The ROI and TCO Benefits of EMC Avamar in VMware Environments

A FOCUS White Paper



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Table of Contents

Executive Summary 1
Introduction 2
Deduplication and Virtualization: Changing the Game 2
The Challenges of Backup 2
From Tape to Disk 3
Changing the Data Protection Paradigm with Deduplication 4
ROI/TCO Justification for Deduplication Storage 4
ROI/TCO Analysis Methodology 4
The Business Case 4
Case Study #1: County Government 7
Figure 1: Data Growth – County Government 7
Figure 2: Cost and Savings over 3-year Period for County Government 8
Figure 3: Contributions to Savings for County Government 9
Figure 4: Summary of Operational Improvements for County Government 10
Figure 5: Financial Summary for County Government 11
Figure 6: TCO Comparison for County Government 12
Case Study #2: Hospital and Clinic Group 13
Figure 7: Costs and Savings - Hospital Group 14
Figure 8: Operational Improvements - Hospital Group 15
Figure 9: Financial Summary - Hospital Group 16
Figure 10: TCO Comparison Tape Only vs. Disk Backup - Hospital Group 17
Case Study #3: Travel and Hospitality Company 18
Figure 11: Costs and Savings by Year - Travel Company 19
Figure 12: Summary of Operational Improvements - Travel Company 20
Figure 13: Financial Summary - Travel Company 21
Figure 14: TCO Comparison of Tape Only vs. Disk Backup with Avamar - Travel Company 22
Conclusions 23
Deduplication and VMware Virtualization 23
Avamar and VMware Customer Results 23
Appendix A: Effects of Deduplication on TCO Components 25
Appendix B: Case Study Details 26
About EMC 27
Other Related Focus Research 27
About Focus, LLC 27

Executive Summary

Data deduplication has received significant attention as one of the game changing technologies of the last decade. Server virtualization has also been recognized as a game changer, and has exploded over the past five years, reaching over a 90% market penetration. (Source: FOCUS Research Series – Managing the Virtual Environment). Combining these two technologies offers IT organizations both major operational improvements and substantial financial benefits.

Exponential data growth, regulatory requirements, and 24X7 availability have all increased the difficulty in completing both virtual and physical backups successfully within shrinking backup windows. In virtual environments, storage challenges are further exacerbated due to virtual server (and associated storage) sprawl that virtualization almost inevitably brings, creating hundreds of duplicate server and/or desktop images (OS and application software). Virtual server consolidation further adds to the backup window problem, since many virtual servers now reside on one physical server sharing one physical pipe. In fact, these backup issues in virtual environments often result in stalling the growth of virtualization within an organization, creating a barrier to growing past the initial 30% virtualized, towards the nirvana of 100% virtual.

Improving backup operations and reducing the storage costs involved in server virtualization are key to the successful expansion of virtualization across an organization. Leveraging the game changing aspects of deduplication in VMware environments can address not only the aforementioned pain points and barriers to expansion, but can also offer a strong return on investment (ROI) and significantly reduce the total cost of ownership (TCO) of virtual and physical data protection.

This paper examines and quantifies the costs and benefits of deduplication in VMware environments. Three detailed case studies from organizations in different industries are presented. For each of these companies, the IT managers wanted more reliable, faster backup and recovery, reduced time and labor costs, reduced storage costs, along with the reduction or elimination of tape and its associated problems. In each case, their operational goals were achieved, along with a strong return on their investment with substantial savings as well.

The financial analysis includes the following:

- Direct and indirect savings including cost avoidance, supplies and services, and labor cost savings
- Net savings
- Return on investment (ROI)
- Total cost of ownership (TCO)

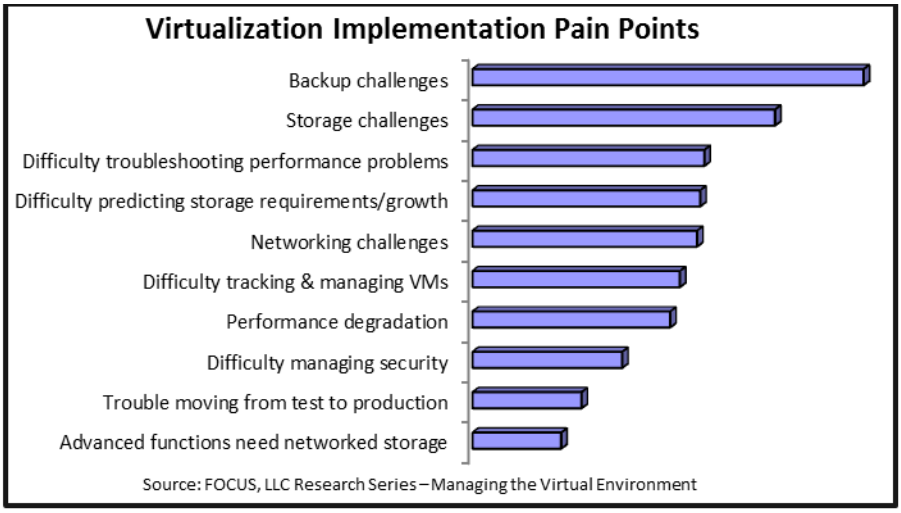
The net savings in these case studies ranged from roughly $787,000 to over $3 million. The ROI ranged from 35% to 450%. The companies all achieved their overall goals, realizing both the business and operational benefits they were seeking, and at the same time recognizing significant cost savings.

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Introduction

Deduplication and Virtualization: Changing the Game

FOCUS Research on virtualization implementations over the past several years consistently indicates that backup and storage challenges are top pain points in implementing virtualization (See Virtualization Pain Points Sidebar). In fact, problems in backing up virtual environments can be a major limitation – both in limiting the expansion of virtualization beyond the initial 30% virtualization currently occurring in most IT shops and in reducing the practical consolidation ratios of virtual servers, due to backup limitations.



Just as server virtualization has been a game changing technology in managing server workloads, deduplication has been a game changing technology in managing backup. Both virtualization and deduplication focus on the benefits of consolidation, optimization and automation (servers or storage), and both deliver significant ROI and TCO benefits. In fact, because server virtualization makes it substantially easier to provision new servers, the initial implementation of virtualization is often followed by virtual server sprawl, creating hundreds of duplicate server and/or desktop images (OS and application software), which contributes to an even greater amount of duplicate data.

Combining deduplication and virtualization brings out the best in these two game changing technologies. Applying deduplication technology in VMware environments helps address the challenges of backing up and restoring virtual servers in increasingly short windows and with limited bandwidth. This not only improves backup and disaster recovery processes while reducing costs, but also helps overcome backup as a barrier to expanding virtualization across the enterprise.

Applying deduplication technology in VMware environments helps address the challenges of backing up and restoring virtual servers in increasingly short windows and with limited bandwidth.

The Challenges of Backup

Exponential data growth, regulatory requirements, and 24X7 availability requirements (and the resulting decrease in backup windows) have all increased the difficulty in completing both virtual and physical backups successfully in the allotted time for backup windows. Data growth is further exacerbated in virtual environments due to the virtual server (and associated storage) sprawl that virtualization almost inevitably brings. Server consolidation using virtualization adds to the backup window problem, since many virtual servers now reside on one physical server sharing one physical pipe.

With tape backup, it is not uncommon for organizations to routinely exceed their backup window or have a backup window that consumes most of the day, or even multiple days. Such long backup

operations cause increased risk and IT stress, by placing at least some of the data at risk of loss. In many cases, since backing up everything cannot be accomplished within the backup window, organizations are forced into difficult decisions of what gets backed up daily and what does not. Such operations also mean that a guaranteed RPO of anything less than 24 hours cannot be met. Furthermore, tape backup schemes (i.e., grandfather-father-son) require that the same data be backed up over and over again, contributing even more to duplicate data.

Recovery time objectives (RTO) continue to decrease while the precision of the recovery point objectives (RPO) increase. In other words, IT managers must be able to recover from a given failure quicker and with less data loss. The time needed to find, mount, and search tape media is not fast enough to keep pace with the changing RTO and RPO requirements of most organizations.

In addition, with the mechanical nature of tape, operational problems continue to be widespread. While many organizations do not realistically expect to eliminate tape entirely, most want to minimize its use and the corresponding operational problems.

As IT organizations seek to improve their data protection strategy going forward, they must address both the virtual and the physical environments, which together include all of these challenges. In addition, because of consolidations, mergers and acquisitions, many IT organizations are grappling with remote operations, often with very divergent backup hardware and software. In many cases, these remote offices do not have professional IT staff, but should still have the same data protection mandates. Central control of remote backup is essential to maintaining the data integrity demanded by the business.

As data grows exponentially, finding and retaining the right skilled people to manage and maintain a reliable data protection scheme can be difficult. Even if qualified individuals can be found, budgets are tight, and head counts are flat, making it difficult to hire enough people. For both people and technology, the legacy of the economic downturn is the mantra to “do more with less.”

From Tape to Disk

It has been many years since the industry has seen a fundamental breakthrough in tape technology. Tape drives continue to get faster and tapes increase in capacity, but tape still involves the same fundamental challenges it always has.

Automated robots make picking and mounting tapes faster, but offsite archive and retrieval cannot be automated. Tape media must still be handled manually inside and outside the data center. Transportation of tapes outside the data center for DR also involves human intervention and it introduces a major security risk, through the possibility of lost or stolen tapes.

Best practices today include the use of tape solely for archive and long-term retention, with disk based backup as the preferred option for the following reasons:

- To gain higher reliability and certainty of backup job success
- To reduce labor associated with tape handling and offsite transportation
- To provide a platform for deduplication enabling:
    - longer online retention of backup data resulting in faster restores
    - consolidation of backup data from remote offices eliminating distributed remote backup
    - improved DR (using the WAN)

Changing the Data Protection Paradigm with Deduplication

Although backup to disk in and of itself has improved the backup process, data deduplication, pioneered by EMC (Avamar and Data Domain), offers a fundamental change in the way organizations protect data. Deduplication changes the repetitive backup practice used with tape, to only writing unique, new data to disk. This data reduction allows full backups to be done nightly (rather than incremental backups nightly and full backups done only weekly) while requiring a greatly reduced amount of disk storage for backup. Furthermore, with the 95 to 99%+ deduplication rates commonly achieved (especially in VMware environments), backup data can be retained online economically in the data center for long periods of time. This reduces the odds that a data element must be retrieved from tape. In addition, deduplication and resulting data reduction enables backup data to be sent over the WAN, centralizing remote office backups and giving that control back to IT. Deduplication over the WAN also allows an automated disaster recovery (DR) solution at a very low cost. All of these factors can significantly improve the RTO.

ROI/TCO Justification for Deduplication Storage

Business case drivers such as more reliable backup and restore, longer data retention, reduced time/labor, and faster backups and restores offer both soft and hard cost justification.

This white paper discusses case histories from real-world scenarios of three VMware customers using EMC Avamar deduplication. The case studies document the actual savings experienced by these customers, each from different industries.

In the three case studies presented, the net savings ranged from $1.4M to $3.2Million. The ROI ranged from 86% to 450%. In addition, the success of backing up with EMC Avamar solutions contributed to the companies' abilities to minimize the effects of VMware server sprawl and data duplication, and significantly reduce their data protection storage costs. All three companies achieved the business and operational improvements they were seeking, recognizing significant cost savings.

ROI/TCO Analysis Methodology

The ROI and TCO information presented in this white paper is based on a financial analysis conducted by FOCUS analysts. Historical financial data was used whenever possible, with future numbers based on financial projections from the customers, based on past experience.

The data from the customers was entered into a customized ROI/TCO calculator created by FOCUS. This unique tool takes all of the data into consideration, and calculates both ROI and TCO. All of the numerical information and charts in this report were created using the FOCUS tool.

The Business Case

This paper discusses several financial-related terms: return on investment (ROI), total cost of ownership (TCO), direct and indirect savings (including cost avoidance and labor savings), and net savings. A definition of each term follows:

ROI (return on investment)

ROI is a measure of the financial return on an investment over a specified period of years (typically three to five for IT), represented as a percentage. A minimum ROI may be required by corporate finance departments in order to get approval on a project/acquisition.

TCO (total cost of ownership)

A TCO model establishes a fully loaded, total cost of a project over time. Decisions are made by comparing the TCO of one approach to the TCO of another. TCO is a cumulative number, over some period of years (typically three to five for IT), and incorporates the changes in costs and benefits over that period (e.g., due to data and storage growth). TCO includes capital acquisitions, maintenance, and operational costs, and should include both cost components that are *direc*t (e.g., hardware and software acquisition, salary costs of full-time employees) and *indirect* (which are often difficult to quantify, such as the cost of waiting for a file to be restored). The TCO categories used in this paper are ***Hardware, Software, Support, Supplies and Services.*** Salaries generally are based on a 30% burden rate, to cover insurance, benefits, etc.

Total savings

Total savings is the amount of both direct and indirect dollar benefits resulting from the project.

Net savings

Net savings is the net amount saved over a given time, calculated by subtracting the costs for that time period, from the total savings for that time period.

Direct savings

When the project results in a direct cost reduction, where cash outflow is reduced, these reductions are direct savings. Significant direct savings described by users in this paper's case studies include:

- Cost avoidance in hardware and software — these savings are the result of eliminating the need to purchase additional hardware and/or software as a result of the new solution.
- Savings can include avoiding tape hardware and/or disk storage to complete backups within the available backup window, as well as for performing tape backup in remote sites. For users already up against the window, or for users eliminating tape in remote sites, this can be the largest percentage of savings.
- For organizations already using disk-based backup, but without deduplication, savings can also come from adding deduplication and reclaiming storage as a result.
- Savings can also come from eliminating the cost of network upgrades, which were avoided due to reduced bandwidth requirements from backup of remote sites using Avamar's client-based deduplication.

- Supplies and services — these savings involve a reduction in the total cost of tape media and the services to transport and maintain those tapes offsite. For users with a large number of tapes, these savings can be significant.

Indirect savings

When implementing a project can save time and labor (for IT staff and/or end users), the result is considered indirect savings. Cost avoidance in labor is time saved by backup administrators, systems administrators, and/or end users as a result of implementing the project. These savings would allow the choice of either spending time on other projects or potentially reducing headcount (of full-time equivalents or FTEs). For purposes of this paper, this category is calculated as a cost reduction.

IT staff time and labor savings in these case studies are a result of reducing/eliminating tape handling costs for backup and restore, and reducing overall time needed for backup and restore activities.

In the case of end-user time saved due to faster restores, it is an estimate of the cost of downtime due to waiting for a restore of lost data, often referred to as restore latency. Estimates are based on the number of restore events and the number of end-users affected by the restores. These savings represent the business impact of faster restores.

Case Study #1: County Government

The first case study is the county government of one of the most densely populated counties in the United States. The IT organization supports 42 departments, consisting of 6,000 employees who are widely scattered across the county. There is IT support for all the typical county facilities including library branches, health centers, senior centers, the jail, the courthouse, and police and fire stations (most of which, as one would expect, have no IT staff onsite). The IT staff is responsible for backing up all of the enterprise systems. The IT environment includes 330 servers (including physical and VMware VMs) mostly on blades, with 80 TB of data backed up.

The county was experiencing exponential data growth, as shown in Figure 1. File Space nearly tripled during the period of 2007 – 2010. Based on the history and upcoming plans, IT was anticipating ongoing data growth of 30-60%. Storage costs were growing out of control, while budgets were getting slashed, and the CTO was expected to reduce storage costs to help with the county's $100 Million plus deficit.

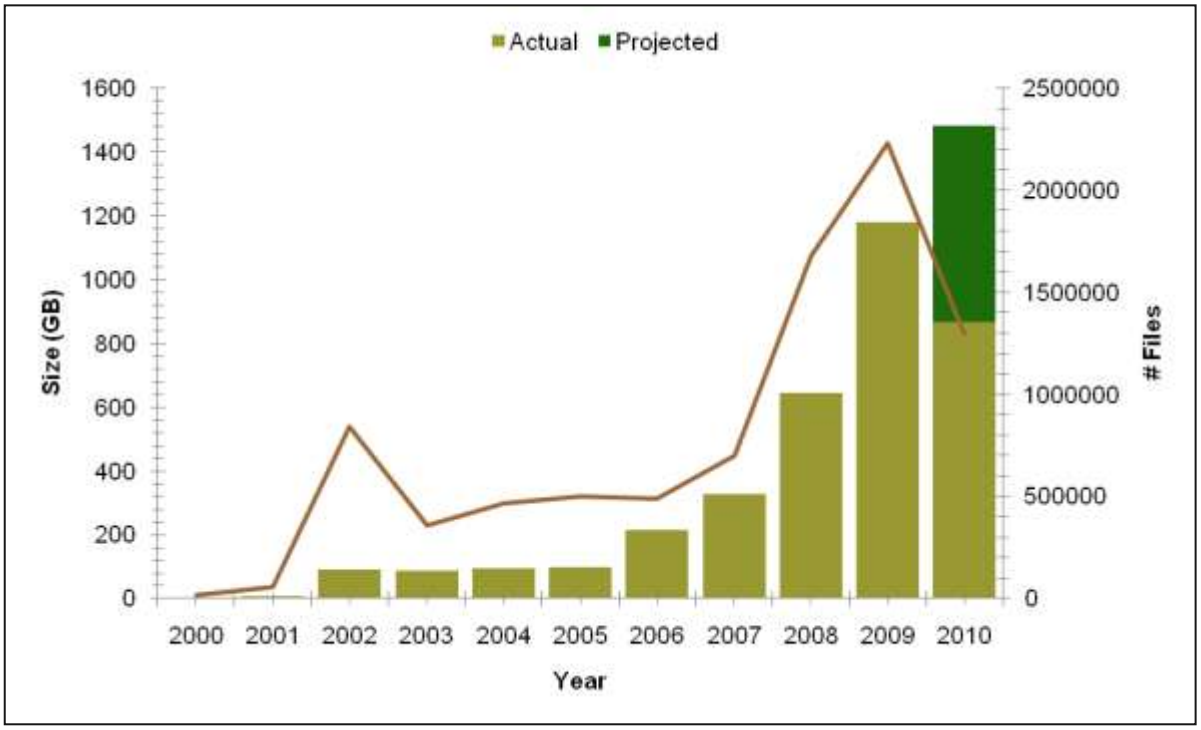


Figure 1: Data Growth – County Government

The IT staff was unable to complete backups within the backup windows, and in fact, full backups exceeded the backup window by 2 days. Backup traffic was a big problem. The restore process was "awful", and users complained about waiting 3 days for their data to be restored.

The CTO described four major goals:

- Get away from tape and tape issues and problems
- Backup everything within backup window

- Reduce the amount of storage for backups
- Decrease restore time to a reasonable timeframe

The County began their analysis with a Proof of Concept, which the CTO summarized by saying, "The POC knocked our socks off!" They were impressed by the dedupe ratios and the resulting storage space savings. As a result, IT moved forward quickly, and their implementation of two Avamar grids resulted in immediate savings, as shown in Figure 2 below. Savings are shown above the zero line, with costs shown in red, below the line.

Savings started immediately in year 1. Direct Savings in year 1 came largely from Cost Avoidance of Hardware/Software ($561,230) - mostly from avoiding disk storage and tape library upgrades. The IT group was also able to eliminate multiple traditional backup products as they moved to Avamar, reducing software license costs.

Indirect Savings in year 1 included Cost Avoidance in Time/Labor ($267,571) – which was split between IT and end-user time. Total Savings for year 1 were $875,571. Subtracting the cost of the Avamar solution in Year 1 ($378,094), yielded a Net Savings in Year 1 of just under a half million ($497,477). (Net savings are calculated by subtracting the Incremental Cost of Disk Backup (shown in red) from the total savings (the sum of Total Indirect Savings (labor cost avoidance) and Total Direct Savings (supplies and services and hardware cost avoidance).

The cost for the Avamar grids was front-loaded for the initial purchase, but there was also some growth of the Avamar grids in Year 2 and Year 3 to keep up with data growth. (This increase in storage was substantially less than would have been required, due to Avamar deduplication.) Including the yearly growth, there was still a positive net savings every year – as indicated by the green line on the chart showing Net Savings.

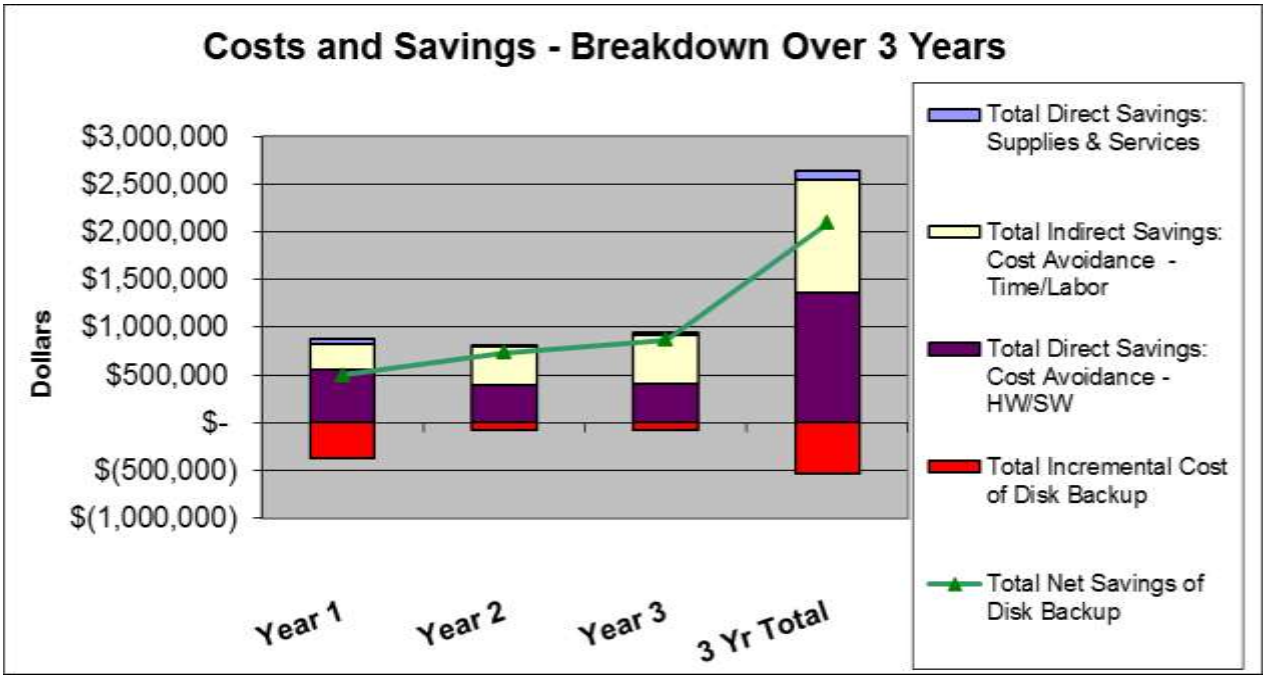


Figure 2: Cost and Savings over 3-year Period for County Government

During Year 2 and Year 3, Time and Labor savings exceeded Hardware/Software Cost Avoidance savings. Over the 3-year period, Hardware/Software Cost Avoidance was 52% of savings, whileTime/Labor was 45% as shown in Figure 3.

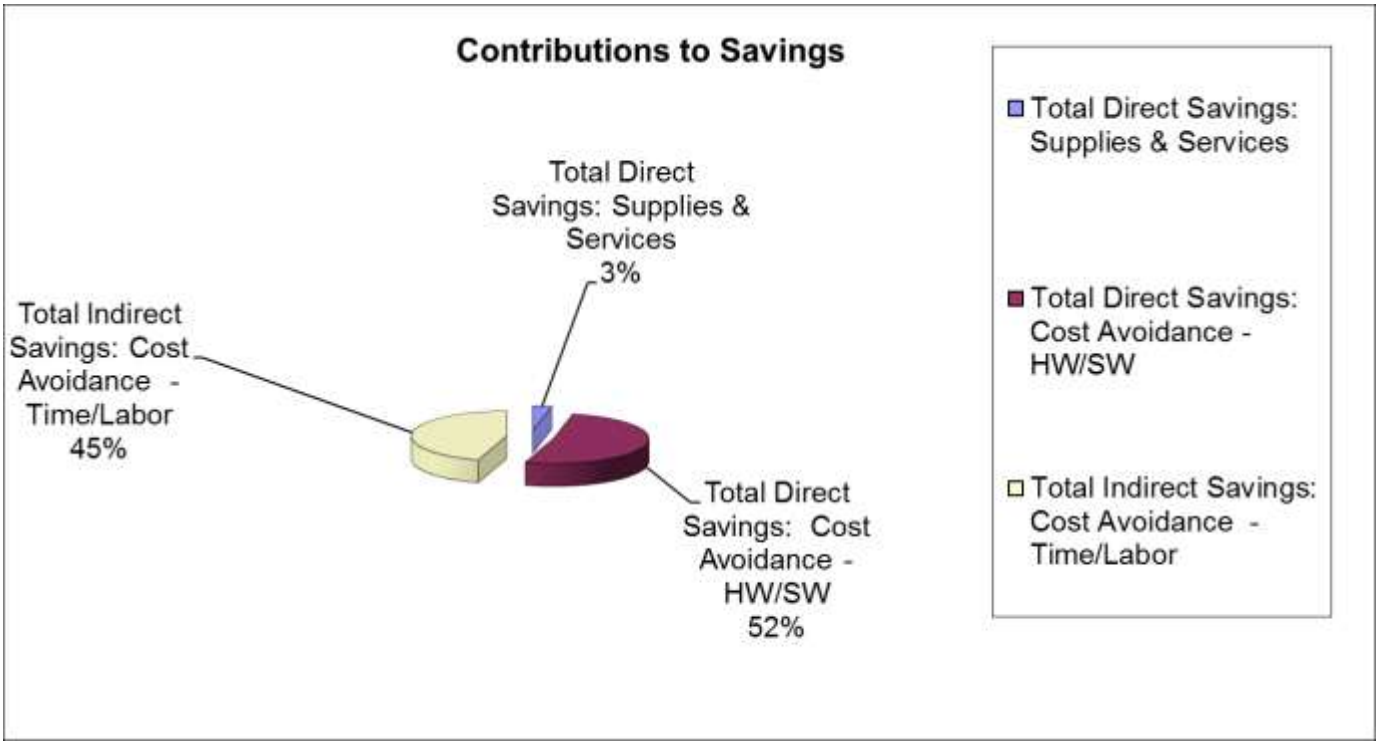


Figure 3: Contributions to Savings for County Government

Many of the goals of the CTO and his organization were focused on operational improvements. Figure 4 gives a summary of the operational aspects of the county's improvements using Avamar solutions.

	Units	Tape Only	Avamar	% Improvement	Savings over 3 Years
3-Year TCO Per TB	**Cost per TB**	$8,892	$4,944	44%	$2,094,001
Backup window	**Hours**	24-36	5	79-86%	
RTO (Recovery Time Objective) achieved	**Minutes/ Hours**	5	0.75	85%	
Backup Data Kept Online	**Days**	25	60	140%	
Data Deduplication Rate	**Percentage**	--	99+%	100%	

Figure 4: Summary of Operational Improvements for County Government

The TCO all-in costs over the three years resulted in a savings of just over $2 Million, representing a 44% improvement in TCO/TB. The backup window improved dramatically – in some cases from three days to three hours, and allowed the entire environment to be backed up with full daily backups. Restores went from a minimum of five hours to less than an hour. Both backup and restore time reductions were roughly 85% improvements.

In addition to dramatically improving both backup and recovery times, Avamar's deduplication technology achieved 99%+ deduplication rate. This resulted in the ability to keep 60 days of backup data online. (VMware environments generally have very high deduplication rates because the OS and application software images in the VMs create a significant amount of duplication across VMs, making these environments great candidates for deduplication).

Figure 5 shows the financial summary over the three-year period. Before Avamar, Hardware/Software costs were growing constantly to keep up with exponential data growth. These savings are reflected in the cost avoidance numbers in this chart. Moving away from tape and its labor-intensive processes, and reducing both backup and restore times also resulted in significant savings in Cost Avoidance in Time and Labor.

Some growth was required on the Avamar grids, as shown in years 2 and 3, but dedupe kept the upgrade costs very reasonable.

Over the 3-year period, the County saw a Total Savings of $2,634,116. With a total investment in Avamar solutions over the three years of $ 540,115, there was a Net Savings of $2,094,001, with an outstanding Return on Investment of 388%.

Savings:	Yr. 1	Yr. 2	Yr. 3	Total
Direct Savings- Supplies & Services	46,769	16,795	21,833	85,397
Cost Avoidance- HW/SW	561,230	393,955	402,842	1,358,027
Cost Avoidance – Time/Labor	267,571	401,357	521,764	1,190,692
Total Savings	**875,571**	**812,107**	**946,439**	**2,634,116**
Costs:				
Total Incremental Cost of Avamar	378,094	81,011	81,011	540,115
Summary:				
Total Net Savings with Avamar	**497,477**	**731,096**	**865,428**	**2,094,001**
ROI (3 Years)				**388%**

Figure 5: Financial Summary for County Government

Figure 6 offers a deeper look into the TCO comparison of tape-only versus the move to Avamar's deduplication backup software and system. The Total Cost of Ownership for continuing with their previous Tape-only scenario was $4.7 Million versus a TCO for Avamar of $2.6 Million, a total reduction of just over $2Million.

The total cost of Tape Backup Hardware and Maintenance, shown in blue and red respectively, was $1.8 Million, which with Avamar was reduced to $1.14 Million. The other significant component, shown in light blue, is IT Administration Cost (labor), which was reduced by $586,460.

The other key area of improvement for the County was outside of the IT organization itself. Given the fact that users previously often had to wait three days for restores, the effect of faster restores on the end users was significant. This business impact of faster restores is shown in the Avamar TCO column, in purple below the zero line, and was estimated by the County to be $604,232.

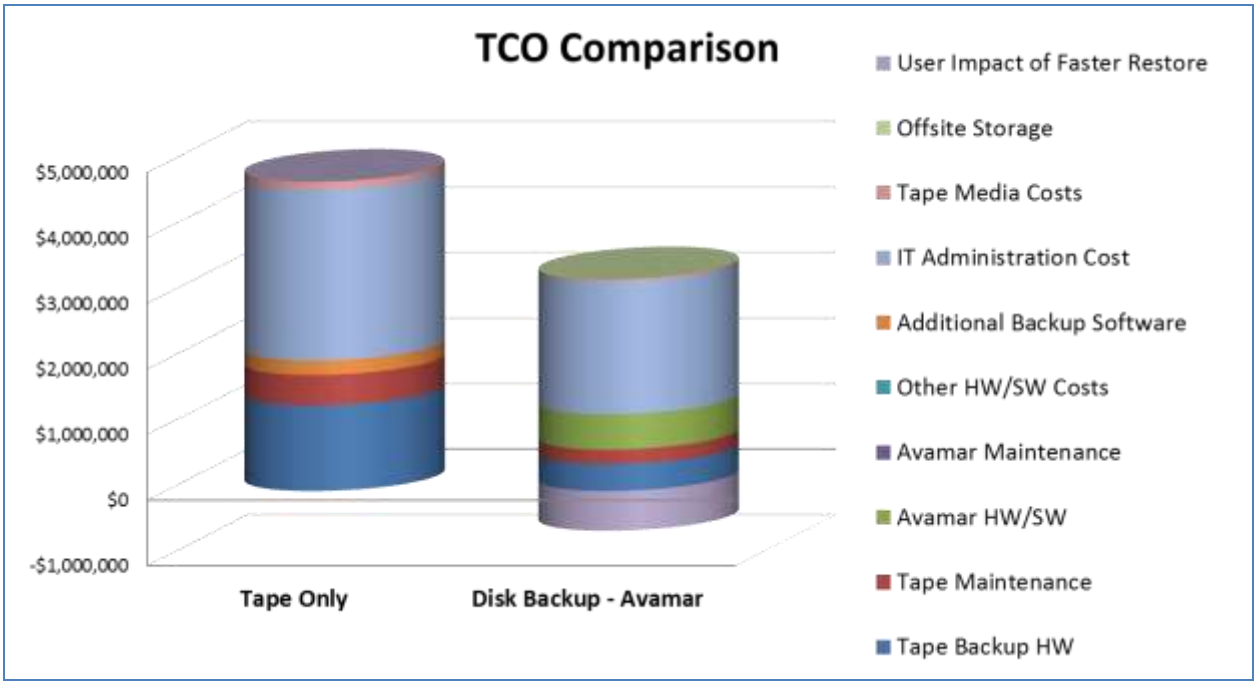


Figure 6: TCO Comparison for County Government

In addition to the financial benefits, the CTO had high praise for the operational results. "Everyone is happy with backup and restore times and the ease of restore. Our Sysadmins are a terrific testimonial because they are not here all night and their customers aren't screaming!'

Backup improvements included not only reduced time (backup of shared network drives (6 TB) went from three days to three hours) but also the impact on the network ("Backup traffic is no longer killing us"). This shows the power of Avamar deduplication, resulting in actually backing up only the unique changed blocks on a daily basis – in this case 30-40 GB of new data per night.

Because of the reduced storage requirements, they were able to move to 30-60 days online backup retention. Overall, the improvements in backup, restore and online retention had a major effect on the

data protection strategy and execution. The CTO summarized by saying, “We were making really bad compromises because we couldn’t do proper retention periods. Now we follow best practices.”

Based on their success to-date, IT is now working on moving to image backups leveraging Avamar’s integration with VMware’s vStorage APIs for Data Protection (VADP) and changed block tracking (CBT). They are also now looking at implementing Avamar at SunGard for disaster recovery.

Case Study #2: Hospital and Clinic Group

The next case study is a health care group consisting of 3 hospitals and 20 to 30 clinical locations, and including 250 providers. The IT environment consists of 450 servers, with 68 TB of storage, and 26 TB of data backed up. Servers run a typical mixed environment of Windows, SQL, Oracle, and VMware vSphere. The Group is in the process of consolidating to a primary and secondary datacenter, and going from 50 VMs to 400 VMs. Data growth has been roughly 50% growth per year, slowing to 30%. In total, they were using five different backup systems, many of which were not current and not in compliance with their license agreements. There were also seven different (and some very old) tape libraries in use. In addition, the remote hospitals were all responsible for their own backup, creating huge reliability issues. As part of the consolidation, they made the decision to convert all VM backup to Avamar, and use replication for disaster recovery.

Their challenges revolved around reliability and time of their backups. They could not meet their backup windows, since it required 7 days to back up everything, and they did not have enough disk or tape resources to back up all the data. Because it took a full week to back up everything, on any given day only a few servers were backed up. They also were having significant issues with tape reliability and failing drives, requiring “extensive babysitting “of all their backup jobs.

Like many hospitals, they were working on upgrading to a new electronic medical records (EMR) system and needed to improve their backup for use by the entire hospital group, including both the data centers and all the remote hospital clients. Overall, they were focused on three major goals:

- Ensure reliable backup for the new EMR system
- Get all servers backed up (physical and virtual) within a reasonable window
- Improve the reliability of both backup and restore

As part of their initial project research, they talked with another health care customer who had implemented Avamar with their planned EMR system. According to the Hospital Group Director of Technical Services, “Their success, backup times and dedupe rates got our attention.” Based on that, they proceeded with a proof of concept (POC) with extremely positive results. “With Avamar’s ease of use, our POC was way too easy. The system was up within two hours, and backed up four systems, including local and remote sites, and including testing the restores. There was nothing to it.”

To achieve their goals and get rid of all the tape as soon as possible, they made a major initial investment up front, with significant Avamar grids in both datacenters (with the remote sites having Avamar software agents only). This allowed them to begin backing up everything every day. (They previously backed up only 70% every day.)

As Figure 7 shows, they saw immediate savings in Year 1 of just under a million dollars ($995,307), with positive net savings achieved by Year 2. In Year 3, they upgraded the Avamar grids significantly, adding more disk storage to handle their data growth. Because the upgrade occurred in Year 3, in order to include the benefits of the upgrade, the analysis for this case study was based on 5 years. Positive net savings was achieved for Years 2, 4 and 5, and overall for the entire 5-year period.

The initial savings in Year 1 were largely due to Hardware/Software Cost Avoidance. However, over the 5-year period, slightly more savings came from Time and Labor savings (54%) versus Hardware/Software Cost Avoidance (43%).

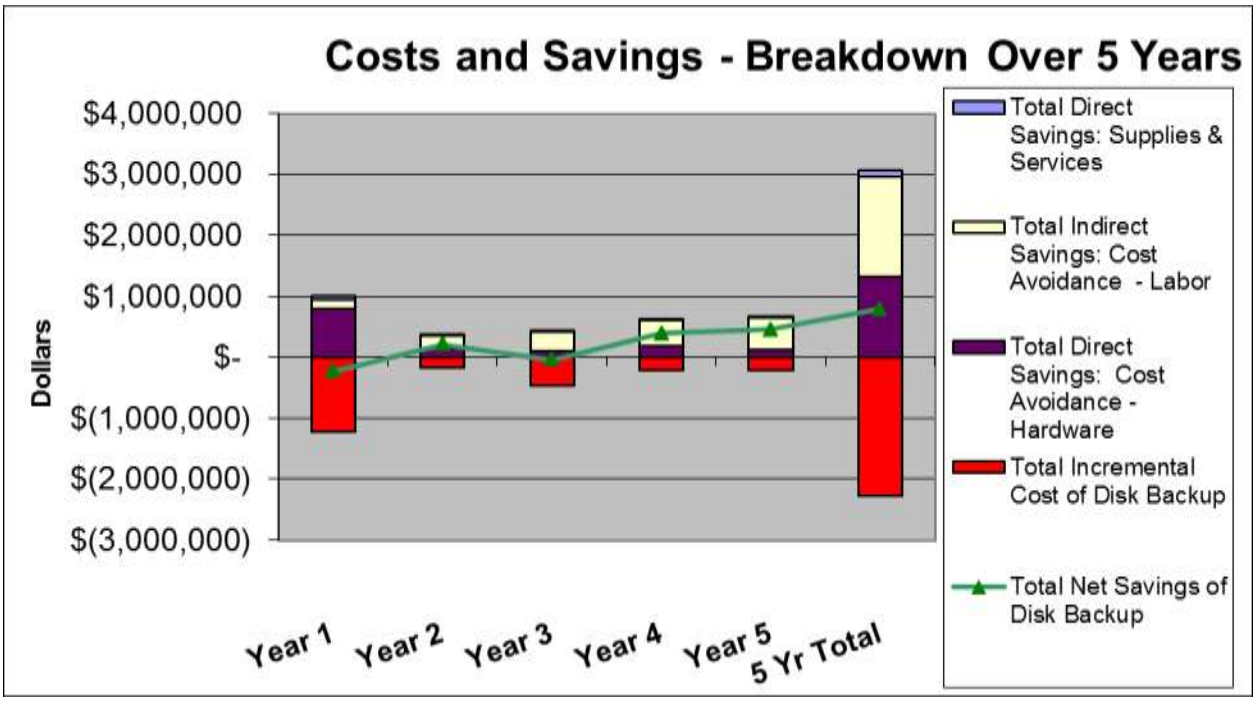


Figure 7: Costs and Savings - Hospital Group

Figure 8 shows both the TCO improvement as well as the operational improvements of the Avamar implementation. Over the 5-year period, the Hospital Group achieved a TCO reduction of $787,021. In addition to the major reduction in tape hardware, this number also included a reduction in tape media, other hardware, and time and labor. Savings in tape media were just under $100,000and represent an 82% improvement in tape media cost per TB.

The backup window was a "huge change", and they can now actually back everything up within 12 hours. As the Director of Technical Services put it, "Because it previously took a full week to back up everything, on any given day only some of the servers were backed up. Now we backup everything every day. We were playing Russian roulette and it was very scary. Now we sleep at night."

> ***"Because it previously took a full week to back up everything, on any given day only some of the servers were backed up. Now we backup everything every day. We were playing Russian roulette and it was very scary. Now we sleep at night."***
>
> **Director of Technical Services, IT**

Recovery time also changed dramatically, and was reduced from often taking 3 to 4 days down to 12 hours. Avamar's deduplication also now allows them to retain 30-60 days of backup data online.

	Units	Tape Only	Avamar	% Improvement	Savings over 5 Years
3 Year TCO Per TB	**Cost per TB**	$10,542	$8,033	24%	$787,021
Tape Media Cost Per TB	**Cost per TB per Year**	$2,549	$471	82%	$96,690
Offsite Storage & Transportation Costs	**Cost Per TB**	$0	$0		$0
Backup window	**Hours**	5-7 days	12 hours	90%	
RTO (Recovery Time Objective) achieved	**Minutes**	3 to 4 days	12 hours	83%	
Backup Data Kept Online	**Days/Weeks**	14 days	14 - 30-60 days		

Figure 8: Operational Improvements - Hospital Group

Figure 9 gives the financial summary, and shows the numbers behind the charts. Looking at the breakdown of savings and costs by year, this summary shows the Avamar investments in Year 1 and Year 3, and the positive net savings for all other years and overall for the 5-year period.

It also shows a Total Savings of just over $3 Million, with a Total Cost of $2.3 Million, yielding a Net Savings of $787,021, and an ROI of 35%.

Savings:	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Total
Direct Savings- Supplies & Services	$ 54,042	$ 6,476	$ 9,066	$ 11,785	$ 15,321	$ 96,690
Cost Avoidance- HW	$ 790,187	$ 137,224	$ 97,874	$ 187,874	$ 114,074	$ 1,327,232
Cost Avoidance - Labor	$ 151,078	$ 226,617	$ 317,264	$ 412,443	$ 536,176	$ 1,643,579
Total Savings	**$ 995,307**	**$ 370,317**	**$ 424,204**	**$ 612,102**	**$ 665,571**	**$ 3,067,501**
Costs:						
Incremental Cost of Avamar	$ 1,220,480	$ 163,000	$ 463,000	$ 217,000	$ 217,000	$ 2,280,480
Summary:						
Total Net Savings with Avamar	**$ (225,173)**	**$ 207,317**	**$ (38,796)**	**$ 395,102**	**$ 448,571**	**$ 787,021**
ROI (5 Years)						**35%**

Figure 9: Financial Summary - Hospital Group

Examining the TCO comparison in Figure 10 highlights several key points. The TCO for the previous tape-only scenario was $3.3 Million, while the TCO for Avamar deduplication backup software and system was $2.5 Million, a reduction of $787,021. The biggest TCO component of the tape-only environment was Labor, shown in blue. This was a huge savings with Avamar, as shown, which started immediately upon the elimination of tape. The IT staff was able reduce their backup staff requirements from two full-time equivalents (FTEs) to roughly one-sixth of one FTE. (Previously they had two FTEs spending 320 hours per month on backup, now they have one person spending only 30 hours/month on backup). In addition to the Time and Labor reduction, the Director of Technical Services added, "Avamar has improved our backup reliability immensely. We no longer worry about failed jobs, or switching tapes at remote sites."

Tape Backup Hardware and Maintenance cost was another major component, at a cost of $936 thousand, representing a reduction of $907 thousand in the Avamar TCO column.

Moving to Avamar also saved the Group on software. Traditional Backup Software using tape-only was $253,662 and dropped to $73,552 with Avamar, yielding a savings of an additional $180 thousand.

In addition, because IT previously could not meet the backup windows, the IT staff had concluded that 30 servers would have required upgrades to try to meet their window. This upgrade was avoided, and IT eliminated one NAS device that was no longer needed, offering an additional savings in Other Hardware/Software Costs of $240 thousand.

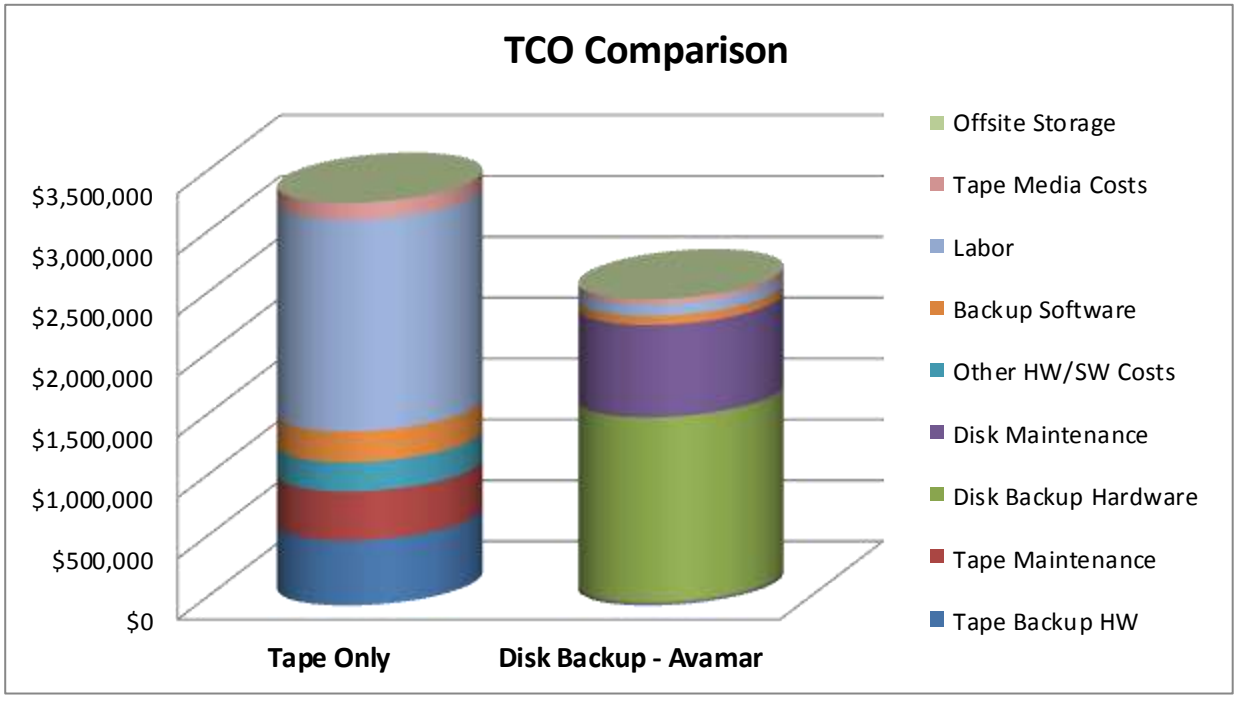


Figure 10: TCO Comparison Tape Only vs. Disk Backup - Hospital Group

When reviewing these numbers, the Director of Technical Services was quick to point out, "The ROI and TCO reduction is good, but it doesn't even factor in the reliability and security issues, or the chance we were taking that we wouldn't have been able to recover in some cases."

Case Study #3: Travel and Hospitality Company

The third case study is a travel and hospitality company with over 2 million customers worldwide, 7000 employees, and an IT staff of 150. There is one primary datacenter, one secondary data center, and a disaster recovery site, along with 15 remote offices. They run a mixed environment of Windows, Solaris, and Red Hat Linux, and are virtualized on VMware ESX, upgrading to vSphere. There are 200 servers, with over 500 VMs, and 40 TB of data across multi-vendor storage, which they are moving towards EMC.

There were two major components to the backup upgrade project.

1. Remote site backups were highly unreliable. They had no IT staff onsite, so business people were swapping tapes and were supposed to arrange for offsite storage, which was not reliably happening. They had "lots of anxiety on restores, and prayed that everything worked."
2. Datacenter backups were done to an aging tape library, with a high failure rate, and they were concerned about rapidly growing offsite storage costs, particularly with the addition of another data center. Tapes were also being used past their useful life. They wanted to "take control of backups, but without eating up the network." To avoid the cost of upgrading network links from all the remote sites (which are VMware sites), they were looking for source-based deduplication from the remote sites, to allow backup using low bandwidth.

They approached the project with three major goals:

- Improve backup reliability of the remote VMware sites without requiring a WAN upgrade
- Reduce the cost of backup and reduce/eliminate offsite backup storage and transportation costs
- Go tapeless

They implemented Avamar grids in the data centers, with Avamar software agents on the clients in the remote sites, and were up and running and backing up all remote sites within 30 days. As a result, there were huge savings starting immediately in Year 1, as shown in Figure 11.

Cost Avoidance from Hardware/Software in Year 1 was just over $400 thousand, with Time/Labor Cost Avoidance of $174 thousand. Total Savings in the first year were $611 thousand. With the initial cost of Avamar of $140 thousand, there was a Net Savings in Year 1 of $471 thousand, and a Net Savings over the 3-year period of $1.3 Million. Including all savings, they achieved positive net savings every year, as shown by the green line.

Without Avamar, to improve their remote site backups, they would have had to upgrade all the network links to the remote sites over the next few years. As a result of implementing Avamar with client side deduplication and the resulting reduced bandwidth requirements, during Year 2 and Year 3, they had additional Hardware Cost Avoidance savings by avoiding any WAN link upgrades. As the VP of Technology so aptly put it, "Our remote VMware sites have lots of duplication (software images and data), with a low change rate, and low bandwidth from those sites. This is really Avamar's sweet spot!"

"Our remote VMware sites have lots of duplication (software images and data), with a low change rate, and low bandwidth from those sites. This is really Avamar's sweet spot!"

VP, Technology Services

Travel and Hospitality Company

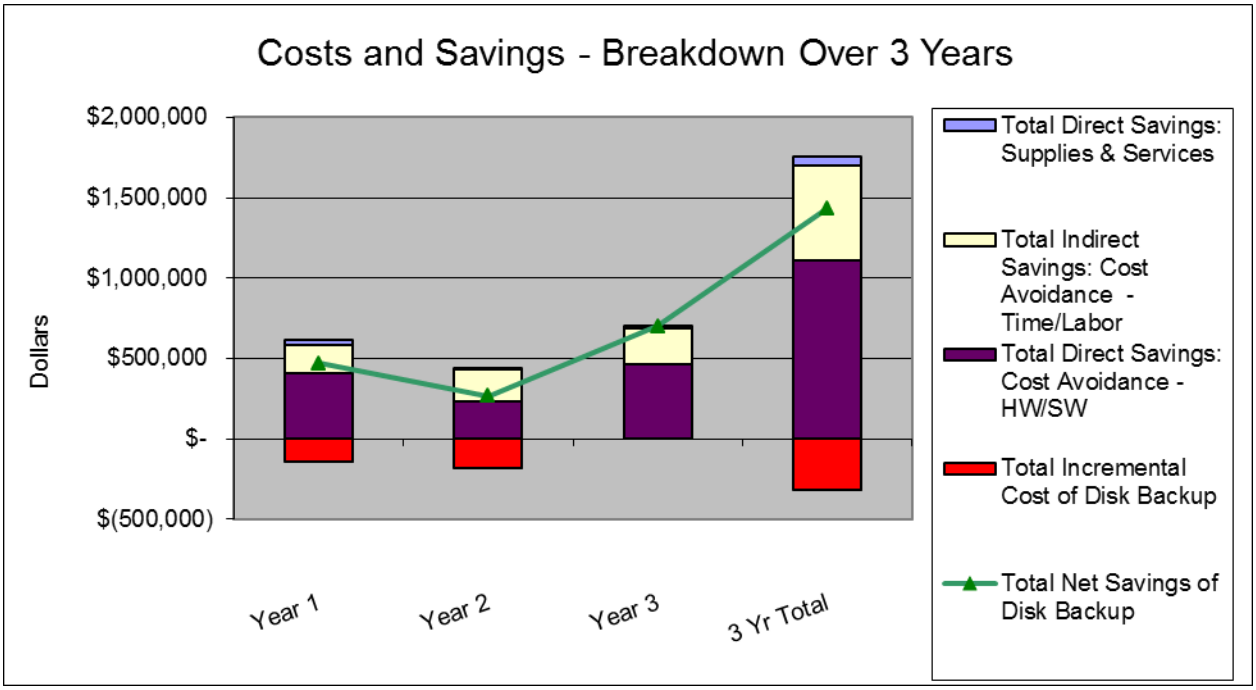


Figure 11: Costs and Savings by Year - Travel Company

In terms of cost and savings breakdown by category, Year 1 savings were mostly Hardware/Software Cost Avoidance. In Year 2, Time and Labor savings were about equal to Hardware/Software Cost Avoidance, and in Year 3, Hardware savings were again a larger percentage. No additional expansion was required of Avamar grid, increasing the net savings in Year 2. Over the 3-year period, Hardware Software Cost Avoidance represented 63% of the savings, with Time/Labor being 34%.

In addition to overall savings, IT also experienced improvements in TCO and cost per TB, as well as operational improvements. Figure 12 shows the reduction in 3-year TCO per TB for the previous tape only environment versus the Avamar implementation, showing a 66% improvement and a 3-year savings of $912 thousand.

In addition, in terms of operational improvement, the backup window, including VMware backups, was reduced from 72 hours to 6 hours, and "the backup failure rate went from 5-10 per day, to 5 per week."

There were additional benefits specific to the VMware environment as well. "Before Avamar, backups were slowing down our guest VMs, which kept trying to back up at the same time. We were constantly having to adjust, and backup management was a pain in the neck. Now we have increased our consolidation ratio, and Avamar has made the management nightmare go away."

Recovery time was also reduced, from 25 hours to 1 hour. Based on these results, both backup and restore experienced over a 90% improvement. Furthermore, with Avamar deduplication and the reduced cost of online storage, the company was able to move to an online retention period of 7 years.

	Units	Tape Only	Avamar	% Improvement	Savings over 3 Years
3 Year TCO Per TB	Cost per TB	$6,512	$2,183	66%	$912,256
Offsite Storage & Transportation Costs	Cost Per TB	$900	$787	13%	$16,872
Backup window	Hours	72	6	92%	
RTO (Recovery Time Objective)	Hours	25	1	96%	
Backup Data Kept Online	Days/ Weeks/ Yrs	2 days	7 years	--	

Figure 12: Summary of Operational Improvements - Travel Company

Figure 13 gives the overall financial summary, showing a total savings of $1.75 Million, and a total incremental cost of $319 thousand, resulting in a total net savings of $1.4 Million. This represents an extremely high ROI over the 3-year period of 450%.

Savings:	Yr. 1	Yr. 2	Yr. 3	Total
Direct Savings - Supplies & Services	$ 31,400	$ 12,992	$ 14,551	$ 58,943
Cost Avoidance- HW/SW	$ 405,217	$ 234,987	$ 466,357	$ 1,106,561
Cost Avoidance – Time/Labor	$ 174,820	$ 195,798	$ 219,294	$ 589,912
Total Savings	**$ 611,437**	**$ 443,777**	**$ 700,202**	**$ 1,755,416**
Costs:				
Incremental Cost of Avamar	$ 140,000	$ 179,000	$ -	$ 319,000
Summary:				
Total Net Savings with Avamar	**$ 471,437**	**$ 264,777**	**$ 700,202**	**$ 1,436,416**
ROI (3 Years)				**450%**

Figure 13: Financial Summary - Travel Company

Figure 14 illustrates the breakdown of the TCO categories. The TCO for the previous Tape-Only environment was $1.9 Million versus the TCO for the new Avamar environment of $460 thousand, a reduction of $1.4 Million.

There were several major contributors to this improvement. First was the avoidance of the network upgrades to the 14 remote sites, due to Avamar's reduced bandwidth requirement. This is shown under Other Hardware/Software Costs and reflects a savings of over $500 thousand.

The second highest contributor was a reduction in Traditional Backup software by moving to Avamar, resulting in savings of just over $550 thousand.

The reduced time of backup and restore added additional IT administration savings of $160 thousand.

As a result of Avamar's reduced restore times, there was also a major improvement for the users outside of IT. Based on the frequency of restores and the time impacts on the end-users, there was an additional End User Business Impact of Faster Restores of $430 thousand.

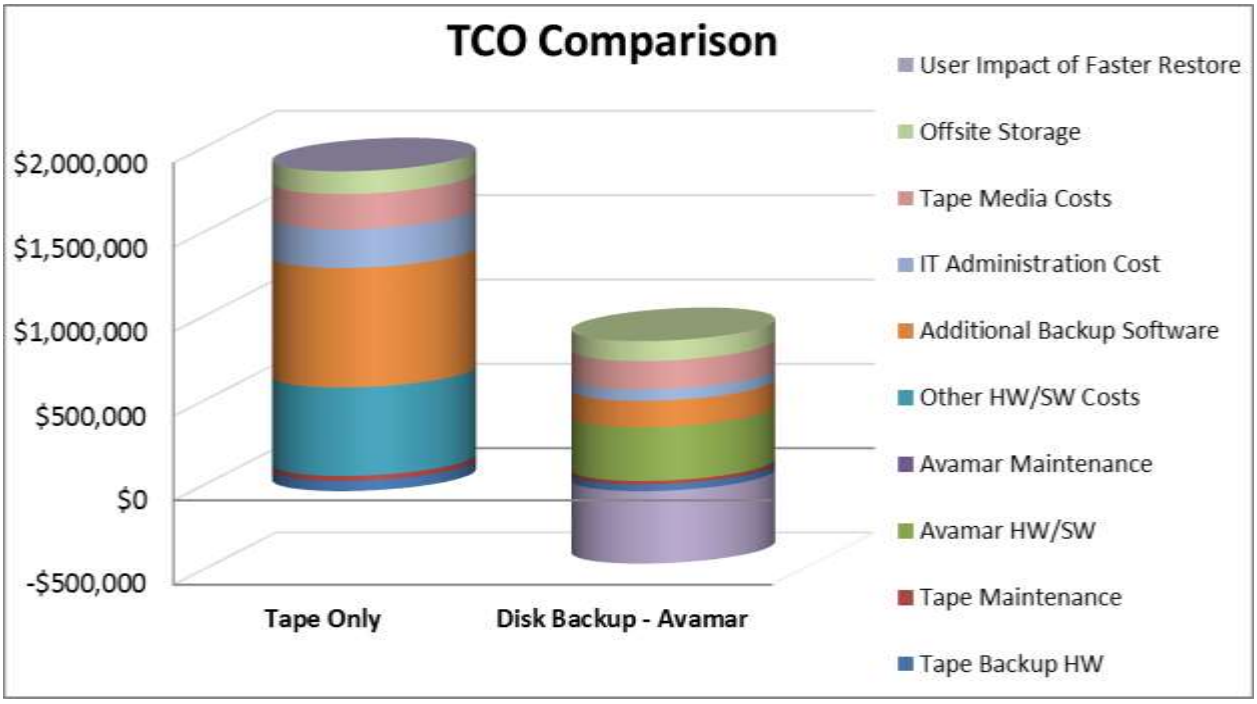


Figure 14: TCO Comparison of Tape Only vs. Disk Backup with Avamar - Travel Company

Overall, according to the VP of Technology Services, "Avamar has done a fantastic job of solving our problems, and things have gone exceptionally well."

Conclusions

Deduplication has proven itself as a game changing technology, with both financial and operational benefits and the potential for a radical change in the way companies protect both virtual and physical environments. What this means is that data protection, including backups and DR, can become reliable, highly automated and efficient, with fast backup times and fast recovery from local and remote storage becoming a reality.

Deduplication Benefits with VMware

- **Server sprawl and VM duplication becomes moot relative to storage for backups**
- **High deduplication ratios (96-99%+)**
- **Full backup of remote sites can be done without any network upgrades due to client dedupe**
- **Reduce disk storage required for backups**
- **Easy to implement/use**
- **Reliable, nightly full backups within backup window**
- **Increased online backup retention – much faster and easier restores**

Deduplication and VMware Virtualization

Deduplication plays an especially important role when implemented in conjunction with virtualization. The nature of virtual servers is to create multiple copies of the same or similar VM images, including OS and application software, as well as application data. This creates large amounts of duplication. As virtualization grows, along with the ease of provisioning new VMs comes virtual server sprawl, increasing duplication even more. This makes VMware environments great candidates for deduplication.

With backup as a top pain point for implementing/expanding virtualization, in order to grow the virtualized environment, organizations need to improve their virtual backup operations, meeting shrinking backup windows and minimizing backup storage costs. Again, deduplication offers great benefits here.

In addition, organizations with remote VMware sites connected over low bandwidth are particularly good candidates for the network benefits Avamar can bring. Avamar's client side deduplication greatly reduces the bandwidth needed for backup of those remote sites. For organizations who have been using disk-based backup (without deduplication), Avamar offers additional benefits in reducing disk space through deduplication.

It should be noted that Avamar provides deduplicated backup and recovery for both virtualized and physical environments, improving overall data protection for the enterprise. This benefits companies as they transition from physical to virtual infrastructure, by providing a single management interface and global deduplication across both environments.

Avamar and VMware Customer Results

These three VMware Avamar case studies show a variety of companies, of different sizes, in different industries, private and public sector, with different environments. All show huge improvements in their in backup and restore operations with cost savings across the board, and a solid return on their Avamar investments. In addition to local storage improvements and savings, deduplication enabled backup over

the network, reducing network costs. The companies profiled here all were able to move to a new paradigm for backup and DR, including the replacement of tape and backup of remote sites while avoiding network upgrades. This paradigm shift offers IT organizations the opportunity to minimize tape use, and all the associated management costs.

Overall, these VMware and Avamar customers are extremely pleased with their results. They have successfully leveraged these two game changing technologies together to achieve more reliable and efficient backups and restores, improved and cost-effective disaster recovery plans, more productive IT and end-user staff, and a stronger foundation for continued exponential growth of data and virtualization – all while reducing costs, yielding a solid return on their investment.

Appendix A: Effects of Deduplication on TCO Components

TCO Category	TCO Component	Effect of Deduplication Storage	Calculation of Costs/Savings
Hardware & Software	Tape Backup HW & Maintenance	Reduction or elimination of need for any or additional tape libraries, drives or media servers in local and/or remote offices	No additional tape HW, possible elimination of current HW, avoidance of future HW
	Dedupe Backup Storage and networking HW/SW & Maintenance	Incremental cost of deduplication HW for storage and WAN Vaulting/replication Savings from reclaiming storage used for disk-based backup without deduplication Eliminating cost of network upgrades avoided due to reduced bandwidth requirements with dedupe	Incremental initial costs plus any additional required over analysis period Subtract cost of disk storage reclaimed through dedupe Subtract cost of network upgrades
	Traditional Backup SW Licenses & Maintenance	For Avamar, deduplication software replaces traditional backup software. No cost agents avoid cost of additional backup SW agent licenses.	For Avamar, substitute Avamar cost for traditional backup SW cost (reducing additional license costs and eliminating agent costs)
Support	Labor (Backup Admin FTEs)	Reduced labor in tape mounting, handling, and transporting from remote offices.	Number of hours saved per week
	Labor (Sysadmin, Backup Admin FTEs)	Time saved due to faster restores.	Number of restores per week times number of hours saved per restore due to data being kept online
	Time/Labor (End-Users)	End-user time saved/yr due to faster restores	# of users affected times # of restores per week
Supplies	Tape Media	Reduction in number of tapes.	Reduced # of tapes in inventory and added per year (after implementing EMC Backup) times cost of tape
Services	Offsite Tape Storage & Transportation	Reduction in storage, transportation, and tape recall costs. Potential elimination of service contracts at remote sites.	Average reduction in invoiced costs after implementing EMC Backup

Appendix B: Case Study Details

	#1	#2	#3
Amount of Storage in TB	170	68	150
Amount of Data in TB	80	26	40
% Growth over 3 Years	50%, 30%,,60%	50%, 40%, 30%	12% each year
Annual tape media cost before using Avamar	$11,197	$7,377	$13,200
Ongoing cost of tape media after using Avamar	0	$3,060	$6,600
Offsite Storage Costs/Yr Before using Avamar	0	0	$40,000
Offsite Storage Costs using Avamar (Yr 1)	0	0	$35,000
# FTEs for Backup and Support	4	2	.5
Tape Handling Hours Saved	30 hours/week	69 hours/week	8 hours/week
Admin Time Saved due to faster Restores	6 hours/week	0	6 hours/week
User Time Saved due to faster Restores	34 hours/week	8.6 hours/week	37.5 hours/week
Data Kept Online using Avamar	60 days	60 days	7 Years
Data Deduplication Rate using Avamar for all protected applications	99%+	96%+	99%+
Backup Window Before and After using Avamar	24-36 to 5 hours	5-7 days to 12 hours	72 hours to 6 hours
Recovery Time Improvement	5 hours to 45 minues	3-4 days to 12 hours	25 hours to 1 hour

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Other Related EMC Deduplication Information:

http://www.emc.com/products/family2/avamar-family.htm

http://www.emc.com/collateral/software/data-sheet/h2568-emc-avamar-ds.pdf

http://www.emc.com/collateral/software/data-sheet/h2823-avamar-vmware.pdf

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About Focus, LLC

Barb Goldworm, founder, president and chief analyst of Focus, LLC, is a well-known industry expert, frequent keynote speaker, book author, and columnist on virtualization, cloud computing, systems and storage. Barb has spent 30 years in technical, marketing, sales, senior management, and industry analyst positions with IBM, Novell, StorageTek, EMA, and multiple startups. In addition to being a frequent speaker, Barb is Virtualization Chair for *Interop*, *COMDEX,* and *Data Center Insight*s, chaired *Blade Systems Insight* and the *Server Blade Summit on Blades and Virtualization*, created and chaired the Network Storage Track of *Interop*, and has been one of the top rated expert speakers at *Data Center Decisions* and *Storage Networking World*. Barb has been a regular expert columnist and speaker for *TechTarget, Ziff-Davis, Computerworld Storage Networking World Online, Network World* and *Information Week*. She has served on multiple advisory boards and has been a frequent judge for awards such as Best of VMworld, and Product of the Year. She has published hundreds of articles, business and technical white papers and market research reports, as well as the book, "*Blade Servers and Virtualization*", published by Wiley.

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