

A Forrester Total Economic  
Impact™ Study  
Commissioned By Pure Storage

Project Director:  
Bob Cormier, Vice  
President And Principal  
Consultant

March 2016

# The Total Economic Impact™ Of Pure Storage FlashArray Storage Solutions For VDI

Cost Savings And Business Benefits  
Attributed To Pure Storage

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## Executive Summary

At the beginning of 2016, Pure Storage commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study to examine the potential return on investment (ROI) customers may realize by deploying Pure Storage FlashArray storage solutions for virtual desktop infrastructure (VDI) environments. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Pure Storage solutions for VDI.

To better understand the benefits, costs, and risks associated with an investment in Pure Storage, Forrester conducted in-depth interviews with St. Luke's healthcare system's IT infrastructure manager. St. Luke's of Duluth, Minnesota has two hospitals, 14 primary care clinics, 24 specialty clinics, and two pharmacies that serve the people of northeastern Minnesota, northwestern Wisconsin, and the Upper Peninsula of Michigan. St. Luke's has been using Pure Storage FlashArray solutions in Citrix XenDesktop and XenApp environments for 26 months. For more information about St. Luke's, see the Analysis section. According to Pure Storage, its FlashArray Series solutions are economical all-flash storage solutions for virtually any workload. Purity is the Pure Storage operating environment built from the ground up for flash. It is provided at no additional cost with every FlashArray and runs consistently across the entire FlashArray hardware family. For more details on the Pure Storage solution, see Appendix A.

### Quantified benefit categories of Pure Storage FlashArrays (Risk- and present value-adjusted over three years)

- Increased provider productivity using tap-and-go (Pure Storage and Imprivata) — \$1,074,320.
- Simplification of deployment and management tasks savings — \$116,324.
- Air conditioner unit — capital cost avoidance savings — \$193,182.
- Legacy storage cost avoidance benefits — \$290,909.
- Power and cooling savings — \$17,982.
- Flexibility option — Forever Flash — \$99,211

### PURE STORAGE'S SOLUTION PROVIDED SIGNIFICANT CAPITAL AND OPERATIONAL COST SAVINGS

Our interviews and subsequent financial analysis found that St. Luke's experienced the risk-adjusted ROI, benefits, and costs shown in Figure 1.

The analysis points to risk-adjusted benefits of \$1,791,928 over three years versus implementation and operating costs of \$536,051, equating to a net present value (NPV) of \$1,255,878. The risk-adjusted ROI was a very favorable 234%, and the payback period was a quick three months.

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

**ROI:**  
**234%**

**Benefits PV:**  
**\$1,791,928**

**Costs PV:**  
**\$536,051**

**NPV:**  
**\$1,255,878**

Source: Forrester Research, Inc.

Though the price per raw gigabyte (GB) of flash storage has traditionally been more expensive than hard drive storage, according to Pure Storage, pricing for an all-flash array (AFA) has come down to about \$1/usable GB. A growing number of use cases have developed, including healthcare, where the performance, resiliency, and ROI of flash make the decision to

go all-flash easier. This is due to data reduction features such as deduplication and compression, where the usable per-GB cost is the same or less expensive in most use cases except for low data reduction applications such as video.

Marcus Dallum, St. Luke's IT infrastructure manager, reported that Pure Storage FlashArrays greatly improved the infrastructure operations of the organization. In addition, the performance benefits of Pure Storage have resulting business benefits that transcend the data center and have a positive impact on this healthcare organization and patient care. The following are the benefits quantified in this case study:

- › **Total benefits associated with Pure Storage FlashArray Storage Solutions for VDI — \$1,791,928.** St. Luke's experienced the following benefits (risk- and present value-adjusted) over three years (further detailed in the Benefits: Quantified section):
  - › Increased provider productivity using tap-and-go (Pure Storage and Imprivata) — \$1,074,320.
  - › Simplification of deployment and management tasks savings — \$116,324.
  - › Air conditioner unit — capital cost avoidance savings — \$193,182.
  - › Legacy storage cost avoidance benefits — \$290,909.
  - › Power and cooling savings — \$17,982.
  - › Flexibility option — Forever Flash — \$99,211.
- › **Costs associated with Pure Storage — \$536,051.** St. Luke's experienced the following costs (present value-adjusted) over three years (further detailed in the Costs section):
  - › Planning and deploying Pure Storage — \$5,384.
  - › Pure Storage costs — \$513,259.
  - › Professional services and training\* — \$0.
  - › Ongoing labor to manage Pure Storage — \$17,408.

\*No professional services or training was required by St. Luke's to deploy and use Pure Storage FlashArrays.

If the risk-adjusted NPV of costs and benefits still demonstrates a compelling business case, it raises confidence that the investment is likely to succeed because 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 values considering risk. Assuming normal success at mitigating risk, the risk-adjusted numbers should more closely reflect the expected outcome of the investment.

## Disclosures

The reader should be aware of the following:

- › The study is commissioned by Pure Storage and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.
- › 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 study to determine the appropriateness of an investment in Pure Storage.
- › Pure Storage 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 contradict Forrester's findings or obscure the meaning of the study.
- › The interviewed customer name was provided by Pure Storage. Pure Storage 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 investing in Pure Storage. The objective of the framework is to identify the benefits, costs, flexibility, and risk factors that affect the investment decision.

### APPROACH AND METHODOLOGY

Forrester employed four fundamental elements of TEI in modeling Pure Storage: benefits, costs, flexibility, and risks.

Forrester took a multistep approach to evaluate the impact that Pure Storage had on St. Luke's (see Figure 2). Specifically, we:

- › Interviewed Pure Storage marketing, sales, and product management personnel, along with Forrester storage analysts, to better understand the value proposition for Pure Storage.
- › Conducted in-depth interviews with Marcus Dallum, St. Luke's IT infrastructure manager, to obtain data with respect to costs, benefits, flexibility, and risks.
- › 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.
- › Risk-adjusted the financial model based on issues and concerns St. Luke's raised in the interviews. Risk adjustment is a key part of the TEI methodology. While St. Luke's provided cost and benefit estimates, some categories included future projections or a broad range of responses, or had a number of internal or external forces that might have raised or lowered costs and benefits. For that reason, each benefit has been risk-adjusted and is detailed in the Benefits: Quantified section.

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

### INTERVIEWED CUSTOMER

Forrester derived its conclusions in large part from information received during in-depth interviews we conducted with Marcus Dallum, St. Luke's IT infrastructure manager. St. Luke's is a healthcare system in Duluth, Minnesota. It comprises two hospitals, 14 primary care clinics, 24 specialty clinics, and two pharmacies serving the people of northeastern Minnesota, northwestern Wisconsin, and the Upper Peninsula of Michigan.

After a review process evaluating several vendors, St. Luke's selected Pure Storage FlashArrays, as it believes Pure Storage can satisfy the following business challenges, goals, and objectives:

- › **Happier and more productive physicians and other providers.** Under the legacy storage environment, healthcare providers complained about slow performance hampering their ability to efficiently move from one patient to another. Once Pure Storage was deployed, performance improved and providers became more productive.
- › **Capex cost reduction.** St. Luke's was adding additional virtual host servers and storage capacity to circumvent the performance degradation and inefficiencies in its legacy storage area network (SAN). The goal was to find a new solution to support its growing virtual environment at a lower overall capital cost while dramatically improving the environment to meet the new paradigms facing healthcare IT.
- › **Opex cost reduction.** St. Luke's wanted to reduce costs for power and cooling and the following administrative tasks: initial storage deployment, growing and shrinking volumes, monitoring capacity and performance, and managing hosts and host groups.
- › **Simplicity.** Storage administration must be simpler than the legacy environment for both implementation and ongoing administration.
- › **Latency.** St. Luke's needed predictable sub-millisecond latency for its applications. Its legacy storage had unacceptably high latency around 300 milliseconds.
- › **Performance and scalability.** Its legacy mechanical spinning disk storage was becoming increasingly slow and unable to keep up with growing performance demands. It was hoping to future-proof its virtualized storage environments with Pure Storage.
- › **Resiliency.** Its next storage system had to include nondisruptive upgrade capabilities for capacity expansion, controller upgrades, and software updates, as well as meet data-at-rest encryption requirements for patient data, all without any performance degradation.

### HIGHLIGHTS FROM THE INTERVIEWS

- › St. Luke's invested in a Pure Storage FlashArray FA-420, 26 months ago, and recently replaced and upgraded to Pure's FlashArray//m50 in order to add capacity.
- › There are currently 1,700 VDI users, including healthcare providers and administrative staff.
- › St. Luke's is running several other workloads on its Pure Storage FlashArray, including VMware servers, a Citrix XenDesktop and XenApp VDI environment, a Microsoft SQL server database, and an FTP server.
- › Prior to its investment in Pure Storage, its legacy mechanical spinning disks were becoming increasingly slow and unable to keep up with the growing performance demands of VDI. Transactional latency levels were unacceptably high at 300 milliseconds. The previous legacy storage arrays could not handle 200 users without unacceptably long log-in times as well as slow access to medical records and sluggish applications.

- › St. Luke's needed sub-millisecond latency for its applications to satisfy medical and administrative staff productivity requirements to better serve its patients, and it achieved that goal with its investment in Pure Storage FlashArrays (both the FA-420 and //m50). St. Luke's reported that compared with its previous disk arrays, Pure Storage was at least 10 times faster.
- › The upgrade to the FlashArray//m50 was done during normal business hours and took only 60 minutes. The St. Luke's interviewee stated: "Most of the time was spent re-cabling connections and making them look nice. We didn't have to come in at night, and we didn't have to announce any downtime." In addition, software updates and dot releases are done nondisruptively during the day.
- › With the Purity operating system's FlashReduce data reduction services, St. Luke's was able to achieve 8.4 to 1 data reduction for its VDI FlashArray, both persistent and nonpersistent. When thin provisioning was added, data reduction ratios improved to around 10.1 to 1. St. Luke's has a standard gold image with dedicated desktops all running Windows 7 and with the same applications installed.
- › St. Luke's estimates significant hardware cost avoidance savings with Pure Storage FlashArrays compared with its legacy VDI storage environment.
- › St. Luke's has seen efficiencies in power, cooling, and space since it invested in Pure Storage FlashArrays. It was able to defer replacing an air conditioning unit, as Pure Storage had fewer space and cooling requirements than its legacy disk environment.
- › With Pure, the St. Luke's storage administrator spends less time monitoring capacity and performance and managing hosts, host groups, and snapshots than with the legacy storage environment. If St. Luke's chose to extend its legacy storage hardware environment to try and match Pure's current performance, it would have to add significantly more terabytes and hire an additional highly skilled storage administrator, or half of a full-time equivalent (FTE), to manage the incremental hardware.
- › St. Luke's healthcare providers save time with a "tap-and-go" feature enabled by Pure Storage and Imprivata functionality. Imprivata fits into the XenDesktop architecture by integrating the Imprivata OneSign product with Citrix XenDesktop to provide No Click Access, authentication, and single sign-on with just the tap of a badge.

St. Luke's invested in the following Pure Storage solutions:

- › Initial investment: FA420-11TB FlashArray that includes three years of 24x7 next-business-day support.
- › Subsequent recent upgrade: FlashArray//m50-40TB that includes three years of 24x7 advanced maintenance and support and next-business-day delivery.

## BENEFITS OVERVIEW

Though performance and productivity are the main goals that organizations have when they deploy flash storage, Forrester has interviewed many other customers that found economic validation for their Pure Storage investment in a variety of ways. This is a key point to keep in mind since some interviewed customers found great value in specific areas, such as rack space and power savings. Other customers found that these benefits were relatively insignificant

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*"In our Pure VDI environment, we have about an 8.4 to 1 data reduction ratio. If you add in the thin provisioning, it's 10.1 to 1. So it's been really great, to be able to have that many virtual desktops use up so little space."*

~Marcus Dallum, IT infrastructure manager, St. Luke's

compared with other benefits, such as the capital expense savings and the ease of use of Pure Storage's Purity operating system.

## **BENEFITS: QUANTIFIED**

### **⊕ Increased User Productivity Using Tap-And-Go (Pure Storage And Imprivata)**

One of the benefits for St. Luke's associated with Pure Storage FlashArray solutions for VDI is the tap-and-go feature used by healthcare providers during patient visits. Providers can move from patient room to their office to patient room all day long, and with a tap of their badge, they can log into the virtual desktop in the patient's room. Tap-and-go (St. Luke's name for it) is a function of using Pure Storage in conjunction with Imprivata functionality. Imprivata fits into the XenDesktop architecture by integrating the Imprivata OneSign product with Citrix XenDesktop to provide No Click Access, authentication, and single sign-on with just the tap of a badge.

There are about 1,300 providers taking advantage of tap-and-go, each "tapping" an average of 40 times a day and saving 20 seconds with each login versus the pre-Pure Storage legacy environment. That equates to about 13 minutes saved per day, per provider, and an aggregate of 16,900 minutes, or 282 hours per day saved.

Storage is no longer the bottleneck. In fact, the 20 seconds to use the tap-and-go feature is attributed to authentication latency, not storage latency. St. Luke's was unable to identify incremental patient revenue associated with tap-and-go; however, it was able to conservatively estimate provider productivity savings equal to four provider FTEs at an average fully loaded cost of \$120,000 annually. Forrester assumed that only a fraction of the aggregate saved minutes could translate into actual reductions in headcount. Readers of this study may find that their users see more productivity than outlined here. See Table 1 for the user productivity benefits, which have been risk-adjusted (downward) by 10% on the assumption that not all extra time made available is used for productive purposes.

**TABLE 1**  
**Increased User Productivity Using Tap-And-Go — Pure Storage And Imprivata**

Ref.	Metric	Calc./Source	Year 1	Year 2	Year 3	Total
A1	Tap-and-go — average daily time savings per VDI user	Minutes	13	13	13	
A2	Number of users taking advantage of tap-and-go	Users	1,300	1,300	1,300	
A3	Number of minutes saved daily across all VDI users	A1 * A2	16,900	16,900	16,900	
A4	Number of FTEs saved	Interviews	4	4	4	
A5	Average fully loaded cost of an FTE	Industry average	\$120,000	\$120,000	\$120,000	
At	Increased provider productivity using tap-and-go (Pure Storage and Imprivata)	A4 * A5	\$480,000	\$480,000	\$480,000	\$1,440,000
	Risk adjustment	↓ 10%				
Atr	<b>Increased provider productivity using tap-and-go — Pure Storage and Imprivata (risk-adjusted)</b>	At-10%	<b>\$432,000</b>	<b>\$432,000</b>	<b>\$432,000</b>	<b>\$1,296,000</b>

Source: Forrester Research, Inc.

### + Opex Cost Reduction — Simplification Of Deployment And Management Tasks Savings

St. Luke's achieved immediate expense savings, as no professional services or training was needed for the initial deployment of Pure Storage FlashArrays. St. Luke's IT infrastructure manager credited this to the simplicity of Pure's Purity operating system environment.

A small amount of flash capacity can handle the performance load of dozens of drives that represent more potential points of failure within a disk array. With fewer components to worry about, St. Luke's told Forrester that Pure Storage FlashArrays are overall easier to maintain than hard disks and have less redundant array of independent disks (RAID) rebuild operations, which typically lead to performance degradation, downtime, and administrative labor to remedy. The opex savings came from the following two categories:

- › **No professional services or training needed to deploy Pure Storage FlashArrays.** St. Luke's cited the simplicity of deploying Pure Storage FlashArrays. No professional services or formal training was needed to deploy the Pure Storage Flash Arrays. In Year 1, St. Luke's saved \$30,000 in professional services and training cost avoidance, representing costs associated with a comparable initial deployment of hard disk storage. It also saved \$30,000 in Year 3, when it upgraded/replaced the FA420-11TB with the FlashArray //m50-40TB.
- › **Simplification of ongoing storage management tasks.** The St. Luke's storage administrator is able to save 10 hours per week with Pure Storage versus its legacy storage environment due to the simplicity of the following tasks: growing and shrinking volumes, monitoring capacity and performance, managing hosts and host groups, and having fewer RAID rebuild operations. At a fully loaded annual cost of \$140,000 (senior storage administrator), St. Luke's saves one-quarter of an FTE (10 hours per week), or \$35,000 per year (\$105,000 over three years). Attrition savings were not quantified for this study. However, as future replacements of storage administrators could be more junior than predecessors due to the

simplicity of Pure Storage, the predicted attrition savings were up to \$20,000 annually in salary and benefits per administrator.

The labor savings benefits have been risk-adjusted (reduced) by 15% in Table 2 to reflect how long it may take to redeploy administrators to other value-added tasks at St. Luke's. See the section on Risks for more detail.

**TABLE 2**  
**Simplification Of Deployment And Management Tasks Savings**

Ref.	Metric	Calc./Source	Year 1	Year 2	Year 3	Total
B1	No professional services or training needed to deploy Pure Storage FlashArrays	Interviews	\$30,000	\$0	\$30,000	\$60,000
B2	Annual cost per storage administrator (fully loaded)	Industry average (US)	\$140,000	\$140,000	\$140,000	-
B3	Simplification of storage management tasks — one-quarter (25%) FTE saved	Interviews	25%	25%	25%	-
B4	Labor savings due to simplification	B2*B3	\$35,000	\$35,000	\$35,000	\$105,000
Bt	Total simplification benefits	B1+B4	\$65,000	\$35,000	\$65,000	\$165,000
	Risk adjustment	↓ 15%				
<b>Btr</b>	<b>Total simplification benefits (risk-adjusted)</b>	<b>Bt-15%</b>	<b>\$55,250</b>	<b>\$29,750</b>	<b>\$55,250</b>	<b>\$140,250</b>

Source: Forrester Research, Inc.

*“When we upgraded from the FA-420 to the FlashArray//m50, we did that on a Monday afternoon during normal business hours. I think it took them an hour or two. Most of the time was just re-cabling everything and making sure the cables looked nice. We were able to do all of that during normal business hours. We didn’t have to come in at night. We didn’t have to call any downtimes. In fact, I don’t think I was even there. I think I actually took that day off.”*

— Marcus Dallum, St. Luke's IT infrastructure manager

#### ⊕ Air Conditioner Unit — Cost Avoidance Savings

Prior to investing in Pure Storage, St. Luke's was scheduled to replace its data center air conditioning unit at a cost of \$250,000. The projected growth in legacy disk storage was going to require more cooling. After replacing its legacy storage with Pure Storage FlashArrays, St. Luke's is now able to defer replacing the air conditioning unit indefinitely, saving \$250,000.

The air conditioner unit savings have been risk-adjusted (reduced) by 15% in Table 3 to reflect future price variations in air conditioners. See the section on Risks for more detail.

**TABLE 3**  
**Air Conditioner Unit — Capital Cost Avoidance Savings**

Ref.	Metric	Calc./Source	Year 1	Year 2	Year 3	Total
Ct	Air conditioner unit — capital cost avoidance savings	Interviews	\$250,000	\$0	\$0	\$250,000
	Risk adjustment	↓ 15%				
<b>Ctr</b>	<b>Air conditioner unit — capital cost avoidance savings (risk-adjusted)</b>	Ct-15%	<b>\$212,500</b>	<b>\$0</b>	<b>\$0</b>	<b>\$212,500</b>

Source: Forrester Research, Inc.

### ⊕ Legacy Storage Cost Avoidance Benefits

Previous to investing in Pure Storage, St. Luke's had considered adding additional virtual host servers and disk storage capacity to circumvent the performance degradation and inefficiencies in its VDI environment. The alternative goal was to find a new solution to support its growing virtual environment at a lower overall capital cost and improve performance.

St. Luke's replaced its legacy storage arrays with the following Pure Storage solutions:

- › Initial investment: FlashArray FA420-11TB.
- › Subsequent Year 3 upgrade: FlashArray//m50-40TB.

St. Luke's reported that Pure Storage FlashArrays were less costly on a dollar/GB useable capacity basis than the sub-\$5 per GB that is the average cost for performance disk. The use case is contrasted with a traditional Fibre Channel 15K SAN array and also takes Pure Storage's deduplication and compression features into account. St. Luke's told Forrester it could boost storage efficiency with primary storage deduplication and/or compression. St. Luke's reported the following data reduction results:

- › With the Purity operating system's FlashReduce data reduction services, St. Luke's was able to achieve an 8.4 to 1 data reduction for its VDI, both persistent and nonpersistent. When thin provisioning was added, data reduction ratios improved to around 10.1 to 1. St. Luke's has a standard gold image with dedicated desktops all running Windows 7 and with the same applications installed.

The raw price of flash storage continues to drop. Couple that with Pure Storage's data reduction technologies, and customers are realizing that the cost of all-flash storage can be less than the cost of performance disk. As a result, storage administrators can focus on performance-sensitive applications first, where the dollar per input/output operations per second (IOPS) and dollar per GB are in favor of all-flash arrays versus hard drives. The dollar per IOPS is only \$0.48 for solid-state disk, compared with \$3.50 per IOPS for hard drives.

In order for the legacy storage environment to match Pure Storage's current level of overall performance, St. Luke's estimated it would have needed another \$400,000 in storage hardware, including at least 48.2 terabytes of disk storage plus associated software and maintenance expenses. Forrester assumed these expenses would have been incurred in Year 1, and we represent them as cost avoidance savings from investing in Pure Storage. Forrester applied a risk adjustment (downward) of 20% to reflect price variations in storage (see Table 4).

**TABLE 4**  
**Legacy Storage Cost Avoidance Benefits**

Ref.	Metric	Calc./Source	Year 1	Year 2	Year 3	Total
Dt	Legacy storage cost avoidance benefits	Interviews	\$400,000	\$0	\$0	\$400,000
	Risk adjustment	↓ 20%				
Dtr	<b>Legacy storage cost avoidance benefits (risk-adjusted)</b>	Dt-20%	<b>\$320,000</b>	<b>\$0</b>	<b>\$0</b>	<b>\$320,000</b>

Source: Forrester Research, Inc.

### ★ Power And Cooling Savings

St. Luke's reported significant power and cooling savings when it replaced legacy disk storage with Pure Storage FlashArrays. Its power and cooling savings totaled \$22,679 (risk-adjusted) over three years and assumes a cost per KWH for power of \$0.14 and a cost per KWH for cooling of \$0.10 (see Table 5). We have risk-adjusted the savings downward by 7% to reflect regional KWH rate differentials.

**TABLE 5**  
**Power And Cooling Savings**

Ref.	Metric	Calc./Source	Year 1	Year 2	Year 3	Total
E1	Power and cooling costs — legacy disk	Interviews	\$9,316	\$9,316	\$33,536	\$52,167
E2	Power and cooling costs — Pure Storage	Interviews	\$4,961	\$4,961	\$17,860	\$27,782
Et	Power and cooling savings	E1 - E2	\$4,355	\$4,355	\$15,677	\$24,386
	Risk adjustment	↓ 7%				
Etr	<b>Power and cooling savings (risk-adjusted)</b>	Et-7%	<b>\$4,050</b>	<b>\$4,050</b>	<b>\$14,579</b>	<b>\$22,679</b>

Source: Forrester Research, Inc.

## FLEXIBILITY OPTION BENEFITS

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 (or option) to engage in future initiatives but not the obligation to do so.

A key flexibility option associated with Pure Storage is its Forever Flash model. The model is designed to reduce storage ownership costs over the deployment life cycle and offer a continual in-place equipment upgrade plan that eliminates storage downtime and the need for traditional costly and risky “forklift upgrades.” Here are the details according to Pure Storage:

- › **Fresh every upgrade.** Customers that are expanding their storage arrays (either by adding capacity or upgrading controllers) are able to reset their maintenance on the entire array to the then-current first-year rates, typically enabling customers to experience a reduction in the cost/TB of maintenance over time.
- › **Flat & Fair.** Customers are able to renew their maintenance on the entire array at flat or better maintenance and support pricing rates. Customers will not be subjected to increased out-year maintenance fees, and may see a reduction in per-TB maintenance rates over time.
  - › **Free every three.** Storage buyers can receive a controller upgrade every three years when they renew their maintenance agreements at the beginning of years 4 or 7 (an additional three years of maintenance must be purchased at this time to qualify for the controller upgrade). Combined with Pure’s nondisruptive controller upgrades, Forever Flash keeps enterprise applications running on the latest hardware with no downtime.

St. Luke’s has not yet experienced Pure Storage’s Forever Flash future flexibility option. However, it plans to take advantage of Pure Storage’s Forever Flash model at the end of the third year of its FlashArray//m50-40TB life cycle. At that time, St. Luke’s will renew its maintenance contract for another three years at a cost of \$86,700. Pure Storage will provide controller upgrades at no charge, which is a benefit of \$176,400. Forrester values flexibility options using the Black-Scholes Option Pricing model, taking into account the data points in Table 6. The risk-adjusted value of the option to use Forever Flash is \$99,211.

Not quantified for this study is any future cost and risk avoidance of the typical legacy (spinning disk) data migration when upgrading to new controllers.

**TABLE 6**  
**Flexibility Option — Forever Flash**

Ref.	Metric	Year 3
F1	Cost to acquire option (maintenance cost)	\$86,700
F2	Asset value (cost avoidance of not paying to refresh arrays)	\$176,400
F3	Option expiration	36 months
F4	Risk-free rate of return	2.5%
F5	Unlevered beta corrected for cash	1.6
F6	Risk adjustment of flexibility benefit	↓ 50%
Ftr	Black-Scholes Option value (risk-adjusted)	<b>\$99,211</b>

Source: Forrester Research, Inc.

The value of flexibility is clearly unique to each customer, and the measure of its value varies from organization to organization. For the purpose of this analysis, we have assumed that St. Luke's sees future value in being able to take advantage of Forever Flash. The value of the flexibility option is based on the Black-Scholes Option Pricing model. (For information regarding the flexibility calculation, please see Appendix B.)

### Total Benefits And Flexibility Option

Table 7 shows the total of all benefits and the flexibility option as well as present values (PVs) discounted at 10%. Over three years, St. Luke's expects risk-adjusted total benefits to be a PV of \$1,791,928.

**TABLE 7**  
**St. Luke's — Total Quantified Benefits And Flexibility Option (Risk-Adjusted)**

Ref.	Metric	Year 1	Year 2	Year 3	Total	Present Value
Atr	Increased provider productivity using tap-and-go (Pure Storage and Imprivata)	\$432,000	\$432,000	\$432,000	\$1,296,000	\$1,074,320
Btr	Simplification of deployment and management tasks savings	\$55,250	\$29,750	\$55,250	\$140,250	\$116,324
Ctr	Air conditioner unit — capital cost avoidance savings	\$212,500	\$0	\$0	\$212,500	\$193,182
Dtr	Legacy storage cost avoidance benefits	\$320,000	\$0	\$0	\$320,000	\$290,909
Etr	Power and cooling savings	\$4,050	\$4,050	\$14,579	\$22,679	\$17,982
Ftr	Flexibility option — Forever Flash	\$0	\$0	\$99,211	\$99,211	\$99,211
Ttr	Total quantified benefits (risk-adjusted)	<b>\$1,023,800</b>	<b>\$465,800</b>	<b>\$601,040</b>	<b>\$2,090,640</b>	<b>\$1,791,928</b>

Source: Forrester Research, Inc.

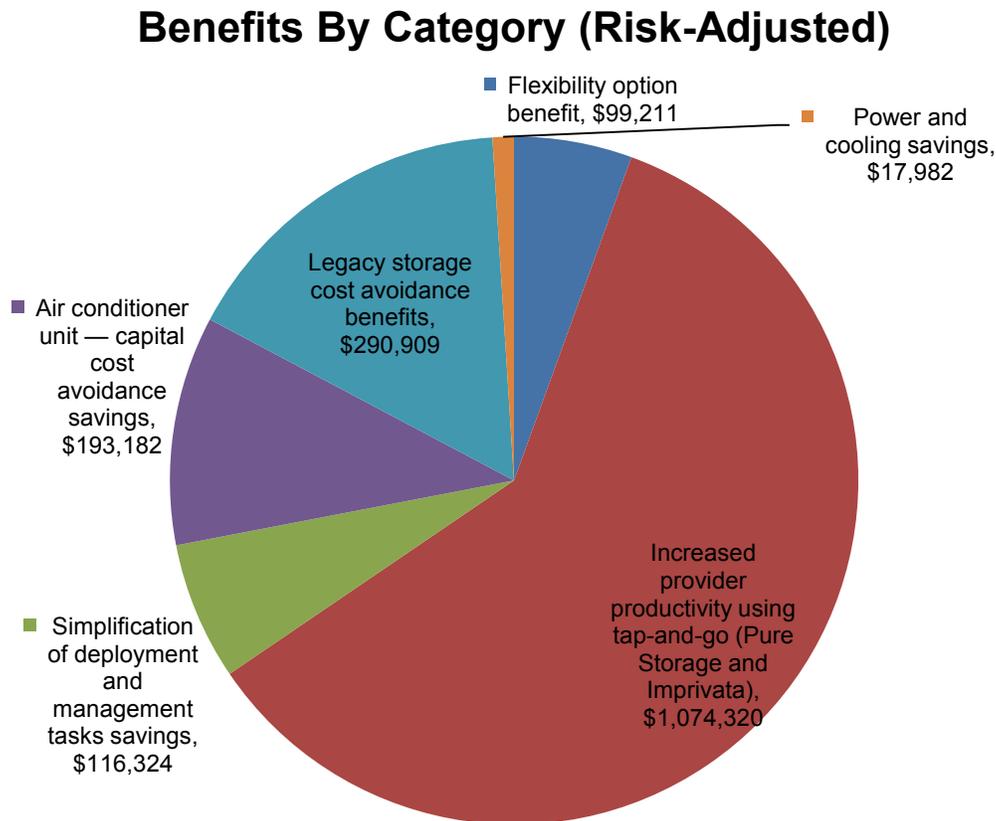
### BENEFITS: UNQUANTIFIED

The customer interviews revealed the following additional benefits of using Pure Storage; however, St. Luke's is not able to quantify the benefits at the present time:

- › The combination of Pure's FlashArrays and its Purity operating environment provides storage acceleration for faster reporting. There is anecdotal evidence that the electronic medical records (EMR) SQL Server database, which now runs on Pure Storage, can produce EMR reports twice as fast as the legacy storage environment.
- › According to the St. Luke's IT infrastructure manager, all Pure Storage maintenance software upgrades and dot releases are being done nondisruptively during the day. And the upgrade from the FA-420 to the FlashArray//m50 was done during normal business hours, taking between 1 and 2 hours, with most of that time spent re-cabling and making sure the cables looked good.
- › St. Luke's predicted future attrition savings, i.e., future replacements of storage administrators could be more junior than predecessors due to the simplicity of Pure Storage, saving up to \$20,000 annually in salary and benefits per administrator.

FIGURE 3

Quantified Benefits By Category (Risk- And Present Value-Adjusted) Totaling \$1,791,928



## COSTS

### Ⓢ Costs Associated With Pure Storage

St. Luke's incurred costs in the following categories associated with Pure Storage:

- › **Planning and deploying Pure Storage.** The internal labor associated with planning and deploying the Pure Storage FlashArray solutions totaled 80 hours across the following staff functions: server administration, storage administration, and network administration. The average fully loaded cost per IT staff is \$140,000 (\$67.30 hourly), for a total labor cost of \$5,384 (80 hours\*\$67.30) as an initial investment period expense.
- › **Pure Storage costs.** St. Luke's will incur the following Pure Storage costs totaling \$603,591 during the three-year period (see Appendix A for more information about Pure Storage). These costs represent Pure Storage's average selling prices at the time of delivery: There were no incremental third-party hardware or software costs incurred by St. Luke's.

  - FA420-11TB FlashArray and includes three years of 24x7 next-business-day support.
  - FlashArray//m50-40TB and includes three years of 24x7 advanced maintenance and support and next-business-day delivery.

- › **Professional services and training.** St. Luke's reported that deploying Pure Storage FlashArrays did not require any vendor or partner professional services or training costs. Therefore, there are zero dollars associated with this cost category (Forrester has captured this cost avoidance in the Benefits: Quantified section).
- › **Ongoing operations.** St. Luke's requires a storage administrator to spend an average of 2 hours per week maintaining and enhancing the Pure Storage FlashArrays. 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 8 shows the total of all costs as well as associated present values discounted at 10%, over three years. Forrester chose not to risk-adjust costs because St. Luke's received fixed price quotes for Pure Storage products and services. St. Luke's expects costs to total \$629,975, with a present value of \$536,051.

**TABLE 8**  
**St. Luke's — Total Costs Associated With Pure Storage**

Ref.	Metric	Initial	Year 1	Year 2	Year 3	Total	Present Value
G1	Planning and deploying Pure Storage	\$5,384	\$0	\$0	\$0	\$5,384	\$5,384
G2	Pure Storage costs	\$240,350	\$0	\$0	\$363,241	\$603,591	\$513,259
G3	Professional services and training*	\$0	\$0	\$0	\$0	\$0	\$0
G4	Ongoing operations to manage Pure Storage	\$0	\$7,000	\$7,000	\$7,000	\$21,000	\$17,408
Gt	Total costs	<b>\$245,734</b>	<b>\$7,000</b>	<b>\$7,000</b>	<b>\$370,241</b>	<b>\$629,975</b>	<b>\$536,051</b>

\*No professional services or training was required by St. Luke's to deploy and use Pure Storage FlashArrays.

Source: Forrester Research, Inc.

## 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 Pure 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 customer may not be met by the investment in Pure Storage, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates.

While the interviewed customer provided cost and benefit estimates, some categories included future projections or a broad range of responses, or had a number of internal or external forces that might have raised or lowered costs and benefits. For that reason, each benefit has been risk-adjusted and is detailed in the Benefits: Quantified section. See Table 9 for a summary of risk adjustments by benefit category.

Note: Forrester chose not to risk-adjust costs because St. Luke's had received fixed price quotes for Pure Storage fees.

**TABLE 9**  
**Benefit And Cost Risk Adjustments**

<b>Benefit Categories</b>	<b>Adjustment</b>
Increased provider productivity using tap-and-go (Pure Storage and Imprivata)	↓ 10%
Simplification of deployment and management tasks savings	↓ 15%
Air conditioner unit — capital cost avoidance savings	↓ 15%
Legacy storage cost avoidance benefits	↓ 20%
Power and cooling savings	↓ 7%
Flexibility option — Forever Flash	↓ 50%
<b>Costs</b>	<b>Adjustment</b>
(Costs were not risk-adjusted)	↑ 0%

Source: Forrester Research, Inc.

Highlighting risk by adjusting the benefits produces 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 implementation risk that could affect costs is identified as part of this analysis:

- › The St. Luke’s IT staff was used to all spinning discs, so there was a minor fear of the unknown. St. Luke’s avoided implementation risk by taking advantage of Pure Storage’s proof of concept program. St. Luke’s was able to try it before it committed to buying it, so implementation risk was mitigated.
- › Although Forrester did not risk-adjust Pure Storage FlashArray hardware and maintenance costs, other organizations’ costs may vary due to variable discounts.

The following risk was cited by this customer and previously interviewed customers and did not affect the cost and benefit risk adjustments:

- › There is a perception on the part of the interviewed customer that Pure Storage (the company) could be an acquisition target. It’s impossible to predict the impact of an acquisition of Pure Storage by another company; therefore, Forrester did not include cost or benefit adjustments related to this perceived risk. Pure customers may be concerned that a potential suitor would not continue Pure Storage’s product road map, which customers in general viewed in a favorable and positive light.

Table 9 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.

## 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 investment in Pure Storage by St. Luke's.

Table 10 below shows the risk-adjusted ROI, NPV, and payback period values. The cost and benefit values are from summary Tables 7 and 8.

**TABLE 10**  
**Cash Flow (Risk-Adjusted)**

	<b>Initial</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Total</b>	<b>Present Value</b>
Total costs	(\$245,734)	(\$7,000)	(\$7,000)	(\$370,241)	(\$629,975)	(\$536,051)
Total benefits	\$0	\$1,023,800	\$465,800	\$601,040	\$2,090,640	\$1,791,928
Net benefits	<b>(\$245,734)</b>	<b>\$1,016,800</b>	<b>\$458,800</b>	<b>\$230,799</b>	<b>\$1,460,664</b>	<b>\$1,255,878</b>
ROI						<b>234%</b>
Payback period						<b>Three months</b>

Source: Forrester Research, Inc.

The ROI was a very favorable 234%, and the payback period was a quick three months. If risk-adjusted costs, benefits, and ROI still demonstrate a compelling business case, it raises confidence that the investment is likely to succeed because 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 values considering risk. Assuming normal success at mitigating risk, the risk-adjusted numbers should more closely reflect the expected outcome of the investment.

## Appendix A: About Pure Storage FlashArray Storage Solutions For VDI: Overview

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

According to Pure Storage, its FlashArray storage solutions are economical all-flash solutions for virtually any workload. Purity is a storage operating environment built from the ground up for flash. Purity is provided at no additional cost with every FlashArray and runs consistently across the entire FlashArray hardware family. There are three main services of Purity: FlashReduce data reduction, FlashProtect (resiliency), and FlashRecover (including replication), as described below:

- › **FlashReduce data reduction.** Pure Storage FlashArray automatically implements the following results, features, and functionality:
  - 4-6 to 1 — virtual server environments including VMware or Hyper-V, and consolidated virtual server environments with mixed applications.
  - 2-4 to 1 — database environments for OLTP or OLAP.
  - 8-10+ to 1 — virtual desktop (VDI), both persistent and nonpersistent.
  - Pattern removal. This identifies and removes repetitive binary patterns, including zeroes. In addition to capacity savings, pattern removal reduces the volume of data to be processed by the dedupe scanner and compression engine.
  - Adaptive, inline deduplication. High-performance, inline deduplication with 512-byte granularity ensures only unique blocks of data are stored on flash, even for data sets that cannot be reduced by traditional fixed block dedupe implementations.
  - Inline compression. Inline compression encodes data with a lightweight Lempel-Ziv-Oberhumer (LZO) lossless algorithm that uses less capacity than the original format. Coupled with deep reduction, compression reliably delivers 2x to 4x data reduction.
  - Deep reduction. A patent-pending form of the Huffman encoding algorithm is employed as part of Pure Storage's continuous optimization process to further reduce storage consumption. This deeper compression can increase savings on data that was compressed inline.
  - Copy reduction. Leveraging the data reduction engine, Purity provides instant, pre-deduplicated copies of data for snapshots, clones, replication, and xCopy commands. Copying data on a FlashArray only involves metadata.
- › **FlashProtect's resiliency.** This keeps data safe, secure, and available without performance loss and includes the following features and functionality:
  - Nondisruptive capacity expansion. Capacity can be expanded by adding another storage shelf to an existing array via SAS cabling.
  - Nondisruptive controller upgrades (performance expansion). The FlashArray features clustered stateless controllers, where no persistent information is stored within the controllers, simplifying both high availability (HA) and upgrades.
  - Nondisruptive hardware replacement. The FlashArray was designed with at least two of everything and no single point of failure, allowing for online maintenance or replacement of any failed component.
  - Nondisruptive software updates. Because of the dual-controller, stateless design of the FlashArray, software can be nondisruptively upgraded without ever failing a host IO.

- All with zero performance impact. Although the IO handling of the FlashArray is active/active from all ports on both controllers, the array's performance is limited to one controller. This enables all maintenance operations to be performed with zero performance loss.
- › **FlashRecover, including replication.** FlashRecover includes data reduction-optimized backup and disaster recovery. Recover instantly from an extended library of thousands of space-efficient, point-in-time local or remote copies. Protect between data centers or centralize backup and disaster recovery with flexible multisite protection. Features and functionality include:
- Instantly snapshot any volume. Snapshot any volume or group of volumes in the array at the click of a mouse. There is no planning involved, no reservations are required, and there is no performance overhead.
  - Snapshots are just new volumes, with full capabilities. All volumes in the FlashArray are virtual and independent, so mount, read, write, or snapshot against your snapshot — there are no restrictions. All volumes and snapshots have full performance.
  - Snapshots are always full, yet space-saving. In traditional arrays, choosing snapshots versus clones is a tough decision. In the FlashArray, all snapshots function like full clones, but they are always thin, deduped, and compressed.
  - Recover anything to anywhere. With FlashRecover Snapshots, gone are the snapshot chain limitations and rigid recovery rules. Instantly recover any volume from any other volume or snapshot in the array — no data copying is required. And all recoveries include an automated failback recovery snapshot of the original, just in case.

## 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 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.

## 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.

**TABLE [EXAMPLE]**  
Example Table

Ref.	Metric	Calc./Source	Year 1	Year 2	Year 3

Source: Forrester Research, Inc.

### FRAMEWORK ASSUMPTIONS

Table 11 provides the model assumptions that Forrester used in this analysis.

**TABLE 11**  
**Model And Case Study Assumptions**

<b>Ref.</b>	<b>Metric</b>	<b>Calc./Source</b>	<b>Value</b>
H1	Annual cost per storage administrator (fully loaded)	US industry average	\$140,000
H2	Annual cost per server administrator (fully loaded)	US industry average	\$140,000
H3	Annual cost per network administrator (fully loaded)	US industry average	\$140,000
H4	Hourly cost per administrator (fully loaded)	US industry average	\$67.30

Source: Forrester Research, Inc.

The discount rate used in the PV and NPV calculations is 10%, and the 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.