

A Forrester Total Economic
Impact™ Study
Commissioned By
HP

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The Total Economic Impact™ Of HP 3PAR StoreServ 7450 All-Flash Storage

Cost Savings And Business Benefits
Enabled By 3PAR StoreServ 7450 All-
Flash Storage

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Executive Summary

HP commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying 3PAR StoreServ 7450 All-flash Storage. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of the 3PAR StoreServ 7450 All-flash Storage (7450) on their organizations.

To better understand the benefits, costs, and risks associated with a 7450 implementation, Forrester interviewed several customers who were using legacy storage products and some who were using HP 3PAR StoreServ as their primary storage solution. In both scenarios, the customers added the 7450 to their storage architecture in the past year because their existing configuration could not meet performance demands for their virtual desktop infrastructure (VDI) environments. The HP 3PAR Storage family of products provides a range of models from which organizations can design a flash-optimized solution to support mission-critical applications. The 7450, an all-flash array, dramatically accelerates performance compared with a spinning disk alternative, while also decreasing the storage footprint. Furthermore, it reduces administrative tasks so that organizations can grow storage under management without increasing headcount. For those customers already using 3PAR StoreServ products, the all-flash array shares the same core data management capabilities as other 3PAR StoreServ products, so the transition is seamless and easy.

Prior to implementing 3PAR StoreServ 7450 All-flash Storage, the customers had implemented spinning disk storage arrays from another supplier to meet the growth demands for their VDI environments. However, they were experiencing serious performance issues due to storage bottlenecks, leading to unacceptably high latency for end users of mission-critical, database-driven applications. The deficiency in I/O operations per second and inefficient throughput on array controllers led to minutes of delays for system logins and queries. These were expensive delays, hurting employee productivity and translating into high costs. Given that the organizations interviewed operate in industries that demand quick system responsiveness and fast data fetching capabilities, the slow performance affected employee productivity significantly. The performance and capacity demands could no longer be met with adding more traditional spinning disk storage, so customers sought an alternative. With 3PAR StoreServ 7450 All-flash Storage, customers were able to relieve the stress on the VDI environment, enabling them to reduce extenuating unplanned downtime and increase employee productivity while keeping their costs neutral. Said one IT strategist, “The 3PAR StoreServ 7450 provides the absolute sheer speed to enable the maintenance and deliver the performance required — both from an end user and management perspective.”

HP 3PAR STORESERV 7450 ALL-FLASH STORAGE IMPROVES SYSTEM PERFORMANCE

Our interviews with five existing customers and subsequent financial analysis found that a composite organization based on these interviewed organizations experienced the risk-adjusted ROI, benefits, and costs shown in Figure 1. See Appendix A for a description of the composite organization.¹

The composite organization analysis points to benefits of over \$400,000 per year versus implementation costs of \$131,645, adding up to a net present value (NPV) of \$1,082,879 over three years.

With 3PAR StoreServ 7450 All-flash Storage, response times for logins and queries were improved by more than 80%. General system performance for the VDI environment went from “sluggish” and “painful” to “snappy” and required so little oversight that one storage administrator said he “sets it and forgets it.” The composite organization experienced additional savings because the 3PAR StoreServ architecture required less ongoing administration oversight and could gain from the

The HP 3PAR StoreServ 7450 All-flash Storage can improve IOPS and latency results dramatically, increase the overall performance of a high workload environment, and lower administrative management work.

The costs and benefits for a composite organization for 20 TB of 3PAR All-flash storage, based on customer interviews, are:

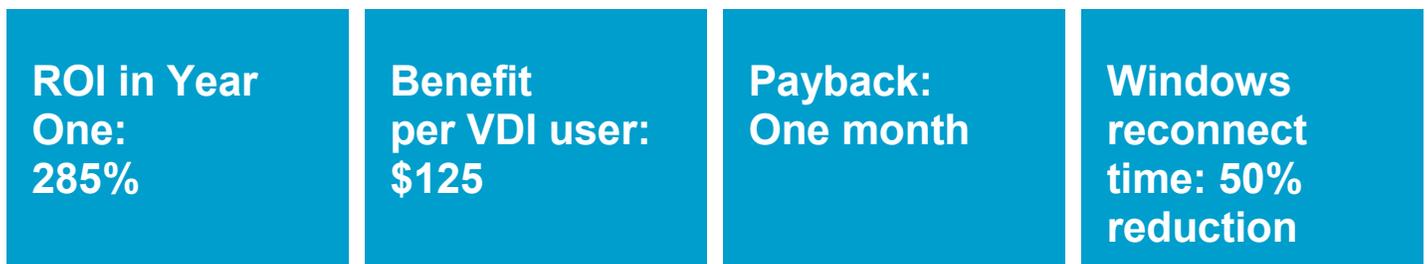
- **Investment costs: \$130,722.**
- **Benefits: \$1,213,601.**
- **Average cost/GB usable (street price) for all-flash storage (included 4:1 compaction and 25% overhead): \$2.20.**

efficiency of using several products in the same 3PAR StoreServ family with one management console. Furthermore, for those customers using 3PAR StoreServ as their primary architecture, it is flash-optimized for midrange, high-end and all-flash for any application or data type. Thus, it can serve different use cases under one management platform.

While the organization on which this financial model is based used the 7450 for its VDI environment, it's worth noting that many customers are purchasing the 7450 for other uses. They include:

- › **Accelerating databases that support mission-critical applications.** Many customers have found significant value in using the 7450 to accelerate an Oracle or SAP environment. These underlie many mission-critical applications, so they are targeted for performance improvement and to improve employee productivity.
- › **General application performance improvement.** Because the cost of all-flash storage is declining, customers are watching the economics closely and, at the right moment, will capitalize on its use for common applications such as web applications, email and ERP systems. Many anticipate a not-so-distant future of all-flash in the data center and, with that, a reduction in storage footprint and data center costs.

FIGURE 1
Financial Summary Showing Three-Year Risk-Adjusted Results



Source: Forrester Research, Inc.

› **Benefits.** The composite organization experienced the following risk-adjusted benefits that represent those experienced by the interviewed companies:

- **Remain cost-neutral while improving IOPS and throughput performance significantly.** The customers interviewed made the decision to move to all-flash storage for performance reasons, but the price per gigabyte for unmatched performance made the decision an easy one. Their investment was “cost-neutral,” meaning that they could upgrade to an all-flash array with a different vendor without increasing their annual storage contract costs. This made it easier to convince the CIO and executive team to make the purchase. They struggled to find a comparison of what an equivalent spinning disk array alternative would have been because they had maxed them out even after doubling the arrays. One customer cited an improvement from 175-300 IOPS for a spinning 10K/15K rpm hard drive to several thousand IOPS for solid state disk. Because the price of all-flash storage is coming down to the levels of the midrange performance spinning disk alternative, customers can manage increased data growth for less spend. For the right applications, the 3PAR 7450 All-flash Storage array could be put to immediate and good use.
- **Increase storage under management without increasing FTEs — up to three times.** On average, the interviewed customers had two full-time equivalents (FTEs) managing storage with no expectation to grow headcount despite the fast clip of storage growth. This can be attributed to 3PAR’s ease of administration. From upgrades to firmware updates to disaster recovery to troubleshooting, most administrative tasks take half the time compared with the legacy vendor’s solution. That’s because the technology has automatic management and optimization features that take place at the subsystem level without administrator intervention. Said one manager of technology services: “If I were to have continued with the old way of doing things, I would have had to double my team. I have easily been able to save two full-time equivalents.” Another customer cited a significant reduction in the ratio of servers per admin, going from 300 servers per admin to 900 servers per admin with its 3PAR solution. In addition to cost savings, this also translates into a secondary benefit: freeing those resources up to focus on value-add activities. The customers said that their storage administrators could spend time on strategic planning and higher-level tasks, such as disaster recovery, rather than storage administrative oversight. This, for some interviewed, also means staying “cloud competitive,” meaning that they can standardize and optimize to keep the costs of hosting their own storage below that of the cloud providers’ alternative offering.²
- **Enable optimal uptime performance.** The customers interviewed shared the goal of meeting executive mandates for uptime, reliability, and stability. With the 3PAR 7450 they are able to sustain a 24/7/365 uptime commitment and meet the demands of a global workforce. Even planned downtime is done during business hours and does not have an impact on the business operations. In the past, this was not the case. Said one storage administrator, “Anytime that I was paged out of bed it was because of the VDI environment.”³
- **Do disaster recovery recompose for upgrades in half the time.** This benefit, a part of the administrative ease, was highlighted by customers because it is both critical for their strategy and leads to the biggest downtime if an emergency event happens. Customers cited the ability to do a full recovery in 4 hours instead of the 8 to 12 hours it took them with the legacy system. Critical users could be brought on within 2 hours in a phased approach that separates nonessential users from those who need immediate access to the VDI environment.
- **Scale under the same footprint.** Although not quantified in the financial model, the all-flash storage uses rack space more efficiently and takes up less space in the data center. The alternative spinning disk array consumes three times as much space. Depending on the scale of the VDI environment and number of users in the environment (e.g., 50,000 users), this would translate to significant heating, cooling, and power cost reduction. It has the potential to be a lot greener and is an anticipated benefit mentioned by customers. Said one director of IT: “When spinning disks go away there will be a collective ‘hallelujah.’ Power supplies, fans, and spinning disks are the most unreliable things in the data center.”
- **Increase usable storage fourfold with compaction.** The customers interviewed for this study anticipate even more savings when they use the data deduplication software update, which is included in the price of the 7450 purchase. Because VDI environments commonly have duplicate copies of repeating data, they stand to gain a great

deal of usable storage space. HP cites a minimum 4:1 ratio for compaction - 3PAR thin and deduplication technologies - and possibly as high as 10:1 (depending on the workload). This benefit is of high importance for the customers and will likely tip the scales for many prospective 7450 customers to make a purchase. Said one customer, “The biggest future benefit for us is the dedupe option — we have lots of data that is repeated on the system, and it would be a huge savings for us.” With the cost of flash storage dropping, the dedupe feature enables the flash option to approach \$2/gigabyte. Because there is no additional charge for it, customers will essentially get free SSD capacity on their existing 3PAR StoreServ arrays.

- **Partner with a proactive, cooperative technology company.** The customers interviewed, although working with more than one supplier, use many products within the 3PAR family. They rely on HP’s sales and account management teams to support them in managing their existing systems optimally and keep them informed about cutting-edge changes that could benefit them. They described HP as a proactive, responsive, and engaging partner. Said one, “Partnership is what comes first. If we need someone to stand beside us, accomplish something new, or get on the edge of new technology, it’s HP. They give us insights on what is coming down the pipe and plan better for technology changes.”

› **Costs.** The composite organization experienced the following risk-adjusted costs:

- **System costs for the 7450 array and its drivers.** These are initial, one-time fees paid to HP for the 7450 system, which includes the base system, drive enclosure, installation and startup services, the Operating System software, the Virtual Copy software, the Reporting Software Suite, and the E-Media software.
- **Services costs to support the 7450 system.** These are initial, one-time fees paid to HP that provide three years of 24x7 proactive care support and support for the entire system described above.
- **Ongoing operations.** The organization requires a storage administrator to spend an average of 2 hours per week maintaining and enhancing the 7450 All-flash array. At an average fully loaded cost per hour of \$67.30, the total cost for ongoing operations is \$7,000 annually, or \$21,000 over this three-year analysis.

Disclosures

The reader should be aware of the following:

- › The study is commissioned by HP and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.
- › Forrester makes no assumptions as to the potential ROI 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 HP 3PAR StoreServ 7450 All-flash Storage.
- › HP 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.
- › HP provided the customer names for the interviews but did not participate in the interviews.

TEI Framework And Methodology

INTRODUCTION

From the information provided in the interviews, Forrester has constructed a Total Economic Impact (TEI) framework for those organizations considering implementing HP 3PAR StoreServ 7450 All-flash Storage. 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 HP 3PAR StoreServ 7450 All-flash Storage can have on an organization (see Figure 2). Specifically, we:

- › Interviewed HP marketing, sales, and implementation personnel, along with Forrester analysts, to gather data relative to 3PAR StoreServ 7450 All-flash Storage and the marketplace for 3PAR StoreServ 7450 All-flash Storage.
- › Interviewed five organizations currently using the HP 3PAR StoreServ product family to obtain data with respect to costs, benefits, and risks.
- › Designed a composite organization based on characteristics of the interviewed organizations (see Appendix A).
- › 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 as applied to the composite organization.
- › Risk-adjusted the financial model based on issues and concerns the interviewed organizations highlighted in interviews. Risk adjustment is a key part of the TEI methodology. While interviewed organizations provided cost and benefit estimates, some categories included a broad range of responses or had a number of outside forces that might have affected the results. For that reason, some cost and benefit totals have been risk-adjusted and are detailed in each relevant section.

Forrester employed four fundamental elements of TEI in modeling HP 3PAR StoreServ 7450 All-flash Storage's service: benefits, costs, flexibility, and risks.

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

FIGURE 2
TEI Approach



Source: Forrester Research, Inc.

Analysis

COMPOSITE ORGANIZATION

For this study, Forrester conducted a total of five interviews with representatives from the following companies, which are HP customers based in North America:

- › A medium-sized financial services organization and credit union based in Canada.
- › A medium-sized nonprofit medical care insurance company that is in an association of regional not-for-profit health and travel insurance providers based in the United States and Canada.
- › A medium-sized nonprofit healthcare system that is one of the three major systems in Ohio.
- › An enterprise-sized natural gas and electricity retailer operating in markets across North America with \$3 billion in revenue.
- › A global semiconductor company based in the US that has 157 worldwide locations and \$24 billion in revenue.

Based on the interviews, Forrester constructed a TEI framework, a composite company, and an associated ROI analysis that illustrates the areas financially affected. The composite organization that Forrester synthesized from these results represents an organization with the following characteristics:

- › A US-based organization that has 600 TB of total raw storage under management within a two-supplier environment. The storage is used for production, disaster recovery, and testing purposes. Half of the storage under management is 3PAR StoreServ, and the other half is a legacy dual controller storage environment.
- › The organization's production environment supports mixed workloads with differing throughput and transaction demands such as VDI, databases, and big data analytics and supports six to eight mission-critical applications that are both homegrown and purchased, including financial, email billing, and email marketing applications.
- › The organization has been operating in a two-supplier environment and has been using 3PAR StoreServ products for the past three years. The organization first purchased a 3PAR StoreServ 10800 product, then added a 7400. It has been happy with the ease of administration. Since the VDI environment was underperforming, the organization continued to add spinning disk storage but hit a breaking point where it could no longer keep up with the performance demands and service-level agreements (SLAs) within the legacy system infrastructure. The organization considers the 3PAR 7450 as its best investment for additional storage to add to the mix and keep up with the VDI growth and performance demands while staying within one storage architecture.

“Nine months ago, we needed a lot of performance in our VDI environment compared with a previous storage configuration. Maintenance on the system was difficult, and there wasn't enough performance to patch and reboot the system. End users were unhappy with the general system performance and responsiveness — it was sluggish. We looked to the 3PAR StoreServ 7450 to solve the performance issues.”

~Senior storage administrator, global semiconductor company

- › The organization has one full-time equivalent for primary storage operations and one SAN full-time equivalent as the storage architect or team lead. One driver of the decision to go with an HP all-flash storage array was to capitalize on the efficiencies of using the 3PAR architecture. Because administrative tasks with 3PAR can take half the time of other non-HP legacy arrays, the organization can grow storage under management without hiring more FTEs.
- › The composite organization has a longstanding, high level of partnership and support from HP, which it values as a key benefit of the 3PAR architecture.

After evaluating key players in the all-flash market, the composite organization chose HP because of its existing partnership, ability to benefit from standardizing its architecture, and competitive pricing and began deployment:

- › The implementation began about a year ago, and the 7450 was up and running quickly because the administration console is the same as that of other HP 3PAR products in the family.
- › The first phase focused on relieving the stressed VDI environment for its 3,000 users and reducing latency and improving performance.
- › Over the next six months to a year, the organization expects to gain even more usable storage with the deduplication feature that is included in the 7450 offering at no additional charge.

INTERVIEW HIGHLIGHTS

Situation

Like many organizations, the composite organization was experiencing a steady storage growth rate of around 30%, driven in part by an increase in unstructured data resulting from acquisitions, the demands of big data, and growth in the number of applications run in the business. The VDI environment, specifically, has grown very quickly, as the organization saw it as a way to reduce the storage footprint and enable its workforce through multiple devices and in many locations. Many of its employees are working in the field in the US and globally with thin or zero clients. Recently, the organization has seen significant performance issues with its VDI environment that supports these 3,000 users, with long delays in startup times and poor video playback, which hurt worker productivity. While already relying on data compression, thin provisioning, and storage virtualization to address storage capacity constraints, the organization was not able to add more spinning disk storage to meet the demands of this environment, and worker productivity was suffering. Said one IT strategist, “To augment the current solution would have been cost-prohibitive — we ended our lease early to move to the 7450 and remained still cost-neutral.” The key challenges that the composite organization faced were:

- › The VDI environment was “maxed out,” and despite more than doubling the spinning disk for it, performance was suboptimal.
- › The poor performance was causing downtime and creating stress for the storage administrators and their managers. Their teams were getting burned by unplanned outages and complaints from users about slow logins and email. Administrators had lost trust in certain storage products or vendors. They refused to approve another purchase without being fully convinced that the new product would resolve their problems.

- › The organization was already using several 3PAR arrays, including the 10,000 and 7,000 series, and it felt confident that adding the 7450 to the mix would be seamless and beneficial to the overall storage architecture.

Solution

The organization added a 3PAR StoreServ 7450 All-flash Storage with 20 TB of capacity to relieve the “maxed out” VDI infrastructure, address its performance issues, and support its rapid growth. The price of all-flash storage has come down, and the performance improvements it provides are incomparable to spinning disk alternatives (one customer cited 175 IOPS versus 100,000 IOPS). Adding the 7450 will also make 3PAR the primary storage architecture of the organization, which provides additional benefits, including reducing operational complexity and streamlining storage administration.

Results

The interviews revealed that:

- › **Performance of the VDI environment improved dramatically, improving employee productivity.** The most significant benefit experienced was in employee productivity once the latency issues for logging into the system and queries were addressed.
- › **Storage under management could grow without additional headcount.** The composite organization was able to reduce its spend on full-time equivalents because its administrative tasks were cut in half. Everything that it had to do in the previous environment with the legacy arrays was easier with the HP 3PAR 7450. Furthermore, the organization was already using other 3PAR products so there was no learning curve for the storage administrators.
- › **Targeted to the right use, the all-flash array was competitively priced for superior performance.** The composite organization described 3PAR StoreServ 7450 All-flash Storage as a critical component of delivering a reliable, stable, high-performance storage infrastructure. However, it specifically benefitted the VDI environment, where random access read delivery and data access times are crucial. Therefore, this environment was a justifiably good use case to take to the CIO with clear and immediately recognizable benefits. However, the organization is very deliberate about its use of all-flash storage and sees that it may not be appropriate for all scenarios at its current price point. The organization will continue to use spinning disk arrays for its testing environment and non-mission-critical applications, and it may include flash components within those arrays as opposed to an all-flash model. Over time, the organization anticipates a move to all-flash storage when the industry is able to provide it for the same price as spinning disk, which could further reduce its costs through a smaller, more efficient footprint in the data center with lower power and cooling costs.

“The former vendors were underperforming, and the combination of the technology, their capacity to support our business, and the way the technology was implemented caused us to have delivery issues.”

~ IT strategist, healthcare organization

“The management console is truly comprehensive and has all I need. I don’t have to switch windows or go to different components – it’s a set it and forget it scenario.”

~ Senior storage administrator, healthcare organization

Benefits

The composite organization experienced a number of quantified benefits in this case study:

- › Employee productivity gains from improved response time.
- › Operational expense savings.
- › Neutral capital expense.

Another important benefit mentioned by the composite organization was the business operations continuity that the 7450 provides. With the business using the 7450, emergency outages and disaster recovery scenarios consume considerable less time, with little to no impact on the business.

+ Employee Productivity Gains From Improved Response Time

The composite organization indicated that a key benefit from the 3PAR StoreServ 7450 All-flash Storage implementation was a marked improvement in employee productivity for critical knowledge workers and healthcare providers. Prior to 3PAR StoreServ 7450 All-flash Storage, employees experienced delays logging into their Windows environment, accessing mission-critical applications, viewing multimedia such as video, and reconnecting to the environment throughout the day as they moved around. As a result, they were collectively losing productivity (and frequently patience). In one example provided by a customer, employees outside of the US experienced significant delays accessing their email (e.g., 15-second response times). Another customer described medical staff needing to log in and out of the system multiple times per day in different areas of the building and experiencing three-minute login delays.

Following the 3PAR StoreServ 7450 All-flash Storage implementation, the composite organization reduced average Windows reconnects by 80%, reduced application queries by just as much, and improved email response time to sub-milliseconds. As a result, the VDI environment could support more concurrent users with faster response times. Although this benefit could be quantified over several different applications, only the Windows login time savings was calculated for the composite organization. The composite organization saved \$407,040 over three years. The total benefit resulting from improved employee productivity to access mission-critical applications over the three years was \$1,221,120, or about \$361 (PV) per VDI user.

Interviewed organizations represented a variety of industries and different types of users within the VDI environment, so a conservative salary estimate of \$80,000 (fully loaded) was used to calculate this benefit, even though the interviewed organizations' workers were frequently earning higher salaries. Also, not all users logging in will be as critical to the business as those who the interviewed companies described, so this benefit was risk-adjusted and reduced by 50%. The risk-adjusted total benefit resulting from improved employee productivity over the three years was \$1,221,120. See the section on Risks for more detail.

TABLE 1

Employee Productivity Gains From 50% Reduction In Windows Reconnect Time

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
A1	Number of VDI users		3,000	3,000	3,000
A2	Number of Windows reconnects per day		2	2	2
A3	Time savings (minutes) per year for full system logins		1,272,000	1,272,000	1,272,000
A4	Days worked		240	240	240
A5	\$ per minute for FTE		\$0.64	\$0.64	\$0.64
At	Annual savings from faster full system logins	A3*A5	\$814,080	\$814,080	\$814,080
	Risk adjustment		↓ 50%		
Atr	Annual savings from faster full system logins (risk-adjusted)		\$407,040	\$407,040	\$407,040

Source: Forrester Research, Inc.

★ Operational Expense Savings

The composite organization indicated that a key benefit from the 3PAR StoreServ 7450 All-flash Storage implementation was a reduction in deployment, management, and administration activities. Because the 7450 requires less management oversight and operates similarly to the other 3PAR family of products within the composite organization's storage architecture, the organization can manage more storage with fewer resources. This benefit is attributed in part to 3PAR's ease of administration. From upgrades to firmware updates to disaster recovery to troubleshooting, most administrative tasks take half the time, according to the technology managers interviewed. At a fully loaded annual cost of \$140,000 (senior storage administrator), the organization saves half an FTE, which amounts to \$70,000 per year, or \$210,000 over three years. Furthermore, there is no deployment or training cost for the 3PAR 7450 because the organization is already using other 3PAR products within the architecture and uses the same management console. This further saves the organization \$30,000 in initial costs.

TABLE 2
Operational Expense Savings: Reducing FTEs To Manage Growing Storage

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
B1	FTE labor avoidance — single family of management tools	Interviews	0.5	0.5	0.5
B2	Professional services and training avoidance to deploy 7450	Interviews	\$30,000	0	0
B3	Annual salary of storage administrator (fully loaded)	Industry average	\$140,000	\$140,000	\$140,000
B4	Full-time savings due to single family of management tools	B1*B3	\$70,000	\$70,000	\$70,000
Btr	Annual operational expense savings due to reduced management tasks	B4+B2	\$100,000	\$70,000	\$70,000

Source: Forrester Research, Inc.

★ Neutral Capital Expense

Although not affecting the financial benefits directly because the investment in the 7450 was cost-neutral, the customers interviewed emphasized that the 3PAR 7450 All-Flash Storage would not increase their contract cost but would deliver immeasurable performance improvements, along with high reliability and availability. This reflects a noticeable shift in the storage environment. The cost per gig of flash storage (especially for certain applications such as the VDI environment) is beginning to match the costs of spinning disk. The alternative — buying more spinning disk to meet increasing performance demands — was both unrealistic and not desirable for IT managers because the underlying technology can't perform at the level required. Table 3 demonstrates (based on industry average) the IOPS performance of a legacy array versus that of the all-flash equivalent. However, the customers interviewed described even more dramatic performance gains. One joked about the ability of the all-flash to easily handle the work that a legacy system struggled to provide at even the bare minimum: "Our sys admin said that our 7450 was completely unimpressed with our VDI solution."

TABLE 3
Capital Expense Neutrality For Higher Performance

Legacy array	175K IOPS
All-flash array	500K IOPS
Number of legacy arrays required to meet bare minimum requirements	~ 3
TB of storage to support VDI environment	20
At \$2 per gig (after discounting), amount spent for three legacy arrays for bare minimum performance	\$120,000
Approximate cost (after discounting) for 20 TB of all-flash storage	\$120,000

Source: Forrester Research, Inc.

Total Benefits

Table 4 shows the total of all benefits across the two areas listed above, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total benefits to be a PV of more than \$1,213,601, or \$404 per VDI user.

TABLE 4
Total Benefits (Risk-Adjusted)

Ref.	Benefit	Year 1	Year 2	Year 3	Total	Present Value
Atr	Operational expense savings	\$100,000	\$70,000	\$70,000	\$240,000	\$201,352
Btr	Employee productivity gains from faster Windows logins	\$407,040	\$407,040	\$407,040	\$1,221,120	\$1,012,248
	Total benefits	\$507,040	\$477,040	\$477,040	\$1,461,120	\$1,213,600

Source: Forrester Research, Inc.

COSTS

The composite organization experienced a number of costs associated with the 3PAR StoreServ 7450 All-flash Storage solution:

- › **System costs for the 7450 array and its drivers.** These are initial, one-time fees paid to HP for the 7450 system, which includes the base system, drive enclosure, installation and startup services, the Operating System software, the Virtual Copy software, the Reporting Software Suite, and the E-Media software.
- › **Services costs to support the 7450 system.** These are initial, one-time fees paid to HP that provide three years of 24x7 proactive care support and support for the entire system described above.

These represent the mix of internal and external costs experienced by the composite organization for initial planning, implementation, and ongoing maintenance associated with the solution.

💰 Cost No. 1. 7450 System Costs

System costs for 3PAR StoreServ 7450 All-flash Storage were incurred in the first year. These initial, one-time fees paid to include the base system, drive enclosure, installation and startup services, the Operating System software, the Virtual Copy software, the Reporting Software Suite, and the E-Media software. During initial implementation, the composite organization incurred system costs of \$102,851, or about \$41 per VDI user.

TABLE 5
System Costs

Ref.	Metric	Calculation	Year 1	Year 2	Year 3
D1	System and drives (7450 2 nodes)		\$102,851	\$0	\$0
Dtr	Total system costs (risk-adjusted)		\$102,851	\$0	\$0

Source: Forrester Research, Inc.

💰 Cost No. 2. Services Costs

The composite organization incurred services costs of \$21,794. These initial, one-time fees paid to HP provide three years of 24x7 proactive care support and support for the entire 7450 system described above.

TABLE 6
Services Costs

Ref.		Year 1	Year 2	Year 3
E1	Support for the 7450 system for 3 years	\$21,794	\$0	\$0
Etr	Total annual services costs (risk-adjusted)	\$21,794	\$0	\$0

Source: Forrester Research, Inc.

💰 Ongoing Operations

The composite organization requires a storage administrator to spend time weekly to maintain the HP 3PAR 7450 All-flash array. At an average fully loaded cost per hour of \$67.30, the total cost for ongoing operations is \$7,000 annually, or \$21,000 over this three-year analysis.

TABLE 7
Ongoing Operations Costs

Ref.		Year 1	Year 2	Year 3
E1	Support for the 7450 system for 3 years	\$7,000	\$7,000	\$7,000
Etr	Total annual services costs (risk-adjusted)	\$7,000	\$7,000	\$7,000

Source: Forrester Research, Inc.

Total Costs

Table 8 shows the total of all costs as well as associated present values, discounted at 10%. Over three years, the composite organization expects total costs to total a net present value of a little more than \$130,722, or \$43.57 per VDI user.

TABLE 8
Total Costs (Risk-Adjusted)

Ref.	Cost	Initial	Year 1	Year 2	Year 3	Total	Present Value
Dtr	System costs	\$0	\$102,851	\$0	\$0	\$102,851	\$93,501
Etr	Services costs	\$0	\$21,794	\$1,000,000	\$1,000,000	\$21,794	\$19,813
Ftr	Ongoing operations	\$0	\$7,000	\$7,000	\$7,000	\$21,000	\$17,408
	Total costs	\$0	\$131,645	\$7,000	\$7,000	\$145,645	\$130,722

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 implement 3PAR StoreServ 7450 All-flash Storage and later realize additional uses and business opportunities. Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix B).

The customers interviewed for this study expect to gain even more usable storage with the data deduplication feature that is included in the costs of the 7450. HP claims that data deduplication will yield a 4 to 1 minimum compression ratio for data including thin provisioning and standard data compression. The compaction ratio could be as high as 10 to 1 depending on the workload. This will further lower the price per gigabyte for the investment in the all-flash storage array, making it even more cost-competitive with legacy alternatives. Below is a cost table provided by HP to demonstrate that additional savings.

TABLE 9
Flexibility Benefit: Data Deduplication

Additional Usable Capacity Available Due to Data Deduplication

20 TB 7450 All-flash Storage	\$239,703 (before discounting)
Total raw capacity	19,200 gigabytes
\$/GB (raw)	\$12.48/GB
Total usable (4 to 1 ratio of combination of deduplication and thin provisioning and 25% overhead)	57,600 GB
\$/GB (usable) — all-flash	\$4.16
Street price (48% discount)	\$124,645
\$/GB (usable) at street — all-flash	\$2.20

Source: HP

ONE-FAMILY ARCHITECTURE BENEFIT

HP customers who use HP 3PAR StoreServ as their primary architecture experience additional benefits beyond those who have a multisupplier model. An organization can address different use cases (midrange thru high-end) with one management platform. The 3PAR StoreServ architecture allows customers to seamlessly move data across midrange, high-end, and all-flash arrays. Storage administrators can map workloads to the right resources at the data center level. This further drives up storage efficiency and enables customers to map workloads to the right resources.

HP 3PAR StoreServ Storage supports federated data mobility across Tier-1, midrange, and all-flash arrays. Administrators can manage resources at the data center level rather than just the system level. Using one console, they can move data and workloads between arrays without impact to applications, users, or services. Further, they can map workloads to the right resources and establish tiers of storage across the data center to meet different SLA requirements.

RISKS

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 3PAR StoreServ 7450 All-flash Storage 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 3PAR StoreServ 7450 All-flash Storage, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates.

TABLE 10
Benefit And Cost Risk Adjustments

Benefits	Adjustment
Employee productivity gains from 50% reduction in system login time	↓ 50%

Source: Forrester Research, Inc.

Quantitatively capturing implementation risk and impact risk by directly adjusting the financial estimates results provides more meaningful and accurate estimates and 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 taken as “realistic” expectations since they represent the expected values considering risk.

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

- › The employee productivity gain was risk-adjusted down by 50% because not all organizations will have a VDI environment that is as mission-critical as the one for the composite organization. The time savings gained may not equate to the same amount of money because those workers may not be completing tasks as of high value. They may have noncritical uses and employees who earn less salary than the average used for the calculation.

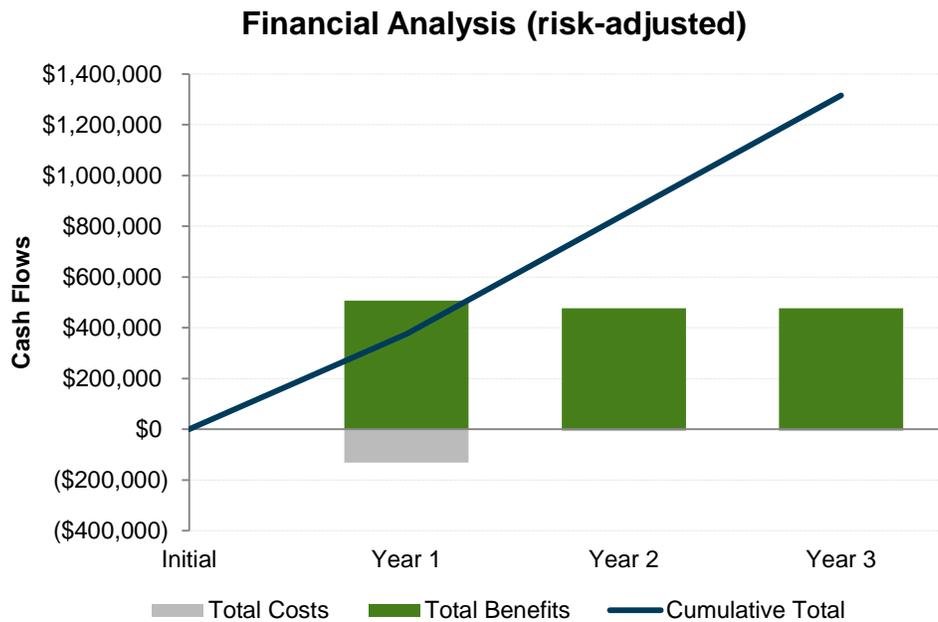
Table 10 shows the values used to adjust for risk and uncertainty in the cost and benefit estimates for the composite organization. Readers are urged to apply their own risk ranges based on their own degree of confidence in the cost and benefit estimates.

Financial Summary

The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the composite organization's investment in 3PAR StoreServ 7450 All-flash Storage.

Table 11 below shows the risk-adjusted ROI, NPV, and payback period values. These values are determined by applying the risk-adjustment values from Table 10 in the Risks section to the unadjusted results in each relevant cost and benefit section.

FIGURE 3
Cash Flow Chart (Risk-Adjusted)



Source: Forrester Research, Inc.

TABLE 11
Cash Flow (Risk-Adjusted)

	Initial	Year 1	Year 2	Year 3	Total	Present Value
Costs		(\$131,645)	(\$7,000)	(\$7,000)	(\$145,645)	(\$130,722)
Benefits		\$507,040	\$477,040	\$477,040	\$1,461,120	\$1,213,601
Net benefits		\$375,395	\$470,040	\$470,040	\$1,315,475	\$1,082,879
ROI						828%
Payback period						One month

Source: Forrester Research, Inc.

HP 3PAR StoreServ 7450 All-Flash Storage: Overview

The following information is provided by HP. Forrester has not validated any claims and does not endorse HP or its offerings.

With HP 3PAR StoreServ Storage, the same effortless, efficient, resilient, and future-proof storage platform that gives you optimized performance with both flash-based and spinning media also scales to address the needs of entire midrange, Tier-1 enterprises and high-end service providers. The same common operating system, consolidated user interface, and rich set of data services are shared across the entire platform, regardless of model.

With the all-flash HP 3PAR StoreServ 7450, you can accelerate applications where milliseconds represent millions of dollars and make informed business decisions in hours or minutes instead of days or weeks. You can cut your system capacity requirements by 75% with HP 3PAR Thin Deduplication and Thin Clones software combined with hardware-accelerated zero-block deduplication. You can choose new high-density 1.92 TB commercial MLCs (cMLCs) in combination with HP 3PAR compaction technologies to lower the cost of all-flash storage to \$2/GB which is equal to that of spinning media.

You can get more from your flash storage with features that extend the flash-based media lifespan and a standard five-year warranty on all HP 3PAR StoreServ SSDs, including new lower-cost cMLC options. You also get the peace of mind that your performance-critical applications are backed by storage with Tier-1 resiliency with the Get 6-Nines Guarantee, which stands behind the ability of all quad-node and larger HP 3PAR StoreServ Storage systems to deliver 99.9999% data availability.



Appendix A: Composite Organization Description

For this TEI study, Forrester has created a composite organization to illustrate the quantifiable benefits and costs of implementing 3PAR StoreServ 7450 All-flash Storage. The composite company is intended to represent a US-based organization that has 600 TB of total raw storage under management within a two-supplier environment and is based on characteristics of the interviewed customers.

- › The composite company has 600 TB of storage for production, disaster recovery, and testing purposes. Half of the storage under management is 3PAR StoreServ, and the other half is a legacy dual controller storage environment.
- › The organization's production environment supports mixed workloads with differing throughput and transaction demands such as VDI, databases, and big data analytics and supports six to eight mission-critical applications that are both homegrown and purchased, including financial, email billing, and email marketing applications.
- › The organization has been operating in a two-supplier environment and has been using 3PAR StoreServ products for the past three years. The organization first purchased a 3PAR 10800 product, then added a 7400. It has been happy with the ease of administration. Since the VDI environment was underperforming, the organization continued to add spinning disk storage but hit a breaking point where it could no longer keep up with the performance demands and SLAs within the legacy system infrastructure. The organization considers the 3PAR 7450 as its best investment for additional storage to add to the mix and keep up with the VDI growth and performance demands while staying within one storage architecture.
- › The organization has one full-time equivalent for primary storage operations and one SAN full-time equivalent as the storage architect or team lead. One driver of the decision to go with an HP All-flash Storage array was to capitalize on the efficiencies of using the 3PAR architecture. Because administrative tasks with 3PAR can take half the time of other non-HP legacy arrays, the organization can grow storage under management without needing to hire more FTEs.
- › The representative organization has a longstanding, high level of partnership and support from HP, which it values as a key benefit of the 3PAR architecture.

In purchasing 3PAR StoreServ 7450 All-flash Storage, the composite company has the following objectives:

- › Relieve a "maxed out" existing VDI storage environment.
- › Remain cost-neutral on the investment while improving performance.
- › Stay within the 3PAR storage architecture to maximize the administrative efficiencies.

For the purpose of the analysis, Forrester assumes that the composite organization is using the 7450 to improve the performance of its VDI environment. Because this environment is mission-critical for the organization and has the need for high-performance and reliable storage, it was a great application of the 7450 product.

FRAMEWORK ASSUMPTIONS

Table 12 provides the model assumptions that Forrester used in this analysis.

The discount rate used in the PV and NPV calculations is 10%, and the time horizon used for the financial modeling is five 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 12
Model Assumptions

Ref.	Metric	Calculation	Value
C1	Hours per week		40
C2	Weeks per year		52
C3	Hours per year (M-F, 9-5)		2,080
C4	Hours per year (24x7)		8,736
C5	Average VDI user salary		\$80,000 fully loaded
C6	Average storage administrator salary		\$140,000 fully loaded
C7	Average gigabytes required per VDI user		20 gigabytes
C8	Hourly rate — VDI user	(C5/C3)	\$38.46
C9	Hourly rate — storage administrator	(C6/C3)	\$67.30
C10	Number of VDI users		3,000
C11	Number of TB of raw storage to support environment		20 TB
C12	Total raw capacity for 2 TB storage		19,200 gigabytes

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, flexibility, and risks.

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.

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. However, having the ability to capture that benefit has a PV that can be estimated. The flexibility component of TEI captures that value.

RISKS

Risks measure 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 risk factors are based on a probability density function known as "triangular distribution" to the values entered. At a minimum, three values are calculated to estimate the risk factor around each cost and benefit.

Appendix C: Glossary

Discount rate: The interest rate used in cash flow analysis to take into account the time value of money. Companies set their own 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 organizations 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 NPV of cash flows.

Payback period: The breakeven point for an investment. This is 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 the Framework Assumptions section) at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations are not calculated until the summary tables are the sum of the initial investment and the discounted cash flows in each year.

Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.

TABLE [EXAMPLE]
Example Table

Ref.	Metric	Calculation	Year 1	Year 2	Year 3

Source: Forrester Research, Inc.

Appendix D: Supplemental Material

Related Forrester Research

“The IT Infrastructure Playbook,” Forrester Research, Inc.

“Brief: Disk Is Dead — For Performance,” Forrester Research, Inc., September 24, 2014

“Market Overview: Midrange Storage,” Forrester Research, Inc., June 12, 2014

“Seven Influential Storage Trends Shaping Your Near-Term Strategy,” Forrester Research, Inc., May 21, 2014

“Brief: Strategic Benchmarks 2014: Storage,” Forrester Research, Inc., March 14, 2014

“Build Your Business Case For All-Flash Storage Arrays,” August 21, 2013

Appendix E: Endnotes

¹ Forrester risk-adjusts the summary financial metrics to take into account the potential uncertainty of the cost and benefit estimates. For more information, see the section on Risks.

² Source: “Five Data Center And IT Infrastructure Lessons From The Cloud Giants,” Forrester Research, Inc., August 15, 2013.

³ In the interview that this example refers to, the customer is using redundancy and the disaster recovery is able to uphold the multiple 9s promise through quicker recomposition of the drive array.