantifiable by labor effort and even time-to-market for business applications.

Lastly, NexentaStor allows the customer to pool all of its storage resources as needed. The customer could theoretically reduce training hours or even headcount for storage software related to legacy vendors.

TABLE 4
Solution Efficiency

Ref.	Metric	Calculation	Initial	Year 1	Year 2	Year 3
C1	Initial hours to provision	Customer reported	16	16	-	-
C2	Provisioning efficiency	Customer reported	75%	75%	75%	75%
C3	Improved provisioning time	C1*(1-C2)	4	4	-	-
C4	IT staff fully loaded hourly salary	Assumption	$60	$62	$64	$66
Ct	Solution efficiency	(C1-C3)*C4	$720	$742	$0	$0

Source: Forrester Research, Inc.

Total Benefits

Table 5 shows the total of all benefits across the three areas, as well as present values discounted at 10%.

TABLE 5
Total Benefits (Non-Risk-Adjusted)

Benefit	Initial	Year 1	Year 2	Year 3	Total	Present Value
Hardware cost savings	$90,000	$105,000	$0	$0	$195,000	$185,455
Enabled capabilities and business impact	$100,000	$5,094	$5,858	$7,029	$117,981	$114,753
Solution efficiency	$720	$742	$0	$0	$1,462	$1,394
Total benefits	$190,720	$110,835	$5,858	$7,029	$314,443	$301,602

Source: Forrester Research, Inc.

COSTS

The interviewed customer experienced two costs associated with NexentaStor:

- Solution costs.
- Internal planning and labor costs.

Total Costs

Table 6 shows the total of all costs as well as the associated present values, discounted at 10%.

The solution cost as quoted by the premium partner and verified by the customer includes NexentaStor, all relevant hardware for the 144 TB tier two backup build and 48 TB tier one HA pair build, annual maintenance and license, and the partner's professional services. Readers are urged to contact Nexenta or one of its partners directly for more information on products and pricing, as the dollar-per-TB ratios presented in this study are highly dependent on the interviewed customer's specific use case.

Internal planning assumes 40 hours of initial planning and business case development. It also factors in a marginal increase of 25% to a budgeted 20% of maintenance each year for one storage resource. For salary assumptions, please see Appendix A.

TABLE 6
Total Costs (Non-Risk-Adjusted)

Benefit	Initial	Year 1	Year 2	Year 3	Total	Present Value
Solution costs	($60,000)	($70,000)	($8,333)	($8,333)	($146,667)	($136,784)
Internal planning and labor costs	($2,308)	($6,000)	($3,708)	($2,546)	($14,562)	($12,740)
Total costs	($62,308)	($76,000)	($12,041)	($10,879)	($161,229)	($149,524)

Source: Forrester Research, Inc.

FLEXIBILITY

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for some future additional investment. This provides an organization with the "right" or the ability to engage in future initiatives but not the obligation to do so. There are multiple scenarios in which a customer might choose to deploy NexentaStor and later realize additional uses and business opportunities. Flexibility would also be quantified when evaluated as part of a specific project (details in Appendix B).

Although the customer did not mention scaling up, readers should note the scalability of Nexenta as a SDS solution. Hardware scalability in terms of capacity will depend on the reader's needs for performance, capacity, and how it is communicated to the partner building the solution.

The main future option that the customer highlighted was an opportunity around cloud. With the underlying robustness built, the customer mentioned iSCSI and cloud in its future plans.

RISK

Forrester defines two types of risk associated with this analysis: implementation risk and impact risk. "Implementation risk" is the risk that a proposed investment in NexentaStor may deviate from the original or expected requirements, resulting in higher costs than anticipated. "Impact risk" refers to the risk that the business or technology needs of the organization may not be met by the investment in NexentaStor, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates.

Quantitatively capturing investment and impact risk by directly adjusting the financial estimates results in more meaningful and accurate estimates and as well as a more accurate projection of the ROI. In general, risks affect costs by raising the original estimates, and they affect benefits by reducing the original estimates. The risk-adjusted numbers should be viewed as "realistic" expectations since they represent the expected values considering risk.

The following implementation risks that affect costs are identified as part of this analysis:

- Increased solution costs based on the level of performance of equipment needed.
- Increased planning and recurring labor effort for higher-visibility and higher-criticality environments.

The following impact risks that affect benefits are identified as part of the analysis:

- Taking minimal advantage of nonproprietary, commercial-grade hardware pricing and competitive bidding.
- Applying NexentaStor only to nonessential environments that do not affect the business.
- Overdedication of resources to managing the solution.
- Continuing to manage a heterogeneous environment that consists of multiple storage software platforms and skill sets.

Table 7 shows the values used to adjust for risk and uncertainty in the cost and benefit estimates. The TEI model uses a triangular distribution method to calculate risk-adjusted values. To construct the distribution, it is necessary to first estimate the low, most likely, and high values that could occur within the current environment. The risk-adjusted value is the mean of the distribution of those points. Readers are urged to apply their own risk ranges based on their own degree of confidence in the cost and benefit estimates.

TABLE 7
Cost And Benefit Risk Adjustments

Costs	Low	Most likely	High	Mean
Solution costs	98%	100%	105%	101%
Internal planning and labor costs	100%	100%	125%	108%
Benefits	**Low**	**Most likely**	**High**	**Mean**
Hardware cost savings	80%	100%	103%	94%
Enabled capabilities and business impact	50%	100%	110%	87%
Solution efficiency	80%	100%	103%	94%

Source: Forrester Research, Inc.

Financial Summary

The financial results calculated in the Costs and Benefits sections can be used to determine the ROI, NPV, and payback period for the organization's investment in NexentaStor. These are shown in Table 8 below.

Table 9 below shows the risk-adjusted ROI, NPV, and payback period values. These values are determined by applying the risk-adjustment values from Table 7 in the Risk section to the cost and benefit numbers in Tables 5 and 6.

TABLE 8
Cash Flow: Non-Risk-Adjusted

Cash flow: original estimates

	Initial	Year 1	Year 2	Year 3	Total	Present value
Costs	($62,308)	($76,000)	($12,041)	($10,879)	($161,229)	($149,524)
Benefits	$190,720	$110,835	$5,858	$7,029	$314,443	$301,602
Net benefits	$128,412	$34,835	($6,184)	($3,850)	$153,214	$152,078
ROI	102%					
Payback period	<1 month					

Source: Forrester Research, Inc.

TABLE 9
Cash Flow: Risk-Adjusted

Cash flow: risk-adjusted estimates

	Initial	Year 1	Year 2	Year 3	Total	Present value
Costs	($63,092)	($77,180)	($12,421)	($11,167)	($163,860)	($151,911)
Benefits	$172,277	$103,829	$5,096	$6,116	$287,317	$275,473
Net benefits	$109,184	$26,649	($7,325)	($5,051)	$123,457	$123,562
ROI	81%					
Payback period	<1 month					

Source: Forrester Research, Inc.

NexentaStor: Overview

NexentaStor is the flagship product from Nexenta Systems. According to Nexenta, NexentaStor is a unified (NAS/SAN) storage software platform with enterprise-class capabilities that address the challenges presented by ever-growing data sets. NexentaStor is an open source-based alternative to vertically integrated, proprietary storage offerings, providing customers the flexibility to select their storage operating system independently from the hardware it runs on.

NexentaStor licensed features add incremental functionality and enhance NexentaStor's standard capabilities.

Additional licensed features available for NexentaStor include:

- Nexenta Cloud Archive.
- Nexenta NameSpace Cluster.
- Nexenta High Availability Cluster.

Other products from Nexenta include:

- Nexenta MetroHA: campus clustering product.
- Nexenta Virtual Storage Appliance (VSA) for VMware Horizon View (NV4V).
- NexentaStor Community Edition for noncommercial use.

Area Data Systems: Overview

In addition to interviewing Nexenta and its customer for this case study, we also spoke with the Nexenta premium partner that deployed the storage solution featured in this case study.

Area Data Systems provides industry-certified storage solutions through a consultative cycle of requirements discovery, proof of concept design, solution testing and evaluation, optimization and tuning, and recalibrating based on performance-to-goal ratios.

Appendix A: Customer Description

The customer interviewed for this case study is a top-tier private US university with an annual endowment of more than $4.2 billion. The customer has the following high-level characteristics:

- A heterogeneous storage environment, with at least four legacy vendors and support for multiple operating systems.
- An IT infrastructure team of 20 people, including three managers.
- It considered various file systems, including Waffle, NTFS, WFS, EXT3, and ZFS and connection types including iSCSI, NFS, Fibre Channel, Fibre Channel over Ethernet (FCOE), and ATA over Ethernet (AoE), before deciding to trial NexentaStor using NFS.
- It trialed NexentaStor's free community version before making a formal purchase decision with the partner.

The customer set the following plan and goals:

- Start the engagement with relatively low visibility and in a less critical environment, such as a tier two backup.
- If the pilot was successful, scale the solution out to other tier one storage use cases requiring high availability.
- Scale up in storage capacity for each use case as needed.
- Leverage NexentaStor for both capex flexibility and virtualization enhancement.

FRAMEWORK ASSUMPTIONS

Table 10 provides the model assumptions that Forrester used in this analysis.

The discount rate used in the PV and NPV calculations is 10% and time horizon used for the financial modeling is three years. Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult with their respective company's finance department to determine the most appropriate discount rate to use within their own organizations.

TABLE 10
Assumptions

Ref.	Metric	Calculation	Value
X1	Hours per week		40
X2	Weeks per year		52
X3	Hours per year (M-F, 9-5)		2,080
X4	Hours per year (24x7)		8,760
X5	FTE annual salary		$120,000
X6	FTE hourly salary		$60
X7	Annual salary increase		3%

Source: Forrester Research, Inc.

Appendix B: Total Economic Impact™ Overview

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies 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.

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 form 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: 1) the likelihood that the cost and benefit estimates will meet the original projections, and 2) 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 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, companies often set a discount rate based on their business and investment environment. Forrester assumes a yearly discount rate of 10% for this analysis. Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult their respective 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 at 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. 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 Framework Assumptions section) 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 flows in each year.

Appendix D: Endnotes

[1] Source: US News & World Report (http://colleges.usnews.rankingsandreviews.com/best-colleges).

[2] Forrester risk-adjusts the summary financial metrics to take into account the potential uncertainty of the cost and benefit estimates. For more information on Risk, please see Appendix B.