

Lab Validation Report

IBM Tivoli Storage manager for Virtual Environments

Robust, Comprehensive Data Protection for Virtualized Environments

By Tony Palmer, Senior Lab Analyst

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ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about data center technology products for companies of all types and sizes. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. This ESG Lab report was sponsored by IBM.

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Introduction

This ESG Lab report focuses on hands-on evaluation and testing of Tivoli Storage Manager (TSM) for Virtual Environments and FlashCopy Manager for VMware from <u>IBM</u>. Testing validated TSM for Virtual Environments and FlashCopy Manager for VMware focusing on ease of deployment and use, application integration and support, and VMware cluster protection.

Background

Figure 1. Data Protection Challenges

The impact of data's unfettered growth on how that data is protected is an issue that has IT managers concerned. The problem with capacity growth is twofold: Can the system accommodate it and can backups be executed in time? And in terms of protection, how much is enough? As presented in Figure 1, the top two data protection challenges identified by IT organizations in response to a recent ESG research survey are reducing backup times, identified by 50% of respondents and costs (56%). Data protection for virtual environments (37%) and keeping pace with data growth (42%) were noted as significant challenges as well.¹

In the same survey, IT managers told ESG they would like to move toward a unified strategy for physical and virtual server protection. Since organizations deploy server virtualization in phases, a level of heterogeneity exists between physical and virtual workloads. Just over half of all respondent organizations currently use separate backup applications to protect data residing on physical and virtual machines. However, when respondents were queried on their *preferred* approach, more than two-thirds cited a preference for a single backup application for both physical and virtual environments. So, while IT is willing to diversify data protection solutions, adding one specifically for virtualization solutions does not appear as a preference.²



Which of the following would you characterize as challenges with your organization's current data protection processes and technologies? (Percent of respondents, N=220)

¹ Source: ESG Research Report, <u>*Trends in Data Protection Modernization*</u>, August 2012.

² Source: Ibid.

IBM TSM for VE

IBM Tivoli Storage Manager is a scalable software offering from IBM designed to provide centralized, automated data protection. TSM software offers not only backup and recovery management, but also hierarchical storage management and functionality that helps users manage massive amounts of data simply and easily. TSM is compatible with all modern operating systems, from Windows and Linux to zOS, and offers components tailored for protection of virtualized environments and business critical applications.

IBM Tivoli Storage Manager for Virtual Environments is designed to enable organizations to protect the massive amounts of information generated on virtual machines without disruption to other operations on the server while enabling restores of data quickly and easily. Figure 2 depicts a simplified view of how TSM for VE fits into the TSM architecture. The VMware vStorage API is fully supported for optimized virtual machine protection. The TSM for VE Recovery agent runs on each VMware vStorage backup server and leverages VMware changed block tracking and TSM "incremental forever" technology to facilitate fast, efficient, consistent backups and restores while reducing resource and storage requirements. Flash Copy Manager for VMware integrates local storage snapshot technology for instant, non-disruptive backups and restores that can be fully catalogued by TSM.



TSM for VE offers numerous benefits for Virtual Environments including:

- TSM for VE uses the vStorage API for Data Protection to interface with VMware hypervisors or vCenter.
- Backup and restore of individual virtual machines leveraging VMware changed block tracking (CBT).
- Block-level "incremental forever" progressive incremental backup improves efficiency, reduces resource and storage requirements, and improves performance in virtual environments.
- TSM for VE provides seamless application protection with agentless Exchange and SQL Server integration.
- Agentless virtual machine image, volume, and file-level restore capability from a single backup.
- Offload of backups from the hypervisor to a vStorage backup server (physical or virtual).
- Movement of virtual machines by vMotion will not break or duplicate backups.
- New or moved virtual machines are automatically discovered.
- Simplify management of the backup and restore process for virtual machines with the IBM TSM console.
- Perform multiple VM backups in parallel, reducing the overall backup window.
- Perform application consistent backups of Microsoft SQL Server and Exchange hosted on VMware.
- Speed recovery of data to reduce downtime following a failure.

ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of TSM for VE at IBM's Almaden Research Center, in San Jose, California and in IBM's lab in Tucson, Arizona. Testing was designed to demonstrate the ease of deployment and use of TSM for VE, including application integration and support, VMware cluster protection, and integration with FlashCopy manager for VMware.

TSM for Virtual Environments

ESG Lab began with a look at the architecture and operation of TSM for VE. As seen in Figure 3, the TSM for VE recovery agent resides on the vStorage backup server and uses VMware Changed Block Tracking to efficiently protect virtual machines and enable them to leverage TSM technologies like progressive incremental backup ("incremental forever") and data deduplication to reduce the capacity required to protect virtual machines.



For 20 years, TSM has been providing customers with progressive incremental backup technology. Traditional backup methodologies use periodic full backups combined with more frequent incremental or differential backups to conserve storage capacity. This approach makes restores more complex and time consuming as users must first restore the most recent full backup, then restore subsequent incremental backups to recover to the current point in time. TSM's progressive incremental backup technology makes one initial full backup, but all subsequent backups are incremental. When combined with TSM's advanced data management techniques, this enables fast full restores without the complexity of managing multiple backup sets. Users get the speed and recoverability benefits of a daily full backup in addition to the reduced network traffic and data storage requirements of incremental backups.

Figure 4 shows a simplified timeline of backups using both progressive incremental and deduplication technology. Day 1 represents the first full backup, in which all files are sent to TSM. TSM then applies deduplication to the data set, marking redundant blocks of data for removal. The reclamation process deletes the redundant blocks.



Figure 4. Improving Efficiency with Progressive Incremental Backups and Deduplication

Day 2 represents the first incremental backup, in which one new file was added. Just that one file is sent to TSM, which then compares the blocks in the file to the pool of already stored blocks and marks redundant blocks for removal. Day n represents a future incremental after a file has been changed. The changed file is sent to TSM, which again compares the blocks in the file to already stored data in the deduplicated disk pool. The unique blocks are retained and the redundant blocks are marked for deletion during the next reclamation process. TSM manages the organization and placement of data so that the backup administrator can select any day and perform a full (or partial) restore to that point in time without having to perform multiple passes of full and incremental or differential backups.

ESG Lab Testing

First, ESG Lab walked through the installation procedure for TSM for VE into an existing TSM environment, beginning with the vSphere plug-in interface install wizard. The first step, seen in Figure 5, was to identify the vSphere host for connectivity during the installation.



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Once installation of the vSphere plug-in was completed, ESG Lab used the configuration wizard, seen in Figure 6 to provide the login credentials for the TSM server, select the VMware data center to manage, then define and register nodes that connect the VMware environment to TSM.

Figure 6. The vSphere Plug-in Interface Configuration Wizard

Once the configuration wizard was complete, ESG Lab used the TSM for VE plug-in GUI to configure a backup schedule. All aspects of virtual machine and vSphere cluster protection are managed from within the vSphere client, enabling VMware administrators to manage the protection and recovery of the entire VMware environment.



/	Schedule a Backup		
	Velcome General Velcome Source Destination Schedule Summary	Schedule When to start the backup: Provide the backup now Schedule for later Select a backup strategy and type. Learn more Backup strategy: Incremental forever (default) Backup type: Discremental Full Full	
		< Back Next > Cancel	

Figure 7 shows the "Schedule a Backup" wizard, where an administrator would enable backups. The wizard walks an administrator through setting the scope of the backups, from a single virtual machine to entire clusters, as well as the backup strategy and type of backups to run. ESG Lab set the backup strategy to the default ("incremental forever") and the backup type to incremental. It's important to note that TSM for VE automatically detects when a full backup is required.

Complete Application Protection

ESG Lab next examined self-contained, application consistent protection of a Microsoft SQL Server database. A Windows 2008 R2 Server running MS SQL Server 2010 hosting two databases named TSMPortal and TSMPortal_DW was selected for testing, as seen in Figure 8. The virtual machine's VMDK file was 40GB, and contained 35.96GB of data.





When the backup process for the running server was kicked off, several operations executed in quick succession: Data Protection for VMware requested a VMware snapshot, the VSS application in the guest froze I/O, VMware created the snapshot, VSS thawed I/O, TSM backed up the snapshot via the vStorage API for Data Protection (VADP), then the VSS application truncated the logs. At this point, an application-consistent backup was verified to be complete by examining the server logs, seen in Figure 9.

Figure 9. TSM Backup Completed

	E Log File Viewer - localhost					
/	Selectlogs	📴 Load Log 👌 Export 😰 Refresh 🍸 Filter 🔍 Search 🚺 Help				
	Database Mail	Log file summary: No filter applied				
	Gurrent - 11/30/2012 3-1	Date	Source	Message		
/	Archive #1 - 11/30/2012	12/4/2012 1:51:23 PM	spid53	Using 'xplog70.dll' version '2007.100.1600' to execute extended stored procedure 'xp_msver'. This i		
	Archive #2 - 10/26/2013	12/4/2012 1:51:23 PM	spid53	Attempting to load library 'xplog70.dll' into memory. This is an informational message only. No user ac-		
	Archive #3 - 10/25/2012	12/4/2012 12:58:30 PM	Backup	Database backed up. Database: msdb, creation date(time): 2008/07/09(16:46:27), pages dumped		
	Archive #4 - 10/12/2011	12/4/2012 12:58:30 PM	Backup	Database backed up. Database: TSMPortal, creation date(time): 2012/10/12(12:22:12), pages dur		
	Archive #5 - 10/10/2011	12/4/2012 12:58:30 PM	Backup	Database backed up. Database: model, creation date(time): 2003/04/08(09:13:36), pages dumped		
	SQL Server Agent	12/4/2012 12:58:30 PM	Backup	Database backed up. Database: TSMPortal_DW, creation date(time): 2012/10/12(12:22:12), page		
	1 Windows NT	12/4/2012 12:58:30 PM	Backup	Database backed up. Database: master, creation date(time): 2012/11/30(15:05:16), pages dumper		
		12/4/2012 12:58:30 PM	spid51	I/O was resumed on database model. No user action is required.		
		12/4/2012 12:58:30 PM	spid52	I/O was resumed on database msdb. No user action is required.		
		12/4/2012 12:58:30 PM	spid53	I/O was resumed on database TSMPortal. No user action is required.		
		12/4/2012 12:58:30 PM	spid54	I/O was resumed on database TSMPortal_DW. No user action is required.		
		12/4/2012 12:58:30 PM	spid55	I/O was resumed on database master. No user action is required.		
		12/4/2012 12:58:25 PM	spid55	I/O is frozen on database master. No user action is required. However, if I/O is not resumed prompt		
the property of the second sec		12/4/2012 12:58:25 PM	spid54	I/O is frozen on database TSMPortal_DW. No user action is required. However, if I/O is not resume		
Let		12/4/2012 12:58:25 PM	spid53	I/O is frozen on database TSMPortal. No user action is required. However, if I/O is not resumed pro		
	Status	12/4/2012 12:58:25 PM	spid52	I/O is frozen on database msdb. No user action is required. However, if I/O is not resumed promptly		
And the second second second	Last Refresh:	12/4/2012 12:58:25 PM	spid51	I/O is frozen on database model. No user action is required. However, if I/O is not resumed promptly		
	12/4/2012 1-52-41 PM	12/4/2012 12:47:35 PM	Backup	Database backed up. Database: TSMPortal, creation date(time): 2012/10/12(12:22:12), pages dur		
	12/4/2012 1.32.41 PM	12/4/2012 12:47:35 PM	Backup	Database backed up. Database: TSMPortal_DW, creation date(time): 2012/10/12(12:22:12), page		
	Filter: None	12/4/2012 12:47:35 PM	Backup	Database backed up. Database: model, creation date(time): 2003/04/08(09:13:36), pages dumpec		
	and the second second	13 10/4/0010 10.47.05 DM	n	Database basis and a second		
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	Program	Date 12/4/2012 12:5	8:30 PM	x		
	Progress	Log SQL Server (Cur	rent - 11/3)/2012 3:05:00 PM)		
	Done (232 records).	Source Backup				
		Message		L		
				Qose		

Finally, a disaster was simulated by deleting the virtual machine. A restore was then executed from the TSM for VE console. Figure 10 shows the completed restore from the TSM for VE reports screen. ESG Lab then powered up and logged in to the restored virtual machine and confirmed that SQL was running and all data had been restored.



It's important to note that organizations can protect their applications with in-guest backups using the TSM Agent, and perform virtual machine consistent backups for DR protection simultaneously.

Protecting Large Virtual Environments

TSM for VE has enhanced the protection of large virtualized environments, both simplifying configuration and control and improving performance. This enables multiple virtual machines to be backed up within one TSM client instance as seen in Figure 11. Administrators have control over how many parallel backups are performed on a single client, which is designed to improve throughput using automatic load balancing across backup sessions and shorten backup windows.



ESG Lab looked at data protection for a large-scale VMware environment by auditing a series of backups run in IBM's Client Environment Test (CET) lab. The CET lab is used to test TSM against large numbers of clients with large, dynamic data sets modeled after real customer environments. A single data set was protected using both TSM 6.3 and TSM for VE (6.4) clients. With TSM 6.3, the "Periodic Full" backup strategy was used, with one weekly full followed by six incremental backups, repeated for 56 iterations. The same data set was backed up using the TSM 6.4 client, using the "incremental forever" Strategy with one full backup followed by 55 incremental backups.





As seen in Figure 12, the TSM 6.4 client was able to reduce storage requirements significantly (up to 66%), while Figure 13 shows that the backup window was also reduced across the board (up to 53.7%).



ESG Lab also examined two large scale backup scenarios with 1,000 Windows 2008 R2 virtual machines. Each VM contained approximately 32GB of data, for an aggregate total data set of 32TB. Only one backup server was configured for all 1,000 VMs.

Table 1 lists the detailed results of "incremental forever," multi-session, and large-scale testing.

Version	Concurrent Instances/Sessions	Data Backed Up (GB)	Total Elapsed Time (Hours)	Backup Data Reduction	Backup Window Reduction
TSM 6.3	One Instance	326	6.03	0	0
TSM 6.4	One Session	110	2.89	66.2%	52.1%
TSM 6.3	Five Instances	1,628	5.46	0	0
TSM 6.4	Five Sessions	552	3.32	66.1%	39.3%
TSM 6.3	Ten Instances	3,306	9.61	0	0
TSM 6.4	Ten Sessions	1,127	4.45	65.9%	53.7%
Version	Backup Mode	Concurrent Instances/Sessions	Data Backed Up	Total Elapsed Time (Hours)	Backup Data Reduction
Version TSM 6.4	Backup Mode Full, Non Deduplicated	Concurrent Instances/Sessions 15 Sessions	Data Backed Up 31.9TB	Total Elapsed Time (Hours) 28.1	Backup Data Reduction 0
Version TSM 6.4 TSM 6.4	Backup Mode Full, Non Deduplicated Full, Deduplicated	Concurrent Instances/Sessions 15 Sessions 15 Sessions	Data Backed Up 31.9TB 4.1TB	Total Elapsed Time (Hours) 28.1 37.4	Backup Data Reduction 0 87.1%
Version TSM 6.4 TSM 6.4 TSM 6.4	Backup Mode Full, Non Deduplicated Full, Deduplicated Incremental, Non Deduplicated	Concurrent Instances/Sessions 15 Sessions 15 Sessions 15 Sessions	Data Backed Up 31.9TB 4.1TB 31.9GB	TotalElapsedTime(Hours)28.137.42.5	Backup Data Reduction 0 87.1% 0

Table 1. Multi-Session Backups with "Incremental Forever" and Multi-Session

What the Numbers Mean

- The TSM 6.4 client significantly reduced the total storage footprint of backups, before enabling deduplication.
- The aggregate backup window (the time required to complete all backups) was reduced by up to 53.7%, allowing more data to be protected in a smaller amount of time.
- The large scale test proved that TSM can scale to protect large numbers of VMs with a single backup server.
- TSM Client Side deduplication achieved an impressive 87.1% deduplication on the first full backup.
- Tests of 30 incremental backups showed no performance impact, and a very small backup window to protect all 1,000 virtual machines.

Why This Matters

ESG asked IT managers to identify major challenges with their data protection technologies and processes.³ The top two responses were the need to reduce backup times, and the cost of data protection systems. Keeping pace with the capacity of data to protect and the need to protect virtualized environments were also high on the list. In the same survey, IT organizations stated a strong desire for a unified solution that was suited to both physical and virtual environments. For years, backup administrators have been struggling to complete nightly backups before business resumes in the morning. As backup windows continue to shrink and data sets grow, IT managers need a solution that can scale to meet the challenge.

ESG Lab has confirmed that TSM for VE delivers significantly greater backup efficiency and performance in virtualized environments than previous versions while offering the same advanced functionality as physical environments enjoy, accessible by VMware administrators through the TSM for VE vSphere plug-in. VMware administrators can protect large-scale virtual server environments using "incremental forever" backup technology, client-side deduplication, and multi-session backup to increase efficiency and performance while reducing storage and resource requirements—protecting greater numbers of virtual clients with larger data sets.

In addition, the ability to know whether or not backup operations are actually successful has long been a challenge for backup administrators. Not surprisingly, IT staffs leveraging some form of backup reporting and monitoring solution—whether included with a backup application or as part of a more comprehensive reporting/analytics or SRM tool—typically enjoy a noticeably higher rate of success for their backup operations than those with no formal tools or processes in place. TSM for VE's detailed reporting, can provide detailed, near real-time and historical reporting to keep administrators informed and ready to act on critical issues affecting their data protection environment, allowing them to keep backups running smoothly.

³ Source: ESG Research Report, <u>*Trends in Data Protection Modernization*</u>, August 2012.

Flash Copy Manager for VMware

ESG Lab next examined IBM Tivoli Storage FlashCopy Manager (FCM) for VMware. FCM for VMware is a data management solution that can be used to streamline storage management in a VMware vSphere environment. FCM for VMware can back up VMware environments by integrating with VMware vSphere APIs and storage hardware snapshot technology. TSM FCM for VMware also offers the option of integration with TSM for VE to store and catalog VMware image backups on Tivoli Storage Manager server storage, as seen in Figure 14.





FCM for VMware is designed to enable policies where fast restores can be made from local storage arrays with longer retention of backups on TSM storage.

ESG Lab Testing

First, ESG Lab examined the FCM for VMware plug-in GUI and performed a backup of a Microsoft Windows 2003 R2 Virtual Machine.

```
Figure 15. FCM Backup Settings—Type of Backup
                            Schedule a Backup
                                                               Backup settings
                            🗹 Welcome
                               Settings
                                                               The choices you enter on this page affect only the VMs that you selected to back up
                              General
                                                               Learn more about these backup settings ...
                              Source
                              Additional backup settings
                                                                  Type of backup to run
                              Destination
                              Schedule
                                                                    Back up to Tivoli Storage FlashCopy Manager
                                                                     Back up to Tivoli Storage FlashCopy Manager and to Tivoli Storage Manager
                              Summary
                                                                   Back up to Tivoli Storage Manager
                                                                                                                               < Back Next > Cancel
```

As seen in Figure 15, when backing up a virtual machine, the administrator has the option to back up using FCM, TSM, or both.

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Figure 16. FCM Backup Settings—VM Processing Options



Virtual machine processing is quite flexible as well, allowing VMs to be backed up via VMware snapshots with or without running memory, or by suspending each VM included in the backup, as seen in Figure 16.

Figure 17. FCM Backup Completed

Outs Stores Cetting Started Summary Backup Restore Reports Configuration CET_Datacenter View: Events Recent Tasks Backup Status Managed Capacity Datacenter Occupance Use this table of operations to verify the progress of running tasks and see the results of tasks that completed in the last Learn more. Restore Pilot. Pilot.	V Summary Log View
Use this table of operations to verify the progress of running tasks and see the results of tasks that completed in the lass	
	t hour.
Alarie Propess Datar Line Chi Trine Uteau December 19, 2012 demo_fon_only Success December 19, 2012 5:54 22 PM CET December 19, 2012 5:55 17 PM CET	
Name Progress Start Time - End Time D	etails
demo_fcm_only Success December 19, 2012 5:54:22 PM CET December 19, 2012 5:55:17 PM CET	

As seen in Figure 17, the FCM full backup completed in less than one minute. Once the backup was completed, ESG Lab logged into the console of the backed up virtual machine and deleted a file.

Figure 18. Deleting an Important File



In the Tivoli Data Protection for VMware plug-in, the Restore tab provided a view of the restore points available for all virtual machines in the datacenter.

Figure 19. Selecting a Restore Point CETVC1 - vSphere Client File Edit View Inventory Administration Plug-ins Help 🔯 🔯 Home 👂 🐉 Solutions and Applications 👂 🚯 Tivoli Data Protection for VMware - cetcli 👂 💋 CETVC1 Search Inventory Data Stores 💌 🚭 ry Backup Restore Reports Co E 🔏 cetvc1 CET_Datacente Q . Fille elect all Restore Point Template Backup Type Location CET_Datacenter December 19, 2012 5:54:22 PM CET (Attachable) ✓ esxcet1.boeblingen.de.ibm.com FCM DEVICE CLASS NAP02 LUN2 ISCSI . No D1_Ubuntu2Disks_NAP02 December 18: 2012 3:41 53 PM CE D2_Ubuntu2Disks_NAP02 FCM DEVICE_CLASS:NAP02_LUN2_ISCSI No (Attachable) 1 03 Ubuntu2Disks NAP02 Te December 18, 2012 1:26:42 PM CET (Attachable) 0 FCM DEVICE_CLASS:NAP02_LUN2_ISCSI ✓ 04_win2k3_NAP02 A SLES11 100GB SVC4L1 ES O December 14, 2012 2:40:09 PM CET FCM DEVICE_CLASS:NAP02_LUN2_ISCSI A SLES11_20GB_SVC4L1_ESX -Showing 5 items | Selected 1 item • 4 Restore Point Details Back End Type: FCM Backup Type: FCM Backup ID: A0HAWPBM85 Task Name: demo_fcm_only Backup ID: 938 Schedule Start Time: December 19, 2012 5:54:22 PM CET Datacenter: CET Datacenter Data Stores: nap02_cet_lun1_iscsi

Host esxcet1.boeblingen.de.ibm.com

. .

Figure 19 shows ESG Lab selecting the most recent restore point. To restore the single deleted file, the snapshot was exported directly to the virtual machine as an additional disk drive. Figure 20 shows the VM with the snapshot mounted as drive E:.

VMware Instance ID: 5039bdc3-c174-095b-f7ef-ae3ecdb244ba

VMware Name: 04_win2k3_NAP02

Status: Success

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Figure 20. The Snapshot Mounted on the Host



Once the snapshot was exported and mounted, the deleted file was restored with a simple drag and drop operation. The entire restore process, from selecting the snapshot to restoring the deleted file was completed in less than two minutes. The ability to restore selected disks to a virtual machine is also essential, as this allows organizations to recover an application's data without the need to process and restore the operating system drive.

/	CETVC1 - vs	phere Client						_ 2 🛛 🔀
/	File Edit View 1	nventory Administration Plug-ins Help						
/		Home 👂 🛃 Solutions and Application	s 👂 🕼 Tivoli Dat	a Protection for VMware -	cetcli1 👂 🛃 CE	TVC1	Search Inventory	Q
	Data Stores 💌	Getting Started Sumr	mary Backup	Restore Report	s Configuratio	n		
	CET_C	@ Welcome	Select virtua	l disks for restore				ach Detach
		Source Select virtual disks Destination				م • 10	tør	
······································		Summary		Label	Size	Path		
				Hard disk 1	1024.000 MB	[nap02_cet_lun1_iscsi] 01_Ubuntu2Disks_NAP02 2.vmdk	1.01_Ubuntu2Disks_NAP0	
				Hard disk 2	50.000 MB	[nap02_cet_lun1_iscsi] 01_Ubuntu2Disks_NAP02 2_1.vmdk	1.01_Ubuntu2Disks_NAP0	LUN2_ISCSI
ALL AND ALL AN								LUN2_ISCSI
and a second sec								EIBM.COM
								LUNZ_ISCSI
						<	ack Next > Cancel	
	4	Backup Type: FCM			Back Er	nd Type: FCM	U	•

ESG Lab selected an Ubuntu Linux VM with two virtual hard drives. Hard disk 1 contained the OS and application binaries, while hard disk 2 contained data files. ESG Lab deleted the data files from hard disk two and executed a restore. The restore completed in less than two minutes.

Figure 21.Restoring Selected Disks

Finally, ESG Lab looked at protection of multiple virtual machines inside a vApp. VMware defines a vApp as a logical entity comprising one or more virtual machines that work together as part of a multi-tier application. VMware vApp uses the industry standard Open Virtualization Format to specify and encapsulate all components of an application as well as the operational policies and service levels associated with it. IBM TSM for VE and FCM can protect the virtual machines inside a vApp like any other virtual machines. Figure 22 shows two virtual machines inside a vApp after ESG Lab restored them both using TSM for VE.

Figure 22. Restoring Virtual Machines in a vApp



Why This Matters

Storage consolidation and server virtualization concentrate processing power and data storage in the data center on fewer servers and storage systems; protecting these assets presents a unique set of operational challenges thanks to growing volumes of data residing on shared, networked storage devices and on applications within virtual machines.

ESG Lab has validated that FlashCopy Manager for VMware provides quick and easy data protection for virtual machines' data residing on shared storage systems from both IBM and third-party vendors. FCM for VMware integrates tightly with TSM for VE and offers organizations a flexible, powerful solution to protect virtual machines with hardware snapshots providing lightning-fast restores of the most recent backups and TSM providing efficient long term backup storage with progressive incremental and deduplication technology.

ESG Lab was able to run multiple application- and VM-consistent backups and restores, with FCM for VMware alone, and in conjunction with TSM for VE, and found backups and restores to be fast, easy, and reliable. Users can greatly extend local retention onsite while simultaneously reducing recovery times using space-efficient hardware snapshots. ESG Lab was able to instantly restore from an FCM backup as soon as the backup was completed.

ESG Lab used the TSM vSphere plug-in to perform agentless full and file-level recoveries of virtual machines directly from the vSphere client. This means more efficient backups and faster time to recovery as VMware administrators can execute recoveries and restores directly, with no intervention required.

ESG Lab Validation Highlights

- ☑ TSM progressive incremental backup, combined with client- and source-side data deduplication technology provided an impressive 95% data reduction factor (more than 19:1) over just 11 days of backups.
- ☑ ESG Lab has confirmed that TSM for VE delivers significant backup efficiency and performance in virtualized environments while offering the same advanced functionality as physical environments enjoy. VMware administrators can easily manage backup and recovery through the TSM for VE vSphere plug-in.
- ☑ VMware administrators can protect large-scale virtual server environments using progressive incremental backups, client side deduplication, and multi-session backup—protecting greater numbers of virtual clients with larger data sets.
- ☑ TSM for VE's detailed reporting can provide detailed, near real-time, and historical reporting to keep administrators informed and ready to act on critical issues affecting their data protection environment, allowing them to keep backups running smoothly.
- ESG Lab was able to run multiple application- and VM-consistent backups and restores with TSM for VE and FlashCopy manager both independently and together, and found backups and restores to be fast, easy, and reliable. Users can greatly extend local retention onsite while simultaneously reducing recovery times using space efficient hardware snapshots.
- ESG Lab used the TSM vSphere plug-in to perform backups, full restores and file-level recoveries of virtual machines directly from the vSphere client. This means more efficient backups and faster time to recovery as VMware administrators can execute recoveries and restores directly, with no intervention required.

Issues to Consider

Because FlashCopy Manager makes an independent copy of a storage volume above the VMware layer, it captures all metadata associated with a virtual machine. TSM for Virtual Environments on its own cannot guarantee that all metadata will be captured, because the VMware API does not guarantee it to TSM.

The Bigger Truth

IBM has continually invested in the TSM platform, recognizing its standing on the cutting edge of data protection. TSM has been uniquely positioned for open systems data management—protecting, retaining, and ensuring accessibility to data. TSM's architecture and design principles were rooted in mainframe storage management concepts, distinguishing it from comparable solutions with features such as integrated archiving, disk-to-disk backup, and progressive incremental backup policies. These and other features are proof points of the level of optimization in the TSM platform. With TSM for VE, IBM has extended these benefits to enable organizations to meet and exceed the demands of relentless growth in virtualized environments.

ESG Lab performed hands-on testing of key TSM for VE features to demonstrate and audit its capabilities. ESG Lab examined client-side data deduplication to understand the value of this capacity optimization technique in combination with deduplicated storage pools and progressive incremental backups over time. ESG Lab found that the two technologies (deduplication and progressive incremental backups) working in concert were able to achieve 90% data reduction after just six incremental backups and 95% reduction after 11 days of backups. Progressive incremental, multi-session backups reduced the amount of data transferred to TSM by two-thirds while shrinking backup windows by more than half.

ESG Lab executed every test documented in this report from within the vSphere client, proving that TSM for VE gives VMware administrators the power to protect and recover their virtualized environments independently, using familiar tools and techniques. The integration of FlashCopy manager was examined as well, showing that organizations can leverage hardware snapshot capabilities in their storage infrastructure for rapid short-term recovery, while seamlessly moving those backups into TSM for long-term retention.

ESG Lab has repeatedly found that the TSM platform achieves optimization in data management in multiple, powerful ways. The solution creates capacity efficiencies through integrated archiving, disk-based data protection, an "incremental forever" backup strategy, and data deduplication everywhere. Similarly, IBM has been and continues to be focused on backup and recovery performance, ease of management, and availability. Optimizations for virtual environments, including progressive incremental and multi-session help accelerate backup and recovery processes. IBM has clearly put a lot of time and effort into TSM for VE and that hard work is paying off: IBM has established TSM's position as one of the preeminent data protection platforms for virtualized environments.



Appendix

Table 2. ESG Lab Test Bed

TSM for VE				
IBM TSM Server IBM p770, 8x 3.55GHz POWER5+ cores (One LPAR) 64GB RAM 2x 4Gb/sec FC HBAs -QLA2340 10 GbE	IBM TSM 6.3.3 AIX 7.1 64 bit			
IBM DS8000 (2107-932, 2-frame) – 39.5TB Usable Capacity	TSM server storage pool for backup/database and log files			
VMware Environment				
ESXi Servers -(five total) IBM x3850, 4-6x quad-core 2.66GHz XEON CPU 128GB RAM 2x 4Gb/sec FC HBAs -QLA2340	ESXi server v5.0.0-469512			
IBM XIV Gen2 - 78TB Usable Capacity	Hosts datastores for VM Guests			
VMware vCenter Server IBM x3650, 2x quad-core 2.66GHz XEON CPU 24GB RAM 10 GbE	VCenter 5.0.0-455964 Windows 2008 R2 Enterprise 64 bit			
vStorage Backup Server IBM x3650, 2x quad-core 2.66GHz XEON CPU 24GB RAM 2x 4Gb/sec FC HBAs -QLA2340 10 GbE	IBM TSM 6.4 Client Windows 2008 R2 Enterprise 64 bit			
VM Guests 1 vCPU and 512MB of RAM 1x 20GB OS disk 1x 25GB data disk - 13GB data populated	Windows Server 2008 R2 Enterprise 64-bit Windows Server 2003 R2 Enterprise 64-bit Ubuntu Server 12.10 64 bit			

