Total Cost Comparison: IT Decision-Maker Perspectives on EMC®, HP® and Network Appliance™ Storage Solutions in Enterprise VMware Environments

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Prepared for:

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Update to Original Study

This report is an update to Oliver Wyman’s October 2007 study “Total Cost Comparison in Enterprise VMware Environments,” in order to incorporate customer data on the impact of deduplication technology on total cost in primary storage VMware environments. In the context of enterprise storage, deduplication is the process of searching through the storage environment to identify and remove redundant data. Typically executed through either a recurring or manual process, a deduplication algorithm scans the storage volumes looking for duplicate data. When duplicate data is identified, the data is removed by the algorithm and replaced by a logical reference that points to the original copy of the data.

To update this study, Oliver Wyman first quantified the incremental impact of deduplication on the total cost of ownership in primary storage VMware environments. Deduplication has been a hot topic in enterprise storage for the past several years, initially applied to backup environments. All three vendors covered in this study – NetApp, HP and EMC – have released deduplication technology for backup storage environments, however NetApp is currently the only major storage vendor to offer deduplication for primary storage – a feature NetApp released in March 2007.

Since there are now a sufficient number of NetApp customers with prolonged experience using deduplication for VMware in full production environments, the impact of deduplication on total cost can be observed and quantified. These results are noted throughout this updated paper. It is certainly possible that either EMC or HP (or both) will eventually release their own deduplication technology for primary storage. For this reason, the white paper continues to cite the differences in costs between the three vendors without including the impact of deduplication.

Furthermore, where applicable, Oliver Wyman updated the baseline hardware configurations for the storage solutions to account for the next generation of the products previously profiled in the original study. For NetApp, the FAS3070 in the previous study was replaced by the next generation FAS3140; for EMC, the CX3-80 was replaced by the CX4-240. The HP hardware configuration remained the same (EVA 8100). Other software for each of the three vendors remained the same from the previous study. Taking into account the updated hardware configurations, Oliver Wyman updated the pricing for all three vendors to reflect 2009 levels. Average pricing discounts for each of the three vendors was then based on Oliver Wyman interviews with storage decision-makers in order to reflect actual market pricing rather than vendor list pricing.

All other findings in the study remain consistent with the original report and are based on the interviews conducted with storage decision makers about their enterprise storage requirements for their VMware environments. As in the original study, all data presented here is based on information provided by study participants about their actual deployments.
Executive Summary

Oliver Wyman, a global strategy consultancy, was engaged by NetApp to conduct primary research with IT decision makers. The goal of the research was to determine the total cost of acquiring, deploying, operating, and managing storage environments from various vendors to support VMware server virtualization solutions. The findings included in this study are Oliver Wyman’s, based exclusively on actual cost data provided by network storage administrators and IT managers from large enterprises across various industries.

Virtualization remains one of the hottest trends in IT today, and VMware, with its industry-leading server virtualization solutions, has been one of the major beneficiaries. Total cost considerations continue to be an important part of the reason many organizations turn to VMware. A virtualized server infrastructure maximizes server utilization, performance and data resiliency, all of which reduce total cost. IT executives point to a number of benefits from deploying VMware, including lower costs of server hardware, improved power and cooling efficiency, lower costs of maintenance and system management, and reduced downtime.

Many companies are also using server virtualization as an opportunity to consolidate their storage and migrate to networked storage architectures. As enterprises start understanding the cost savings VMware provides, they are able to combine the additional benefits of flexibility, scalability, and reliability of a network storage environment. Additionally, almost all of the companies interviewed as part of this study choose to use VMware’s VMotion feature as part of their VMware Infrastructure 3 (VI3) license and therefore require network storage for their VMware environment. As one senior IT decision-maker said, “VMware was basically the big factor for making migration [from DAS] happen to the SAN…the data center would have been buried in fiber, and it would not have been cost feasible.”

This study of large VMware deployments identified two primary conclusions from companies’ actual experiences in deploying VMware:

- **VMware networked storage solutions can drive costs savings of up to 60% compared to traditional environments when taking into account both server-related and storage-related costs, but this is highly dependent on the storage vendor platform deployed.**

- **Total cost savings for storage in a virtualized environment vary widely by storage platform, however. Based on typical configurations and storage management policies, a NetApp solution that includes deduplication is 51% less expensive on a total cost basis than a typical EMC CLARiiON solution and 54% less expensive than a typical HP EVA solution for the same size VMware environment. Without taking into account deduplication, a NetApp**

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Note: the typical environment included in this study had a Virtual Machine-to-host ratio of 10:1, 200 Virtual Machines and 10TB of effective storage.
solution still maintains a 40% and 44% total cost advantage over EMC and HP, respectively.\(^2\)

Figure 1: Relative Cost Advantage of NetApp vs. Comparables\(^3\)
Typical VMware Deployments

This study identified three primary reasons for lower total cost when deploying VMware with NetApp:

- NetApp has a 60% to 62% advantage in Product Acquisition & Ongoing Vendor Costs due to storage efficiencies through the NetApp Snapshot™ (vs. BCV) and Data ONTAP® 7G features such as FlexVol® and deduplication. Without taking into account deduplication, NetApp still maintains a 36% cost advantage over EMC and a 39% cost advantage over HP in Product Acquisition & Ongoing Vendor Costs.

- NetApp has a 45% to 49% advantage in Internal Operational Costs because of its ease of use in managing the VMware storage environment, allowing storage administrators to manage almost twice the number of TB per FTE as in the other environments evaluated.

\(^2\) In this report, results are presented in an indexed format to better illustrate variations between the individual data storage solutions, where they exist. The total cost associated with a NetApp Network Storage (either FC SAN or NFS) solution has been set to 100 and total costs for other solutions are indexed to this figure. The approach to indexing has no impact on relative results.

\(^3\) Throughout the charts and analysis, *NetApp Network Storage* will refer to either the NetApp FC SAN or the NetApp NFS configurations. The NFS configuration is typically slightly less expensive (<5%) than the FC configuration. But, for simplicity and clarity, the analysis treats both configurations as having equivalent TCO cost profiles.

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NetApp is able to recover two times faster than competitive environments due to its Snapshot technology, and has a 39% to 45% advantage in Downtime and Recovery Costs.

Along with total cost, IT decision makers suggested flexibility – the ability to manage multiple protocols and multiple applications on the same system – is very important for VMware networked storage deployments. Customers that did compare multiple vendors appreciated the NetApp infrastructure efficiency in managing multiple protocols in one device, providing the type of flexibility that is a core reason to deploy virtualization solutions in the first place. A NetApp customer elaborated, “Unified storage in one box is what sold us. We are running FC today for VMware, but we can run iSCSI [tomorrow], and use the CIFS protocol as well to consolidate [our file servers].”

Although critical to the decision making process, flexibility is not taken directly into account in the total cost analysis. The body of this report focuses on the total cost of a networked storage environment for a VMware deployment, and explains the cost differences between NetApp, EMC, and HP systems. It is critical to identify that “street” prices (i.e. purchase orders) for these vendors systems are only a small portion of overall costs taken into account in this report, and are not necessarily comparable across vendors.
Approach and Methodology

A. Oliver Wyman’s Research Approach

NetApp engaged Oliver Wyman to conduct primary research with IT managers and network storage administrators to determine the total cost of acquiring, deploying, operating, and managing storage environments for VMware server virtualization. NetApp commissioned this research with the belief that its storage solutions provided a total cost advantage over key competitors. However, Oliver Wyman had complete autonomy over the research, data analysis and results.

Participants in this study were recruited by Oliver Wyman for 60-90 minute structured interviews from two sources: NetApp customer and prospect lists and third-party panels of IT managers. Participants were targeted to provide diversity on a number of dimensions, including:

- Geographic region
- Industry
- Company size
- Number of Virtual Machines deployed
- Primary storage capacity for VMware environment
- Primary storage vendor for VMware environment
- Storage protocol used for VMware environment

B. Defining Total Cost

Through a series of structured interviews, study participants provided Oliver Wyman with detailed cost data for all aspects of their VMware storage environment. Figure 2 provides more detail on the total cost framework used with participants, which includes three primary elements: Product Acquisition & Ongoing Vendor Costs, Internal Operational Costs, and Downtime and Recovery Costs.

- **Product Acquisition & Ongoing Vendor Costs** include all the up-front hardware, software, implementation and training costs associated with purchasing and implementing a storage solution for VMware, as well as hardware and software support and maintenance agreements.

- **Internal Operational Costs** include all labor costs associated with the ongoing management and operation of the VMware storage solution as well as all ongoing non-labor costs (e.g., power, cooling, floor space and other facility costs).

- **Downtime and Recovery Costs** include only those downtime costs that study participants could measure, specifically scheduled downtime and unscheduled downtime caused by application errors. Estimates of indirect business impact costs were not included in this study.

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Figure 2: Oliver Wyman’s Approach to Total Cost

C. Establishing a “Baseline” VMware Storage Environment

In order to ensure a consistent and accurate total cost comparison, participants were shown a VMware storage architecture diagram, Figure 3, and asked to limit the scope of their answers to the storage elements shaded in blue. The baseline environment for this study included 200 Virtual Machines running on physical hosts connected to the primary storage through either Fibre Channel, iSCSI, or NFS.

The baseline environment enables comparisons between companies that have deployed either EMC, NetApp, or HP storage solutions. The primary storage system models compared in this study include the NetApp FAS3140 with dual controllers, EMC CLARiiON CX4-240, and HP EVA 8100. The costs of any secondary storage such as tape drives or low cost disks for backup, or additional systems for disaster recovery purposes are excluded from this analysis. Additionally, server related costs are also excluded when comparing the vendor storage solutions head-to-head.

Data protection is achieved at two levels within the relevant cost areas. At the primary storage layer, disk resiliency is achieved through RAID protection. Additionally, snapshots or full copies are performed to allow for recovery from an application error, file corruption, or human error.

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The additional storage overhead involved in performing snapshots or full copies is included as part of product acquisition costs. Administration time spent on backup and replication for DR is also included in the total cost.

Participants gathered data for the interviews in advance based on this common architecture view and the total cost framework as provided by Oliver Wyman. Where participants’ VMware storage environment differed from the standardized architecture, Oliver Wyman identified the impact of these differences. The findings provided here constitute a consolidated view of all participants’ data over a five-year period, including normalized costs for each cost category.

Figure 3: A Standard VMware Storage Environment View

D. Typical Customer VMware Storage Environments

Study participants running a typical VMware environment have consolidated their Direct-Attached-Storage to Network Storage and mention flexibility, scalability and reliability as the

4 While vendors tend to suggest three-year product lifecycles, Oliver Wyman has found that many IT organizations plan for longer cycles. Differences between the five-year view which is the baseline for this report and a three-year view are noted in the total cost section of this paper.

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main advantages gained. Additionally, most customers interviewed have already migrated to VMware Infrastructure 3 (VI3) licenses and choose to use VMotion for live migration of virtual machines with zero downtime, a feature that requires network storage. Many companies are also looking to reduce total storage costs.

From study participant responses, typical applications hosted on VMware include SQL servers, Test & Development environments, proprietary and small-scale custom apps, and other under-utilized CPU and low IO intensive apps. Customer environments varied with respect to the number of Virtual Machines per each physical (ESX) host deployed due to IO performance considerations, current CPU utilization rates, and memory limitations, but the typical ratio used is about 10:1. Some customers explained that for specific environments such as test and development they are able to reach levels up to 40:1 or better without any issues. The average size of the VMware storage environment for the typical applications deployed in respondent environments was 10TB of effective (usable) storage, which is used as a baseline in this study.

NetApp environments, however, differ from EMC CLARiiON and HP EVA environments in the approach to data protection, which leads to different requirements for the amount of raw storage purchased, as is shown in figure 5. Customers revealed that the best practice for implementing a VMware network storage solution using EMC or HP is to create full live copies such as EMC’s Business Continuance Volumes (BCV) or clones of the primary data for recovery purposes, which inherently leads to 2x storage overhead. NetApp customers, instead, create multiple Snapshot copies per day and estimate the storage overhead to be only 20%.

Although another approach that customers can take is to use VMware’s snapshot capability, VMware Consolidated Backup, most respondents explained that this feature is typically used for a different purpose because it does not provide the same performance as a point-in-time or full copy taken by the storage array itself. One study participant stated: “Its main value is in migrating applications from one VM to another when performing patches or upgrades and for change management and backup plans, but not for recovery purposes.”

Taking into account the differences between vendor environments for local data protection, including RAID and Snapshot or BCV differences, NetApp is far more efficient in storage utilization than EMC or HP. As is illustrated in Figure 4, NetApp requires approximately 1.4 raw TB for every TB of effective storage, whereas EMC and HP environments require approximately 2.3 raw TB. Due to these differences, a raw TB comparison across vendor systems is not relevant.

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5 NetApp environments have a 1.4x overhead capacity requirement due to additional storage required for Snapshot copies along with the extra disks necessary for RAID protection, while EMC and HP environments have a 2.3x overhead capacity requirement for RAID protection and snapshot equivalents (full copies or clones). For 10 TB of effective storage, NetApp requires approximately 13 TB of disk capacity in primary storage, whereas EMC and HP require 57 TB. These figures factor in future growth for both systems, which is 20% year-over-year based on participant responses, and also include the storage utilization benefits customers reported from using FlexVol and deduplication for NetApp deployments.

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Data resiliency is also handled differently in NetApp, EMC and HP environments. NetApp customers use RAID-DP™ (a RAID 6 implementation) with its Data ONTAP 7G operating system, whereas EMC CLARiiON and HP EVA customers typically use RAID 5 to save on disk costs. NetApp customers are also able to leverage FlexVol with Data ONTAP 7G, which study participants reported improves storage utilization by approximately 20%.

Finally, NetApp is the only vendor of the three profiled in this analysis to currently offer deduplication for primary storage in VMware environments. Integrated within NetApp’s embedded file system, deduplication works by periodically searching for and eliminating redundant data objects that share the same underlying “fingerprints”. Due to the high-degree of redundant data that can be produced by virtual machines, NetApp customers that deployed deduplication on their primary storage VMware environment realized upfront storage cost savings of 40-70% (results vary depending on the nature of the customer’s VMware environment itself). For this analysis, Oliver Wyman used a benchmark of 54% cost savings on storage acquisition from deduplication, which is the median of data points observed from customer environments.

**Figure 4: Usable to Raw Ratio in NetApp, EMC, and HP Environments**

<table>
<thead>
<tr>
<th></th>
<th>Usable to Raw TB Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetApp FAS</td>
<td>1.4</td>
</tr>
<tr>
<td>EMC CLARiiON</td>
<td>2.3</td>
</tr>
<tr>
<td>HP EVA</td>
<td>2.3</td>
</tr>
</tbody>
</table>

RAID-DP (a RAID 6 configuration) provides double parity, using two dedicated parity disks out of fourteen data disks in most customer deployments. Typical RAID 5 configurations use one out of eight disks for parity, according to study participants.

At the time of this update, neither HP nor EMC had implemented deduplication for primary storage. However, it is reasonable to expect/assume that eventually HP and/or EMC will offer deduplication on primary storage in VMware environments. This conditional scenario is addressed in a subsequent footnote.

As a result of NetApp’s Unified Storage Architecture, deduplication can be turned on with minimal performance impact. According to the NetApp Deduplication for FAS Deployment and Implementation Guide, only the system’s write performance is affected by dedupe (read performance is typically not affected). With one deduplication process running, performance overhead impact ranges from 0-15%, depending on the hardware configuration and the nature of the environment in general. However, in conversations with NetApp customers (who are using deduplication in their VMware storage environment), many did not report any noticeable performance degradation.

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Further variations were captured among NetApp customers with their usage of certain features such as FlexClone® and deduplication. One such impact of the difference was in the approach taken to creating the Virtual Machines. Typical EMC, HP and NetApp customers used VirtualCenter, a feature of VI3 that automates the process of creating VMs. However, some NetApp customers had deployed the NetApp FlexClone feature to generate the VMs and noted improvements in speed. Moreover, some NetApp customers also used FlexClone for their test, development, and QA environment running on VMware and were able to get significant storage savings. But since most NetApp customers had not standardized on FlexClone as part of their storage environment today, any advantages from using FlexClone are not captured in this total cost study.

Similarly, NetApp customers that had deployed deduplication revealed that they are able to achieve savings in the backup environment of up to 80% for storage related to their VMware applications. However, since the product costs of the backup disks are not considered in this analysis (only primary storage deduplication accounted for in this study), these additional savings are not reflected in this assessment.

It is important to note that the typical NetApp configurations compared to EMC and HP are not truly equivalent. From a performance standpoint, two adjustments would be required:

- EMC and HP environments would require more storage capacity to replicate the number of snapshot copies at equal performance to a typical NetApp environment.
- EMC and HP solutions would require RAID 1 or RAID 10 to rival the low disk failure rate provided by NetApp RAID-DP.

However, this study was designed to provide a total cost comparison based on how enterprises actually deploy the different systems, and the actual (not list) prices they pay for each element. The conclusions presented in this document are based on this “typical deployment” approach for each vendor’s solution.
Overall Findings

A. Total Cost Comparison

Oliver Wyman’s research with IT decision makers suggests that for a typical deployment with 10 TB of effective storage, a NetApp Network Storage solution for VMware is 51% less expensive on a total cost basis than a typical EMC CLARiiON SAN solution and 54% less expensive than an HP EVA SAN solution on a total cost basis. Without accounting for deduplication, NetApp still maintains a 40% and 44% cost advantage over EMC and HP, respectively. This is shown in Figure 5 below.

![Figure 5: VMware Total Cost Comparison: Summary Findings](image)

B. Drivers of Observed Cost Differences

The total cost advantage that NetApp holds over EMC and HP consists of three elements:

1. NetApp achieves a 60-62% cost advantage with deduplication over competitor solutions in Product Acquisition & Ongoing Vendor Costs in a SAN environment. Without accounting

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9 Note that customers that choose to run NetApp with the NFS protocol, rather than FC SAN, reported additional 3-5% total cost savings.

10 Again, the NetApp Network Storage will refer to either the NetApp FC SAN or the NetApp NFS configurations. The NFS configuration is typically slightly less expensive (<5%) than the FC configuration – largely due to the lack of Fibre Channel switch costs and data management efficiencies. But, for simplicity and clarity, the analysis treats both configurations as having equivalent TCO cost profiles.
for deduplication, NetApp still maintains a 36% and 39% cost advantage in this cost category over EMC and HP, respectively.

- Customers suggested NetApp provides better storage utilization than competitors because of its Snapshot capability, FlexVol and deduplication features.
- According to study participants, NetApp deployments are less complicated and tend to have much lower up-front training and installation costs compared to EMC CLARiiON and HP EVA.

The NetApp advantage in Product Acquisition & Ongoing Vendor Costs is greater than in previous studies for four primary reasons:

1. Base product costs continue to drop for all three vendors, lowering product acquisition costs as a percentage of the total costs.
2. In VMware deployments, the comparable models observed were NetApp FAS3140, EMC CLARiiON CX4-240, and HP EVA8100. The NetApp FAS3140 has lower dollar per TB costs than the NetApp models used in prior studies.
3. NetApp customers reported that they no longer require the 2x reservation requirement.
4. Deduplication reduces the amount of required raw storage space by 54% on average, further driving these costs downward.

2. NetApp has a 45-49% cost advantage over competitor solutions in Internal Operational Costs.

- The number of TBs managed per FTE ratio for NetApp storage solutions for a VMware environment is 2x compared to EMC CLARiiON and HP EVA environments, according to customer responses.
- NetApp NFS environments have 20% higher efficiencies in administering, monitoring, and managing storage due to less time spent in provisioning compared to SAN.
- Operating and facility costs, including power, cooling, and floor space, are lower for NetApp per usable TB because of the NetApp storage savings features.

Case Study: Total Cost of Storage in VMware Environments: A Financial Services Firm’s Perspectives

For enterprise customers, server virtualization often goes hand-in-hand with networked storage deployments. These customers are therefore typically sensitive to total cost, and are keen to capture additional benefits provided by migrating to a network storage environment.

One study participant, a North American based financial services firm, explained that flexibility and total cost were the two most important goals for their network storage deployment with VMware. After considering alternative solutions, the firm found that NetApp delivered on its goals by offering features that fit naturally into the best practices that VMware advocates (data protection, disaster recovery, etc.).

The Storage Manager recalled, “We took a bottom-up approach and saw how fast our environment was growing, looked at TCO including hard costs and labor, and [examined] the impact on our backup environment. Backing up/ DR becomes a chore with a large environment, and we found the TCO was lower [for NetApp].” The firm benefitted by key NetApp features. “We decided to utilize NetApp SnapMirror® for replication and [deduplication technology]...these became a driving factor in our solution.” In fact, the manager noted that with deduplication, the firm achieved 80% storage savings on VMware backup data, reducing costs even further.

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3. NetApp has a 39-45% cost advantage over competitor solutions in Downtime and Recovery Costs.

- NetApp Snapshot functionality allows it to recover 2x faster from application errors than EMC or HP solutions.
- According to study participants, scheduled downtime is 33% higher in CLARiiON and 66% higher in HP EVA environments compared to NetApp for VMware deployments.

Each of these factors is discussed in greater detail in the sections that follow.
Detailed Findings

A. Product Acquisition & Ongoing Vendor Costs

Overview

The first and most straightforward element of total cost analysis is Product Acquisition & Ongoing Vendor Costs. This category includes all internal and external up-front costs (using actual reported “street” prices) associated with acquiring and implementing a storage solution for a VMware environment. This category also includes all costs paid to third-party vendors for hardware or software maintenance and support and for any required outsourcing or training.

Taking into account only these “upfront” costs, respondent data show that NetApp SAN solutions with deduplication are 60% less expensive than typical EMC CLARiiON solutions and 62% less expensive than HP EVA for the same size VMware environments (without deduplication, 36 and 39%, respectively. These data are presented in Figure 6.

Figure 6: VMware Storage Product Acquisition & Ongoing Vendor Costs
Indexed: Total Cost for NetApp Network Storage w/ Dedupe = 100

Drivers of Observed Cost Differences

There are several factors that drive differences in Product Acquisition & Ongoing Vendor Costs among these environments, the foremost of which include the following:

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NetApp customers require over 50% less disk capacity for the same amount of effective storage in their primary environment than EMC or HP customers because they are able to more efficiently utilize their disks through Snapshot copies, Data ONTAP 7G and deduplication. NetApp customers said they create multiple Snapshot (point-in-time) copies per day as part of their data protection policies for the VMware environment and require only 20% additional storage overhead. EMC and HP customers, on the other hand, perform BCV or full copies, which require 2x the amount of storage. Additionally, NetApp FlexVol, a feature of the NetApp Data ONTAP 7G operating system, helps reduce the amount of disks required for purchase by about 20% as customers are able to grow and shrink volumes on demand. Interview participants noted that this is especially important for a VMware environment with multiple applications typically deployed, a lot of which tend to be smaller custom built applications and do not take nearly the amount of storage that customers ask for. As one study respondent said, “With VMware, thin provisioning was huge, a big piece of the [overall] solution for us.”

Through NetApp’s deduplication technology, customers can further decrease their upfront storage requirements by 54%.

Interview participants noted that deduplication in their VMware environment worked extremely well, achieving space savings of anywhere from 40-70% at no additional cost (software, licensing, training, upgrades, etc.) and with minimal to non-existent performance degradation. One respondent noted, “Dedupe technology was one of the essential criteria that caused us to switch from another vendor to NetApp... We haven’t suffered any performance problems and enjoy 40-70% space savings across volumes.” For that customer, deduplication effectively delayed the purchase of additional storage by an extra eight months. Another large pharmaceutical company has witnessed similar success with deduplication, “[With deduplication] other vendors are not competitively equal to NetApp...we’ve been able to save approximately 60% disk space across our volumes.”

Implementation and training costs vary by vendor, mostly due to existing capabilities of the IT staff, but are typically lower for NetApp deployments. As one study participant described his HP implementation, “We had to do a massive refresh to migrate from DAS to [HP] EVA.

11 As stated earlier in the paper, NetApp is currently the only vendor of the three covered in this study that is offering deduplication for primary storage. However, even if you took this technology primacy away from NetApp, (by assuming, all else equal, that both the other vendors eventually introduce dedupe and provide similar 54% storage space savings) a NetApp FC SAN solution still commands an overall cost advantage of 40% and 44% relative to EMC and HP, respectively.

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It was a huge undertaking.” NetApp customers are able to use only internal resources and typically did not need any up-front training to handle a VMware deployment. EMC and HP customers tend to use the vendor or other 3rd parties, and end up incrementally adding to their total cost. Furthermore, most EMC and HP customers required some sort of “structured training and on the job training” before being fully functional in the VMware environment.

- Although maintenance contracts are typically equivalent as a percentage of product acquisition costs for all vendors, the level of service tends to differ. NetApp is able to bring its customers solutions that work in their VMware environments, and is constantly engaged on an on-going basis. One NetApp customer explained, “Once we started to talk with NetApp [about VMware], it really sounded like they brought a toolkit to the table and listened to what we needed to do. EMC threw more people at us and tried forcing [an unwanted solution] which started piling up the costs.” An HP customer, on the other hand, said, “A lot of [HP’s] support and maintenance has been outsourced, and their service quality has been reduced.”

- Actual hardware and software prices varied across customer environments. Hardware system and disk prices continue to drop, making Product Acquisition and Ongoing Vendor costs a smaller percentage of total cost. As such, depending on the date of the purchase of the storage equipment, customers varied in how much they paid. Additionally, customers indicated that major discounts were offered by all vendors. For this study, the hardware and software prices have been normalized, and the most current “street” prices have been used.

B. Internal Operational Costs

Overview

Internal Operational Costs include all labor costs related to the ongoing management, operation and administration of VMware storage solutions as well as all non-labor and facility costs such as power, cooling, and floor space.

As product acquisition costs continue to decrease due to lower system and disk prices, Internal Operational Costs are becoming a more important factor in determining total cost of storage solutions. Most participants suggested that they are
increasingly aware of these costs while making purchase decisions and were able to quantify these costs when provided with targeted questions for data collection.

For a typical VMware environment, Internal Operational Costs are 45% less for NetApp than for CLARiiON, and 49% less than for HP EVA. These costs are shown in Figure 7.

**Figure 7: VMware Storage Internal Operational Costs**

Indexed: Total Cost for NetApp Network Storage w/ Dedupe = 100

![Graph showing cost comparison between NetApp, EMC CLARiiON, and HP EVA in VMware environments.]

Note: Internal operational costs not impacted by deduplication.

**Drivers of Observed Cost Differences**

There are a few major factors that determine the NetApp cost advantage over CLARiiON and HP EVA in Internal Operational Costs.

- **NetApp customers are able to administer, monitor, and manage 2x the number of TBs for each full time equivalent resource compared to EMC and HP customers for their VMware storage environment.** NetApp software functionality and ease of use are key factors for some customers in choosing its storage platform. As one study participant simply put it, “*NetApp is easy to implement and manage.*” In a highly dynamic and changing environment such as a VMware deployment, this ease of use provides

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added security and reduces total costs due to the greater amount of storage managed per FTE.

- **NetApp product features such as FlexVol contribute to reducing the workload, a much different story compared to competitor offerings.** Customers noted that EMC environments are typically cumbersome and unfriendly. “Navisphere takes a long time to load and requires deep knowledge to do any provisioning” was one response, whereas another study participant noted, “We are clued in to EMC’s user unfriendliness.” On NetApp, however, customers explained that “FlexVol volumes are more of a management savings than storage, [leading to] at least 20% savings.”

- **Operating costs, including power consumption, are lower for NetApp per Usable TB.** Through product features already discussed such as its Snapshot technology and FlexVol capability, NetApp environments are able to translate the fewer number of TBs required into direct power, cooling, and floor space savings. On average, NetApp environments incur 33% lower facility costs (e.g., power, cooling, floor space) compared to EMC and HP environments.

### C. Downtime and Recovery Costs

#### Overview

Many participants do not currently factor Downtime and Recovery Costs into their total cost analyses for purchasing VMware storage. It is often hard to generalize the frequency of application errors, and particularly its impact across the organization. As a result, many IT environments ignore or discount this element of total cost.

To account for both measurement difficulty and skepticism among some IT professionals, this study includes only two elements in the analysis of Downtime and Recovery Costs, and only includes data where study participants were able to credibly measure impact:¹²

- **Scheduled Downtime**
- **Unscheduled Downtime Caused by Application Errors**

In this study, participants were asked several specific questions aimed at understanding the scheduled and unscheduled downtime of their environments, and although smaller than Product Acquisition & Ongoing Vendor costs and Internal Operational costs, study participants found

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¹² This study excludes any calculation of downtime as a result of a storage system hardware failure. Study participants indicated that most of their systems were deployed in clusters or in fault tolerant configurations such that the likelihood of a hardware failure resulting in an outage was so close to zero as to not be relevant in a total cost calculation.

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that Downtime and Recovery costs are measurable and that there are real differences among different vendors’ solutions.

For a typical VMware storage environment, the Downtime and Recovery Costs are 39% lower for NetApp Network Storage solutions when compared to EMC CLARiiON and 45% lower when compared to HP EVA solutions. These costs are shown in Figure 8.  

![Figure 8: VMware Storage Downtime and Recovery Costs](image)

**Drivers of Observed Cost Differences**

Two important factors drive differences in Downtime and Recovery Costs between NetApp, EMC, and HP EVA environments:

- *NetApp solutions are able to recover two times faster than EMC CLARiiON or HP EVA solutions when faced with an application error.* The NetApp Snapshot functionality allows users to restore to the nearest point in time copy, which is at least 2x faster than restoring from a BCV or full copy. As one study participant noted, “It takes us 10-15 minutes...”

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13 The downtime estimates used in this study are based on published figures by various research experts. Study participants view of unscheduled downtime ranged from $10,000 to $100,000 per hour. The estimated cost of unscheduled downtime used in this study is $50,000 per hour, and the cost of scheduled downtime used in this study is $5000 per hour.

14 Study participants reported, on average, that these types of errors occur roughly once every two years in a typical VMware environment.
recover] from a [NetApp] Snapshot [copy], compared to 1 hour 15 minutes or 1 hour 30 minutes to recover from BCV.” Additionally, NetApp customers create multiple Snapshot copies of their VMware environment daily, which leads to better restore options, whereas EMC and HP customers do one full backup (BCV or clone).

- **NetApp also has lower overall scheduled downtime costs compared to EMC CLARiiON and HP EVA systems.** NetApp product features provide automation for a lot of tasks, and the simplicity of the management interface allows NetApp environments to have minimal scheduled maintenance windows. Furthermore, volume expansion can be done online with NetApp Data ONTAP 7G.

While downtime costs, including hours of both scheduled and unscheduled downtime and dollars associated with each, can vary greatly depending on the organization, conservative figures from participant interviews have been used.

<table>
<thead>
<tr>
<th>Case Study: Critical Environment Requires Fast Recovery</th>
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<tr>
<td><strong>A Healthcare Provider’s Perspective</strong></td>
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<td>Because of the substantial cost savings afforded by VMware, some enterprises have virtualized their very critical applications, and need the highest level of availability for their VMware storage solution.</td>
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<td>A healthcare provider in the US is a prime example. It is running PACS and other clinical apps in a virtualized environment, and needed a robust storage solution that would meet its needs. The Director of Strategic Technology Projects at the company noted that NetApp has been able to deliver. “Never since we bought NetApp have we lost any data,” he explains. And whether he needs to perform a single file restore or a volume restore, the NetApp Snapshot technology has been critical in reducing unscheduled downtime. “Regardless of volume size, it takes us few minutes [to recover data from a NetApp Snapshot copy].”</td>
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Conclusion

Oliver Wyman’s research with storage decision-makers finds the total cost of a NetApp FC SAN storage solution for VMware with deduplication technology is 51-54% lower than typical comparable deployments of offerings from EMC or HP. Without deduplication, NetApp still maintains a 40% and 44% cost advantage over EMC and HP, respectively. Furthermore, study participants indicated that the trend towards storage consolidation and virtualized server deployments will continue as companies find increased cost benefits.

As IT departments become more sophisticated in their management of lifecycle costs, more detailed cost comparison analysis is becoming the rule rather than the exception. Under that view, as evidenced in this report, NetApp has a significant total cost advantage. A total cost comparison is just one of several considerations, however, that go into a typical VMware storage purchase decision. Participants note that a number of elements outside of this study (including specific hardware and software functionality, ongoing vendor relationships, and familiarity with equipment) are inputs that also weigh heavily in any decision. As a result, the importance of the total NetApp cost advantage over competitor solutions must be understood in the context of the broader set of decision criteria.

Other notable differences exist between NetApp, EMC and HP systems that influence decisions for deploying storage solutions for a customer’s VMware environment. For many of the EMC customers in this study, the VMware deployments were merely an extension of their current relationship. Other cases involved the vendor dropping prices considerably to maintain and expand business. However, flexibility is very important for VMware networked storage deployments, and customers that did compare multiple vendors found NetApp superior in this area. One such study participant explained, “We looked closely at EMC CLARiiON, and found it to be relatively inflexible. EMC cringed at over-subscription and this was very important to us.”

NetApp customers, on the other hand, highlighted NetApp infrastructure efficiency in managing multiple protocols in one device, providing the type of flexibility that is a core reason to deploy virtualization solutions in the first place. Furthermore, NetApp NAS customers found they are able to eliminate file servers altogether, leaving the remainder of the servers for consolidation by VMware and leading to a less complex environment. One study participant noted, “The majority of file services from years ago are now running on NetApp NAS, and we have consolidated other servers with VMs.” Such differences, although critical in the decision making process, were not directly taken into account in this report as part of the total cost analysis, but do factor in decisions about which solution to deploy.

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Oliver Wyman

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