

## Storage Management

# Tivoli Storage Manager e la virtualizzazione VMWare

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# Agenda

- Scenario Overview
- VMWare Consolidate backup
- File Level backup
- Full VM backup
- New TSM 5.5 integration with VCB
  - Usage
  - Installation
  - References

# Scenario Overview

- Customer needs
  - Customers running VMware ESX Server 3.0 with new VCB feature
  - Backup and restore virtual machine data
  - Reduce load on ESX Server: leverage VMware Consolidated Backup (VCB) to off-load (from ESX Server) to a Backup Proxy
  - Supports Lan-Free
  - Improve data management and ease of use than what was available in TSM 5.4
- Involved products:
  - ▶ VMware Infrastructure 3 Includes...
    - ▶ ESX Server 3.0
    - ▶ VirtualCenter (single management of multiple ESX Server host)
    - ▶ Consolidated Backup(VCB framework)
    - ▶ Virtual Infrastructure Client(VI Client) (management interface)
  - ▶ VMware components [http://www.vmware.com/download/vi/drivers\\_tools.html](http://www.vmware.com/download/vi/drivers_tools.html)
    - ▶ ESX Server – “VMware ESX Server 3.0.2 Update 1”
    - ▶ VirtualCenter – “VMware VirtualCenter 2.0.2 Update 1”
    - ▶ VCB Framework (Backup Proxy)
      - “VMware Consolidated Backup 1.0.3 Update 1”

# Backup

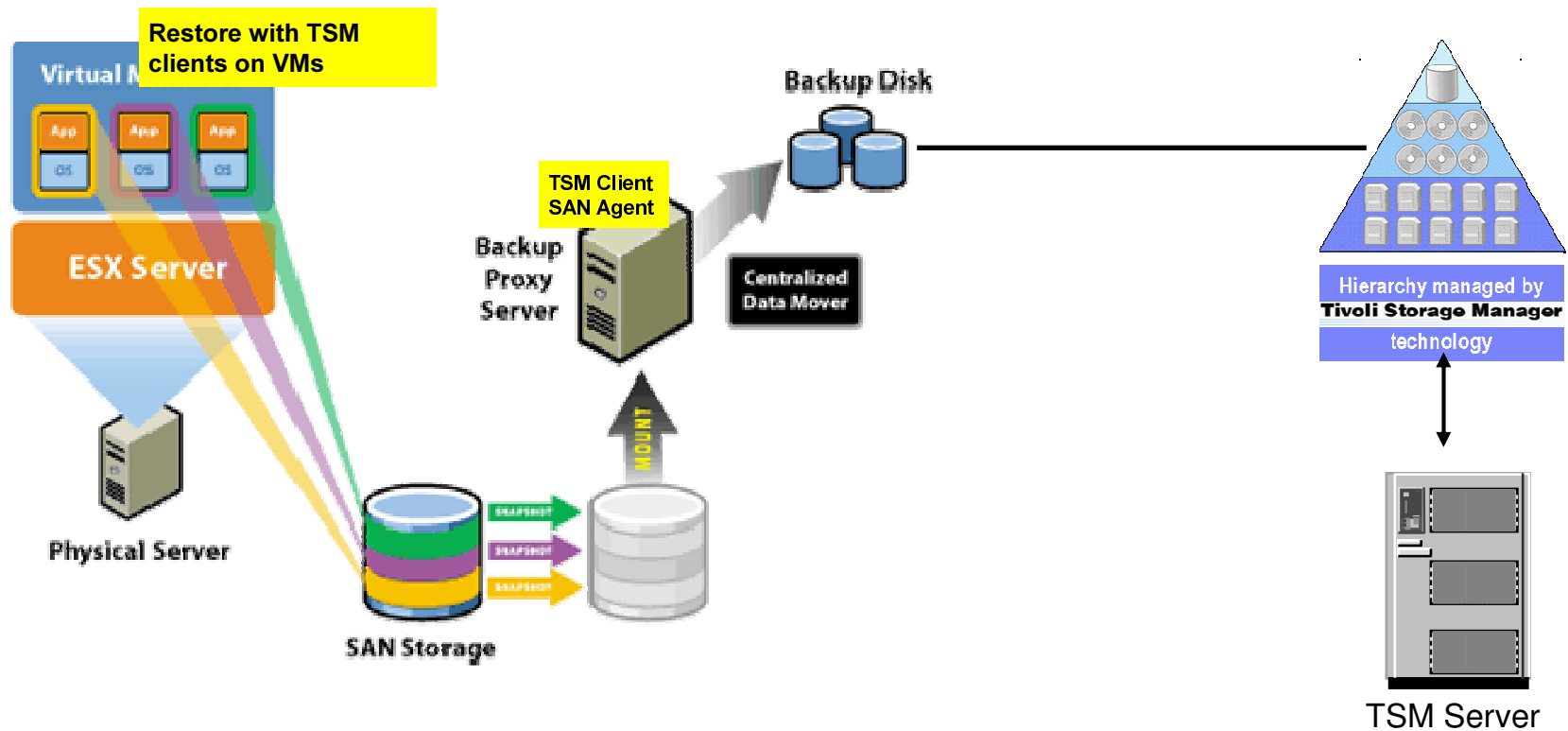
- There are 2 variables that must be taken into consideration when planning the backup
  - If VMWare Consolidate backup is available or not
  - If the backup must be done at file-level or at full-VM level
- The result is depicted in the following table (follow the colors)

	No VCB	VCB
File Level	File Level No VCB	File Level with VCB
Full VM	Full VM No VCB	Full VM With VCB

# VMWare Consolidate Backup (VCB)

- Allows to perform backups from a dedicated physical host (VCB backup proxy) using the VMware snapshot technique and an industry - standard backup software
- Integrates with most major backup applications
- You can use VCB with a single ESX Server host or with a VirtualCenter Management Server.
- Consolidated Backup offers the following features:
  - Offloads backup processes to a dedicated physical host (VCB proxy).
  - Eliminates the need for a backup window by using VMware virtual machine snapshot technology.
  - Doesn't require backup agents in virtual machines.
  - Works with industry - leading backup applications
  - Doesn't restrict the use of Fibre Channel tapes.
  - Supports file - level backups for virtual machines running Microsoft Windows guest operating system.
  - Supports image - level backups for virtual machines running any guest operating system.

# VMWare Consolidate Backup



# Backup: File Level or Full VM?

What means File Level and what Full VM

## **File - level backup**

Makes a copy of individual files contained on the disks within a virtual machine. This can include all files (a full file backup), or selected files, such as those which changed since a previous backup (differential or incremental file backups). File - level backups allow files or directories to be restored individually. Use the file - level backups to prevent data loss due to errors, for example, accidental file deletion.

## **Image - level (Full VM) backup**

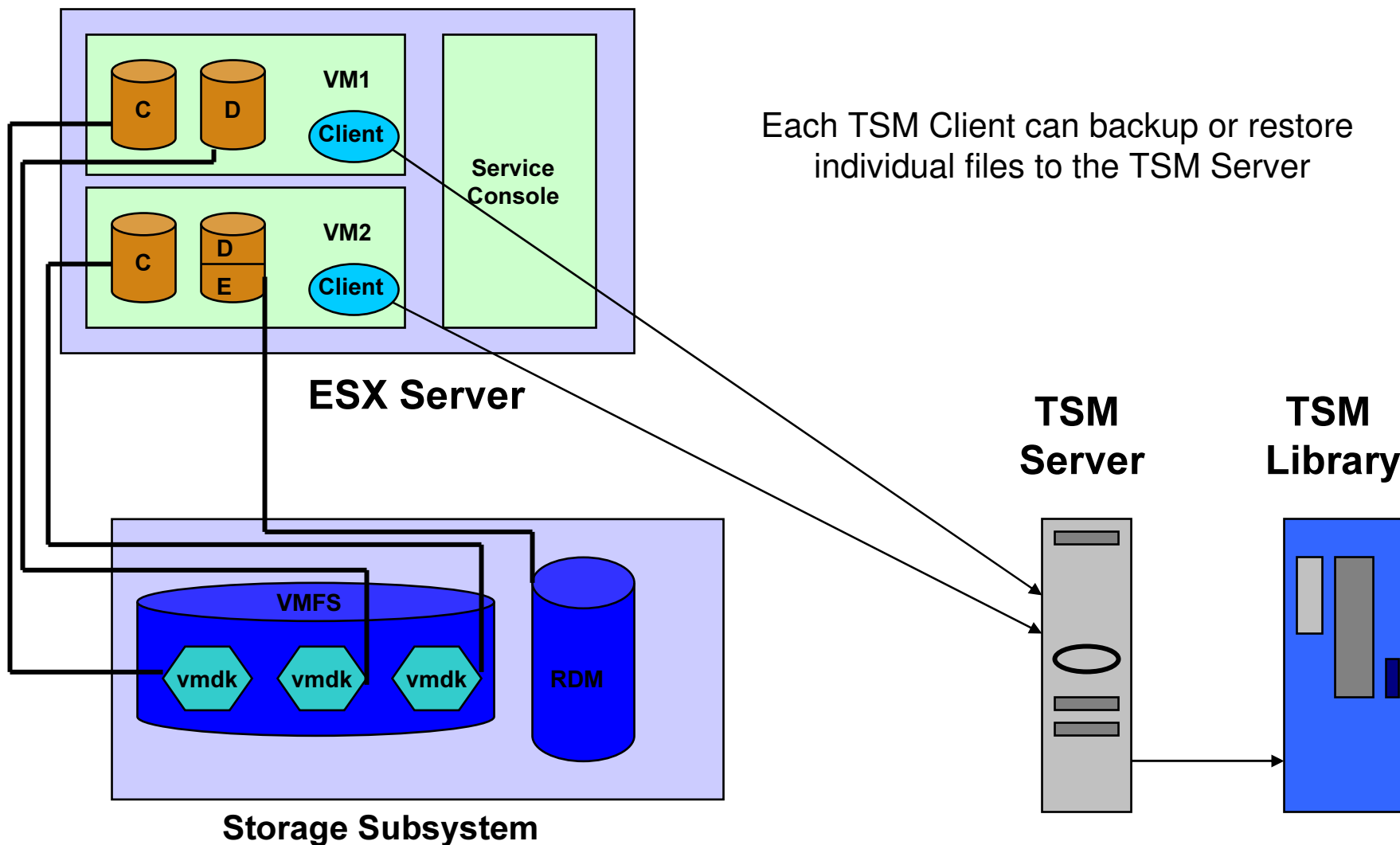
Makes a copy of all the disk and configuration files associated with a particular virtual machine, allowing the restoration of the entire virtual machine. This type of backup is suitable for restoring virtual machines in the event of a hardware failure or a system administrator error, such as the accidental deletion of the virtual machine.

# VMWare Backup Methods

- Original VMWare backup support (no VCB)
  - File-level incremental – install TSM client on guest OS
  - Full-VM backup – install TSM Linux client on ESX Server console (file level backup of \*.vmdk files)
    - available for VMWare ESX 2.x and 3.x (supported in TSM client v5.4, v5.5)
- VMware Consolidated Backup (VCB) – new in ESX 3.0
  - Using VMware TSM Integration Module(TSMIM) - TSM v5.4
    - provided by VMware
    - sample scripts, readme type docs to help create pre/post backup scripts that can be written by user
      - ● samples include File-level and Full-VM
  - Using only TSM - new in TSM v5.5
    - File-level integrated into TSM
    - Full-VM still has to be scripted with or without TSMIM. Not part of v5.5 enhancements.



# File-level backup without VCB

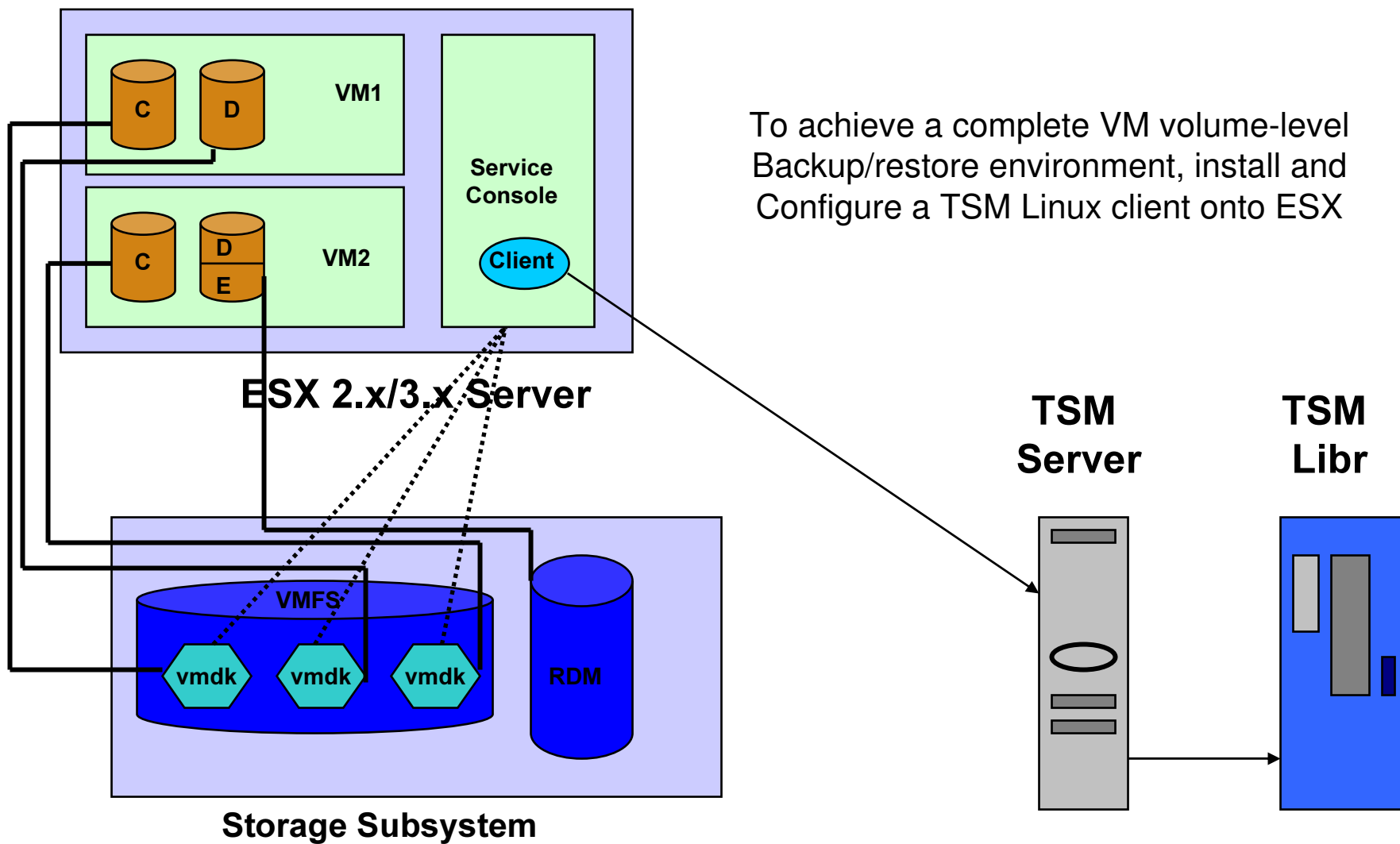


## File-level backup without VCB



- TSM Backup-Archive Client installed in VMware guest machine
- TSM supports any operating system and application/data base which is supported in physical environment (standard support statement for virtual environments)
- No LAN-Free path
  - iSCSI may change this in the future
- Backup load (CPU and i/o) concern with multiple guests on single server

# Full VM backup without VCB



# Full VM backup without VCB

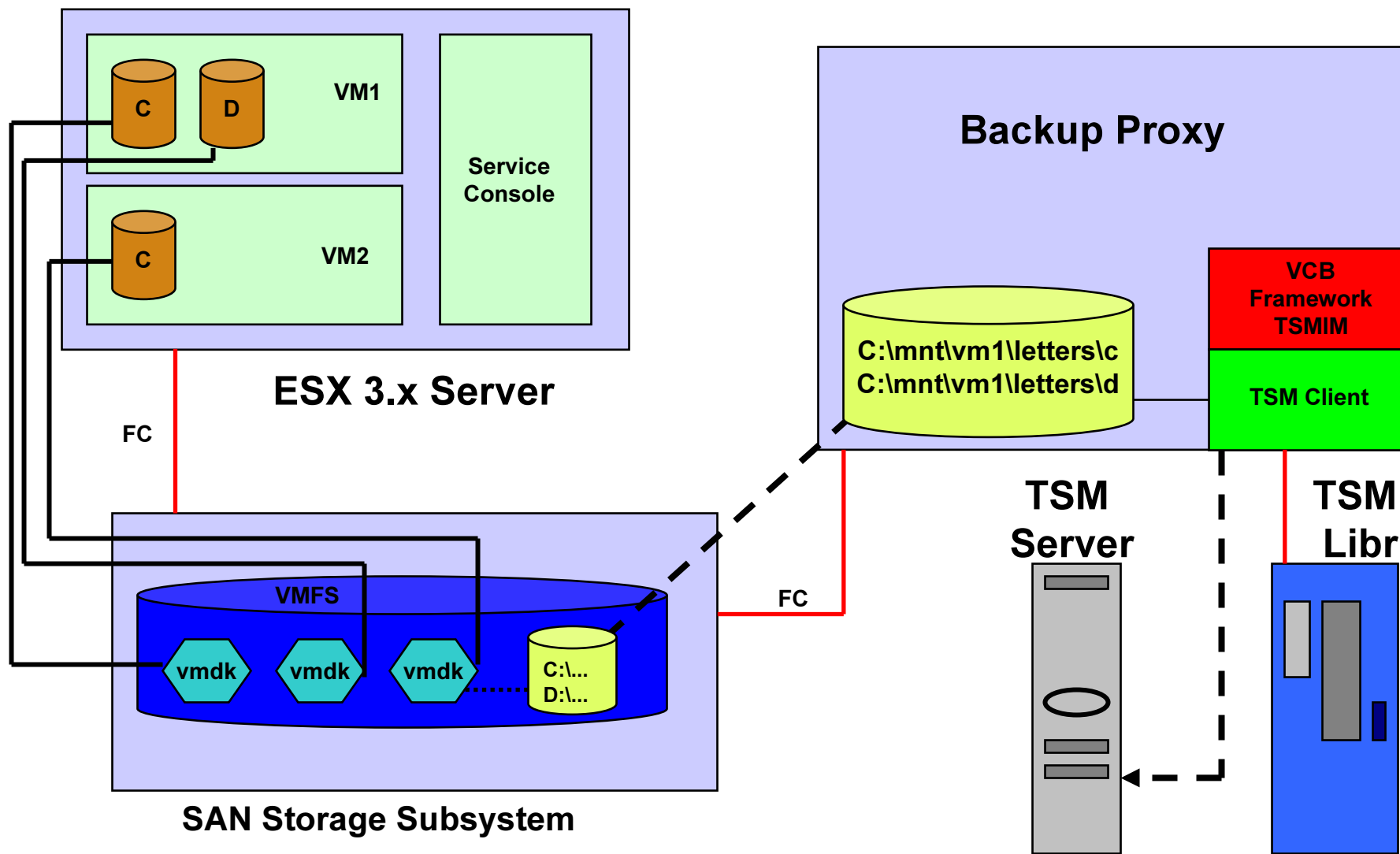


- TSM Linux x86 Backup-Archive Client installed on ESX console
- .VMDK files backed-up selectively
- Using ESX snapshot facilities can backup on-line
- TSM doesn't recognize VMFS file system (but this method is supported)
- Have had issues with ESX kernel compatibility (ESX 2.x is supported by previous TSM clients)
- In future VMware indicates that they will take away the ability for software vendors to install software on ESX console
- Tivoli Field Guide

**Using IBM Tivoli Storage Manager for Backup and Restore on the VMware Service Console**

[http://www-1.ibm.com/support/docview.wss?rs=663&context=SSGSG7&q1=vmware&uid=swg27009931&loc=en\\_US&cs=utf-8&lang=en](http://www-1.ibm.com/support/docview.wss?rs=663&context=SSGSG7&q1=vmware&uid=swg27009931&loc=en_US&cs=utf-8&lang=en)

# File level backup using VCB



# File level backup using VCB



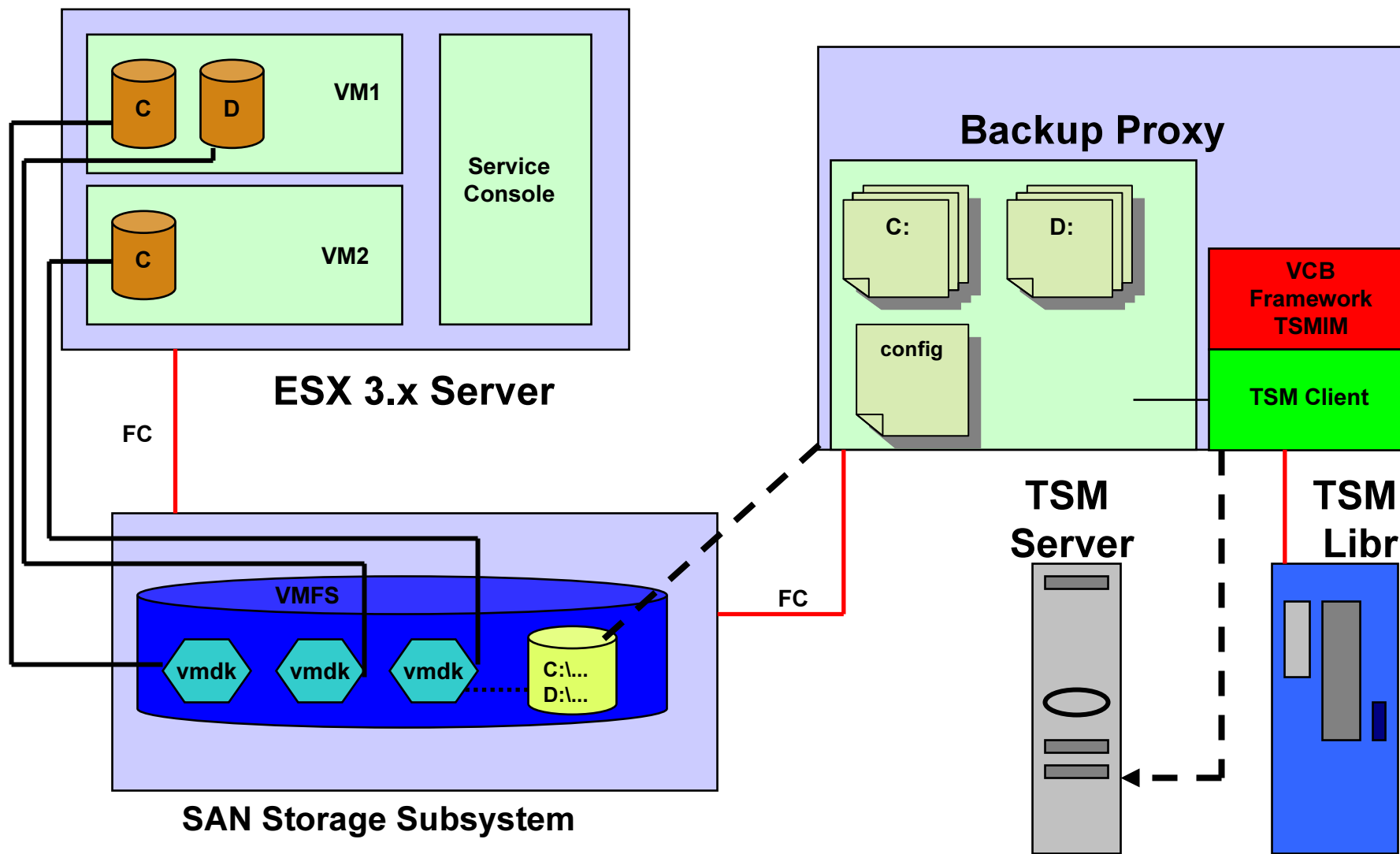
- TSM Windows Backup-Archive Client installed to one or more backup proxies
  - Currently only Windows 2003 supported as proxy
- VCB framework takes/exposes snapshots of guest drives
  - Data is exposed on SAN
  - Movement is off-loaded from guest machine
  - Currently only Windows guest machines
  - No application or database integration
- Restore can be done by restoring data to proxy and manually moving it to original location or by installing TSM Backup-Archive Client on guest OS

## File level backup using VCB



- Pre-TSM 5.5 could use VCB with integration scripts available from VMware (TSMIM)
  - Installation of TSM and integration scripts not ideal
  - Data managed on TSM Server from perspective of backup proxy
    - User had to know mapping of TSM filespace back to guest drive
  
- TSM 5.5 has better integration
  - No integration module
  - Data managed on TSM Server from perspective of guest machine

# Full VM backup using VCB





# Full VM backup using VCB



- TSM Windows Backup-Archive Client installed one or more backup proxies
  - Currently only Windows 2003 supported as proxy
- VCB framework provides set of files which represents full image of machine including drives and configuration information
  - Supports ALL guest OS
- Machine recovery is two step process
  - TSM restore data to backup proxy
  - VMConverter utility converts the images to .VMDK files
- This is not an instant backup
  - VCB framework copies files to a staging area from which TSM can perform backup



# TSM VMware VCB Backup – v5.5

# Usage

Two new dsmc.exe commands for File level VCB backup

- **dsmc backup vm** -vmlist=vm1,vm2
- **dsmc query vm** -vmlist=vm1,vm2

## Actions

- From backup proxy machine:
  - **dsmc backup vm -vmlist=vm1**
    - takes advantage of ESX snapshot facility (on-line backup)
    - virtual machine volumes are exposed to Backup Proxy machine
    - TSM file level backup of virtual machine volumes to TSM Server
    - A pre/post snapshot support is available - via VCB pre/post thaw scripts that are stored in virtual machine
    - All these steps are done as part of the dsmc backup vm command
  - **dsmc query vm -vmlist=vm1,vm2**
    - For each vm specified in -vmlist option displays output similar to the 'dsmc query filespace' which shows all volumes backed up, date of last backup, etc.
- From with-in VM
  - **Restores**
    - Full GUI / command line interface

# Usage (cont)

## Benefits:

- VCB backup of virtual machine data is integrated into the existing TSM command line interface.
- Easy to backup a single vm or list of vm's .
- Easy restore using the exiting restore interface (command line or GUI) from within the virtual machine.
  - Data backed up from backup proxy is stored as if backed up from within the virtual machine.
    - Each VM's data backed up to the nodename of the virtual machine
    - Using the corrected volume name [\\vm1\C\\$](#)
- Easy to setup TSM schedules with action type “command”.
- dsmc backup vm command will run on any machine where the VCB Framework is installed.
- TSM Preferences Editor “VM Backup” tab will be available on any machine where the VCB Framework is installed.
- Backups are off-loaded from ESX server.
- Allows for Lan-Free path to TSM Server.

```

C:\Program Files\Tivoli\TSM\baclient>dsmc backup vm -vmlist=mutalisk,hydralisk
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 5, Level 0.0
  Client date/time: 11/08/2007 12:20:26
(c) Copyright by IBM Corporation and other(s) 1990, 2007. All Rights Reserved.

Node Name: WIN2003R2
Session established with server BABU: AIX-RS/6000
  Server Version 5, Release 5, Level 0.0
  Server date/time: 11/08/2007 12:22:29  Last access: 11/08/2007 12:19:41

Backup UM command started.  Total number of virtual machines to process: 2

Backup of Virtual Machine 'mutalisk'
Mount virtual machine disk on backup proxy for UM 'mutalisk'

Executing Operating System command or script:
  vcbMounter -h odin.storage.usca.ibm.com -u root -p **** -a ipaddr:mutalisk -r
  C:\mnt\tsmvmbackup\filelevel\mutalisk -t file
[2007-11-08 12:20:26.250 'App' 3424 info] Current working directory: C:\Program
Files\Tivoli\TSM\baclient
[2007-11-08 12:20:26.796 'BaseLibs' 2628 warning] [Umdb_Unset] Unsetting unknown
path: /vmomi/

Opened disk: blkfst:///vmfs/volumes/45b166a5-18cefa14-6a6d-00145e298976/UCB - te
st machine/UCB - test machine.vmx-snapshot-1150[vcb_vmfs] UCB - test machine/win
2003r2 - mutalisk.vmdk@odin.storage.usca.ibm.com?xxxx/xxxx
Opened disk: blkfst:///vmfs/volumes/45b166a5-18cefa14-6a6d-00145e298976/UCB - te
st machine/UCB - test machine.vmx-snapshot-1150[vcb_vmfs] UCB - test machine/win
2003r2 - mutalisk_1.vmdk@odin.storage.usca.ibm.com?xxxx/xxxx
Opened disk: blkfst:///vmfs/volumes/45b166a5-18cefa14-6a6d-00145e298976/UCB - te
st machine/UCB - test machine.vmx-snapshot-1150[vcb_vmfs] UCB - test machine/win
2003r2 - mutalisk_3.vmdk@odin.storage.usca.ibm.com?xxxx/xxxx
Opened disk: blkfst:///vmfs/volumes/45b166a5-18cefa14-6a6d-00145e298976/UCB - te
st machine/UCB - test machine.vmx-snapshot-1150[vcb_shark] win2003r2 - mutalisk/
win2003r2 - mutalisk.vmdk@odin.storage.usca.ibm.com?xxxx/xxxx
Proceeding to analyze volumes
Done mounting
Volume 1 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\1 (mbSize=12001
fsType=NTFS )
Volume 2 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\2 (mbSize=203 f
sType=FAT32 )
Volume 3 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\3 (mbSize=203 f
sType=FAT )
Volume 4 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\4 (mbSize=517 f
sType=NTFS )
Volume 5 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\5 (mbSize=517 f
sType=NTFS )
Volume 6 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\6 (mbSize=8197
fsType=NTFS )
Volume 7 mounted at C:\mnt\tsmvmbackup\filelevel\mutalisk\digits\7 (mbSize=15719
fsType=NTFS )

```

## Sample Output:

```
dsmc backup vm -vmlist=mutalisk,hydralisk
```

```

C:\> Command Prompt
Successful incremental backup of '\\vm6\c$'

Total number of objects inspected:      22
Total number of objects backed up:     22
Total number of objects updated:        0
Total number of objects rebound:       0
Total number of objects deleted:        0
Total number of objects expired:        0
Total number of objects failed:         0
Total number of subfile objects:        0
Total number of bytes transferred:      12.26 KB
Data transfer time:                     0.08 sec
Network data transfer rate:             153.25 KB/sec
Aggregate data transfer rate:           2.09 KB/sec
Objects compressed by:                  0%
Subfile objects reduced by:             0%
Elapsed processing time:                 00:00:05
Successful incremental backup of Virtual Machine 'vm6'
Unmount virtual machine disk on backup proxy for UM 'vm6'

Executing Operating System command or script:
    vcbMounter -h odin.storage.sanjose.ibm.com -u root -p **** -U C:\mnt\tsmvmback
kup\filelevel\vm6
[2007-08-13 23:30:06.625 'App' 2820 info] Current working directory: C:\Program
Files\Tivoli\TSM\baclient
[2007-08-13 23:30:07.125 'BaseLibs' 2844 warning] [Umdb_Unset] Unsetting unknown
path: /umomi/

Unmounted c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\1\ (formatted)
Unmounted c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\2\ (formatted)
Unmounted c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\3\ (formatted)
Unmounted c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\4\ (formatted)
Unmounted c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\5\ (formatted)
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\1\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\2\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\3\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\4\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\5\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\digits\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\letters\C\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\letters\E\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\letters\M\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\letters\N\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel\letters\
Deleted directory c:\mnt\tsmvmbackup\mutalisk\filelevel
Finished command. Return code is: 0

Backup UM command complete
Total number of virtual machines backed up successfully: 5
    virtual machine vm1 backed up to nodename vm1
    virtual machine vm2 backed up to nodename vm2
    virtual machine vm4 backed up to nodename vm4
    virtual machine vm5 backed up to nodename vm5
    virtual machine vm6 backed up to nodename vm6
Total number of virtual machines failed: 2
    virtual machine vm3
    virtual machine badvm
Total number of virtual machines processed: 7

ANS1900I Return code is 12.
ANS1901I Highest return code was 12.

E:\tsm550c\run\run10>

```

Sample Output:

Final Statistics – multiple vm's

```

c:\ Command Prompt
E:\tsm550c\run\run10>dsmc query vm
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
Client Version 5, Release 5, Level 0.0 1004FB
Client date/time: 11/12/2007 15:16:36
(c) Copyright by IBM Corporation and other(s) 1990, 2007. All Rights Reserved.

Node Name: UCBPXY
Session established with server TITANIUM_540_PURE_BABY: Windows
Server Version 5, Release 4, Level 0.0
Server date/time: 11/12/2007 15:20:08 Last access: 11/12/2007 15:18:28

Filespace Query for Virtual Machine 'vm1'
Accessing as node: vm1
#      Last Incr Date      Type      File Space Name
-----
1      11/09/2007 10:48:04    NTFS      \\vm1\c$      fsID: 12
2      11/09/2007 10:48:05    NTFS      \\vm1\e$      fsID: 13
3      11/09/2007 10:48:04    NTFS      \\vm1\z$      fsID: 11

Filespace Query for Virtual Machine 'vm2'
Accessing as node: vm2
#      Last Incr Date      Type      File Space Name
-----
1      11/09/2007 10:48:11    NTFS      \\vm2\c$      fsID: 6
2      11/09/2007 10:48:10    NTFS      \\vm2\h$      fsID: 5

Filespace Query for Virtual Machine 'vm4'
Accessing as node: vm4
#      Last Incr Date      Type      File Space Name
-----
1      11/09/2007 10:48:18    NTFS      \\vm4\c$      fsID: 2
2      11/09/2007 10:48:18    NTFS      \\vm4\h$      fsID: 1

E:\tsm550c\run\run10>

```

Sample Output:

dsmc query vm

## Restore GUI

IBM Tivoli Storage Manager - [Restore]

File Edit Actions Utilities View Window Help

Restore Estimate Options Point In Time Help

HYDRALISK

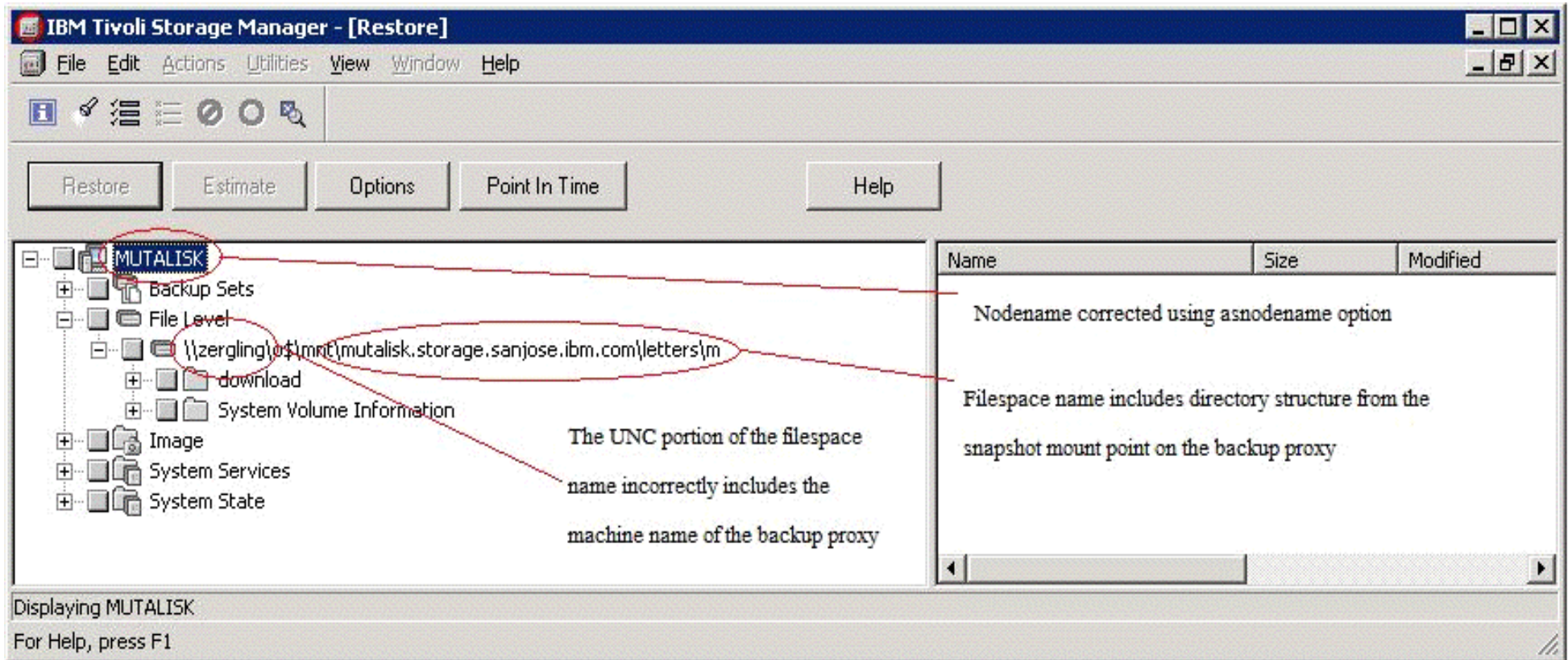
- Backup Sets
- File Level
  - \\hydralisk\c\$
  - \\hydralisk\e\$
    - Copy of jason
    - download
    - jason
    - jbbtest
    - junk
    - logs535
    - logs550\_0621
    - logs550\_0709
    - logs550\_mixed
    - logs\_541
    - logs\_541JBB
    - logs\_550\_0625
    - logs\_550\_0712
    - temp
    - tsmlvsacache
    - TSMmnt
    - tuan
  - \\hydralisk\m\$
  - \\hydralisk\n\$

Name	Size	Modified	Created	Ba
AUTOEXEC.BAT	0 B	12/19/2006 09:2...	12/19/2006 09:2...	11
boot.ini	210 B	12/19/2006 09:2...	12/19/2006 01:1...	11
CONFIG.SYS	0 B	12/19/2006 09:2...	12/19/2006 09:2...	11
ic50290.CAD	0 B	03/16/2007 14:1...	03/16/2007 14:1...	11
MSDOS.SYS	0 B	12/19/2006 09:2...	12/19/2006 09:2...	11
msizap.exe	92.5...	02/17/2007 23:3...	02/17/2007 23:3...	11
NTDETECT.COM	46.6...	03/22/2006 04:0...	03/22/2006 04:0...	11
ntldr	290.1...	03/21/2007 08:5...	03/22/2006 04:0...	11
patchlog.txt	1.21...	12/20/2006 16:2...	12/20/2006 16:2...	11

Displaying \\hydralisk\c\$

For Help, press F1





### (compare) Restore GUI – v5.4

- ✗ all VMs data are saved under single backup proxy nodename
- ✗ filesystem names include directory structure from snapshot mount point
- ✗ restore to alternate location is the only option

Preferences X

General	Backup	Restore	Include-Exclude	Scheduler	Regional Settings	Authorization	Web Client
Command Line	Diagnostics	Performance Tuning	Image-Snapshot	Communication	VM Backup		

Virtual Machine Backup Options

VM List

VMware Virtual Center or ESX Server

Host

User

Password

## Preference Editor

VM Backup Tab

# Install/Configure

## Steps

1. Implement ESX server farm with SAN-attached storage.
  - All virtual disk for all virtual machines are stored on the SAN
2. Plan for a dedicated Windows 2003 server as VCB Proxy machine with access to SAN
3. Zone SAN and configure disk subsystem host mappings so that all ESX servers and the backup proxy can access the same disk volumes.
4. Download and install VCB Framework from VMware
  - [http://www.vmware.com/download/vi/drivers\\_tools.html](http://www.vmware.com/download/vi/drivers_tools.html)
  - Current version: 'VMware Consolidated Backup 1.0.3 Update 1'
5. Install TSM v5.5 client, run setup wizard as a normal TSM install
  - nodename=VCBPROXY (hostname of the backup proxy machine)
6. On TSM server grant backup proxy to VCB backup proxy machine node for each of the virtual machine nodes.
  - grant proxy target=vm1 agent=vcbproxynode
  - grant proxy target=vm2 agent=vcbproxynode
  - ...
7. Update the TSM options on the backup proxy machine either with the GUI Preference Editor or can be specified on the command line or schedule definition
  1. VMCHost – Hostname of the VirtualCenter or ESX Server. Can be full DNS, shorten DNS or IP address
  2. VMUser – VirtualCenter or ESX Server userid
  3. VMCPW – VirtualCenter or ESX Server password
  4. VMLIST – List of virtual machines to back up. Can be full DNS, shorten DNS or IP address

Note: Alternate syntax exist to override if vm hostname is different than TSM nodename

**vm-hostname[tsm nodename]**

Example: **dsmc backup vm -vmlist=vm1, vm2.sanjose.ibm.com, 9.38.11.55[vm3]**

# Install/Configure

Steps (cont)

8. Verify VMware Tools are installed on each virtual machine.
  - Easy install from VMware Virtual Infrastructure client (menu drop down).
9. For each VM, configure the VMware pre-freeze and post-thaw scripts which are run within each virtual machine.
  - Create files C:\Windows\pre-freeze-script.bat and C:\Windows\post-thaw-script.bat
  - Can be used to allow for application-consistent backups (same function as TSM pre/postsnapshot commands)
10. VMware will quiesce NTFS and FAT file system (only for Microsoft Windows machines). This ensures no file system writes are pending at the time the snapshot is taken
11. (Optional step) For each virtual machine, configure the TSM exclude list on the backup proxy
  - Example exclude statement for single VM **exclude "\\vm1\C\$\dir1\...\\*.tmp"**
  - Example exclude statement for ALL VMs **exclude "C:\dir1\...\\*.tmp" exclude "\*:dir1\..."**
  - NOTE: The exclude list on the virtual machine must match the exclude list on backup proxy if incremental backups are to be done from within the virtual machine.
12. Test back up
  - dsmc backup vm -vmlist=vm1,vm2 -vmchost=vchost -vmcuser=Administrator -vmcpw=xxxx
13. Verify backup
  - dsmc query vm -vmlist=vm1,vm2

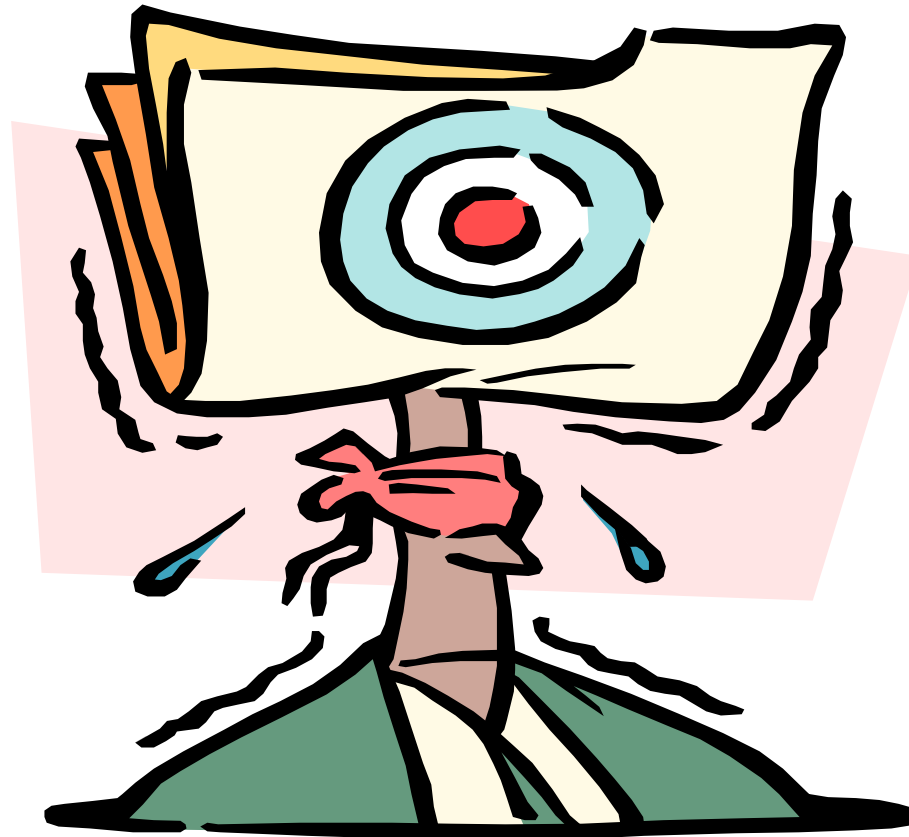
Note: All of these steps, and step by step guide details are documented in TSM Documentation

- **TSM 5.5 Backup-Archive Clients Installation and User's Guide –**  
Chapter 4 Backing up your data – "Using VMware Consolidated Backup (VCB)

# References

- **Product pub sections and readme information that cover component/function.**
  - ▶ **TSM 5.5 Backup-Archive Clients Installation and User's Guide** - Chapter 4 Backing up your data – “Using VMware Consolidated Backup (VCB)
    - ▶ Step by step guide to setting up TSM backup in VMware VCB environment. – **First place to start!**
  - ▶ TSM 5.5 Readme – list of know problems with VMware VCB product issues and links to VMware website
  
- **Whitepapers, IBM Redbooks, DCF docs, forums, etc.**
  - **TSM supported Virtual Machines - DCF**
    - <http://www-1.ibm.com/support/docview.wss?uid=swg21239546>
  - **Software support for IBM SWG products in a VMware environment - DCF**
    - <http://www-1.ibm.com/support/docview.wss?uid=wws1e333ce0912f7b152852571f60074d175>
  - **Using TSM for Backup and Restore on VMware Service Console – Tivoli Field Guide**
    - [http://www-1.ibm.com/support/docview.wss?rs=663&context=SSGSG7&dc=DA480&uid=swg27009931&loc=en\\_US&cs=utf-8&lang=en](http://www-1.ibm.com/support/docview.wss?rs=663&context=SSGSG7&dc=DA480&uid=swg27009931&loc=en_US&cs=utf-8&lang=en)
  
- **VMware web site: [www.vmware.com](http://www.vmware.com)**

# Questions?



# Thank you !