Redpaper

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IBM SAN Volume Controller and IBM Tivoli Storage FlashCopy Manager

This IBM® Redpaper™ document provides a brief overview of IBM Tivoli® Storage FlashCopy® Manager and how it interacts with the IBM System Storage™ SAN Volume Controller (SVC). It describes FlashCopy Manager features and benefits and identifies supported hardware and software. Basic information to help you plan for, install, configure, and use FlashCopy Manager is also included.

IBM Tivoli Storage FlashCopy Manager

In today's business world, where application servers are operational 24 hours a day, the data on these servers must be fully protected. You cannot afford to lose any data, but you also cannot afford to stop these critical systems for hours so you can protect the data adequately. As the amount of data that needs protecting continues to grow exponentially and the need to keep the downtime associated with backup to an absolute minimum, IT processes are at their breaking point. Data volume snapshot technologies, such as IBM FlashCopy, can help minimize the impact caused by backups and provide near instant restore capabilities.

While many storage systems are now equipped with volume snapshot tools, these hardware-based snapshot technologies provide only "crash consistent" copies of data. Many business critical applications, including those that rely on a relational database, need an additional snapshot process to ensure that all parts of a data transaction are flushed from memory and committed to disk prior to the snapshot to ensure you have a usable, consistent copy of the data.

IBM Tivoli Storage FlashCopy Manager helps deliver the highest levels of protection for mission critical IBMDB2, SAP, Oracle, Microsoft® Exchange, and Microsoft SQL Server applications via integrated, application-aware snapshot backup and restore capabilities. This is achieved through the exploitation of advanced IBM storage hardware snapshot technology to create a high performance, low impact application data protection solution.

The snapshots captured by Tivoli Storage FlashCopy Manager can be retained as backups on local disk, and with optional integration with Tivoli Storage Manager, customers can leverage the full range of advanced data protection and data reduction capabilities such as data deduplication, progressive incremental backup, hierarchical storage management, and centrally managed policy-based administration.

Since a snapshot operation typically takes much less time than the time for a tape backup, the window during which the application must be aware of a backup can be reduced. This facilitates more frequent backups, which can reduce the time spent performing forward recovery through transaction logs, increases the flexibility of backup scheduling, and eases administration.

Application availability is also significantly improved due to the reduction of the load on the production servers. Tivoli Storage FlashCopy Manager exploits storage snapshot capabilities to provide high speed, low impact, application-integrated backup and restore functionality for the supported application and storage environments. Automated policy-based management of multiple snapshot backup versions, together with a simple and guided installation and configuration process, provide an easy to use and quick to deploy data protection solution that enables the most stringent database recovery time requirements to be met.

More details about IBM Tivoli Storage FlashCopy Manager are available here:

https://www-01.ibm.com/software/tivoli/products/storage-flashcopy-mgr/

FlashCopy Manager support

FlashCopy Manager (FCM) exploits disk subsystems such as:

► DS8000®

► SVC

► XIV®

► DS 3/4/5k through VSS only

FCM supports applications such as:

► Microsoft Exchange 2003 and 2007 on Windows® 2003 and Windows 2008

► Microsoft SQL Server 2005 and 2008 on Windows 2003 and Windows 2008

► Oracle 10g and11g on AIX® 5.3 and 6.1

► DB2® UDB V9.5 or later on AIX 5.3 and 6.1

► SAP releases running on DB2 V9.5 supported by SAP BRTools 7.10 or later on AIX 5.3 and 6.1

► SAP with Oracle

Prior to FCM, TSM for ACS was the typical solution used to minimize the back-up window (reducing the time where the systems were off line to guarantee data consistency for the back-up operation).
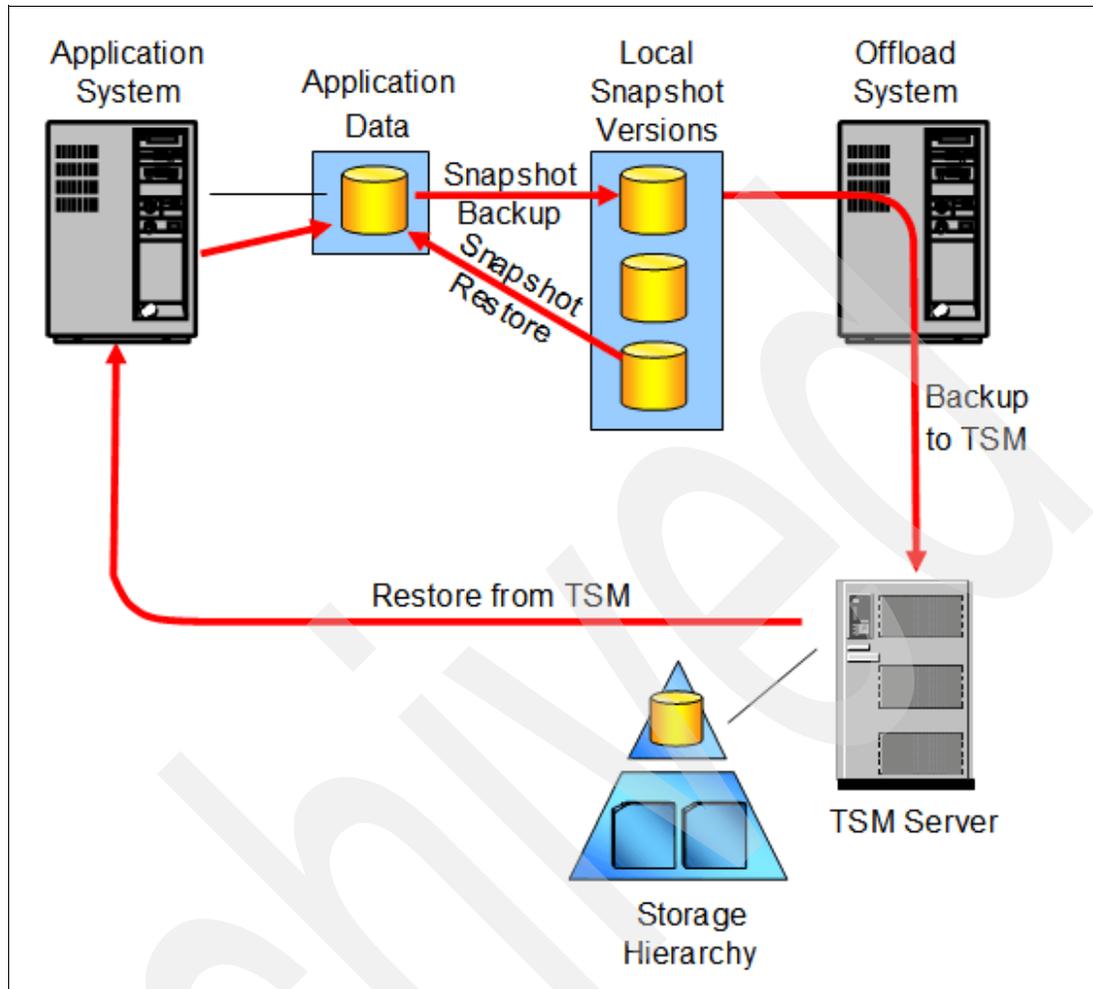
Figure 1   TSM for ACS

With TSM for ACS it was possible to:

► Trigger a snapshot for backup and map the local Snapshot™ versions to a TSM server

► Transfer outboard of the application server to minimize impact to the application

► Provide long term retention and disaster recovery with copies on the TSM server

► Provide very fast restore times from the snapshot

► Provide support for multiple, persistent snapshots

► Provide persistent snapshots retained locally

► Provide policy-based management of local, persistent snapshots

► Have different retention policies for local snapshots and copies on TSM server

► Automatically reuse local snapshot storage when older snapshot versions expire

► Perform restores from:

    – Local snapshot versions

    – TSM storage hierarchy

These TSM for ACS benefits are still valid, but for certain environments (such as DB2, SAP, Oracle on AIX, Exchange and SQL on Windows), it is also possible to trigger the snapshot for

backup and for restore, and exploit the IBM Storage Subsystem, without the intervention of the TSM Server, as shown in Figure 2.
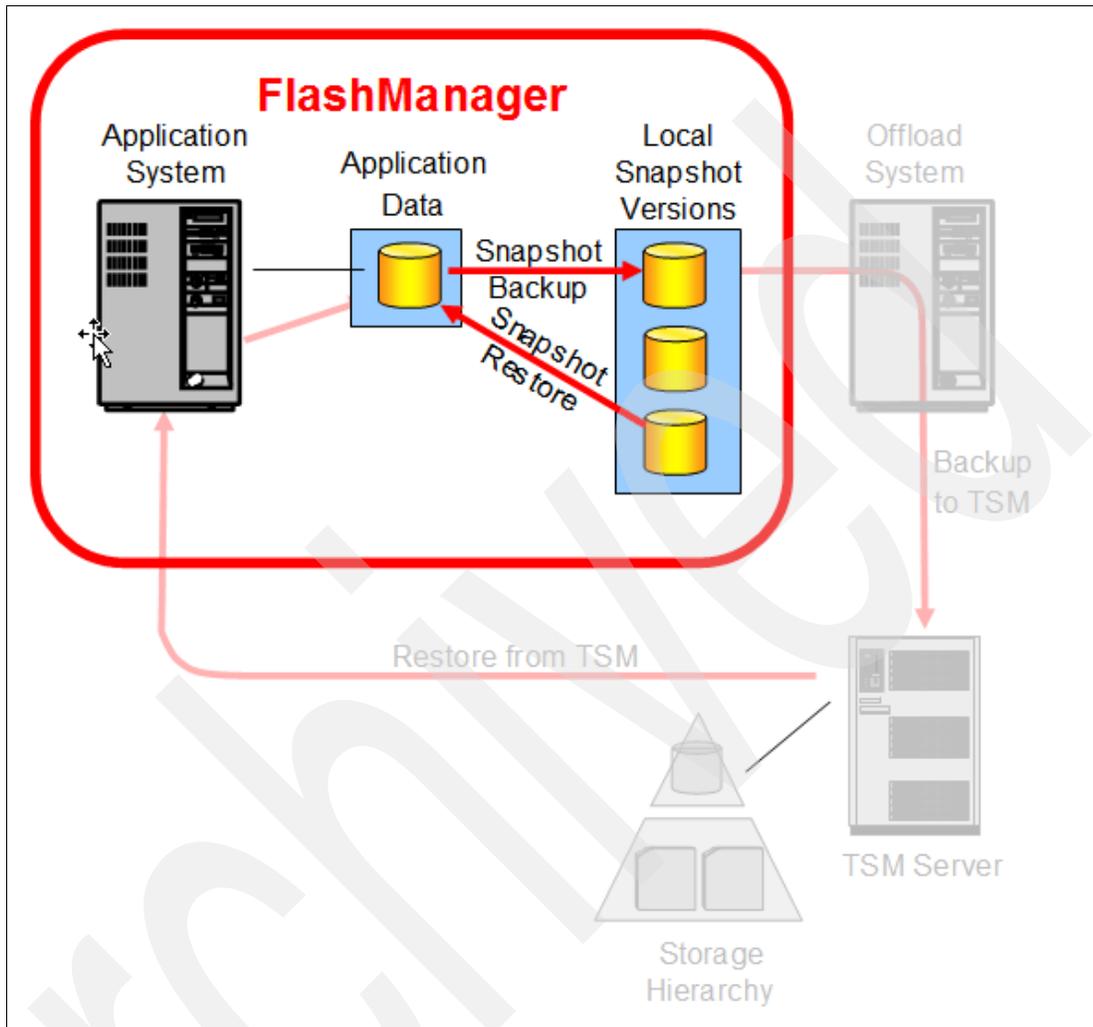

Figure 2   FCM design

Common features

FlashCopy Manager has the following features:

► TSM continues to use Processor Value Units (PVUs) licensing.

► FCM uses managed capacity, which is the sum of the usable capacity for all snapshot volumes.

► FlashCopy Manager performs snapshots at the storage volume level.

► Storage capacity required to be licensed is the total allocated size of the source volumes that are snapped (where the original source data resides).

► Applies to logical storage volumes (can map to multiple physical volumes).

► Applies to both hardware and software snapshots.

► Utilities are included to determine the managed capacity.

Additional support for the SAN Volume Controller

For the SAN Volume Controller, FlashCopy Manager includes the following additional features:

► Support for VSS Instant Restore from Space-Efficient target Volumes (SEV) with SAN Volume Controller 5.1

► Fast Restore is unchanged

► Support for CIM agents using SSL / HTTPS

Supported hardware and functions

FCM exploits the IBM Storage Subsystem without the intervention of the TSM Server.

Table 1 shows the hardware and functionality supported by FCM depending on which operating system platform is used, and with which IBM Storage Subsystem it is integrated.

Table 1   Hardware and supported function

	Full copy	INCR refresh	NoCopy (COW or ROW)	SEV targets	Snap restore	Snap restore from SE targets
AIX	DS8000 SVC	DS8000 SVC	DS8000 SVC XIV	XIV SVC 5.1	DS8000[2] SVC[2] XIV	XIV SVC 5.1
WIN (VSS)	DS8000 SVC	DS8000[1] SVC[1]	DS8000 SVC XIV DS3/4/5k	XIV SVC 5.1 DS3/4/5k	DS8000[2] SVC[2] XIV	XIV SVC 5.1

1 Limits solution to 1 backup version (target set)
2 Done by changing direction on FC map

FCM planning and prerequisites

The requirements for FCM differ depending on the platform that it will operate on, but there are also some common requirements. As usual, planning is the key to successful implementation.

The following requirements to implement FCM into an SVC environment apply to all platforms:

► LAN and SAN connections between the production and Storage Management server for:
  – Tape restore operations
  – Backup/restore of the log files

► LAN or SAN connections for tape backup operations between the backup and Storage Management server unless both are installed on the same system.

► The production machine must have a LAN connection to the CIM Agent. For SVC this can be the SVC console or the SVC cluster depending on the SVC version. The backup server also must have a LAN connection to the SVC CIM Agent.

► LUNs of the production database must not be distributed over multiple disk storage subsystems/SVC storage clusters.
  – For LVM mirroring support:

- Each mirror set of the production database must be located completely on only one disk storage subsystem DSnnnn/ SVC storage cluster.
    - For Oracle ASM support:
        - All failure groups representing a consistent database image must be located on only one disk storage subsystem DSnnnn/SVC storage cluster/XIV.
        - For DSnnnn only one LUN per disk storage subsystem is supported.
- ► The LUNs of the disk storage subsystem used by the production database are accessible to the production system and are the source volumes used by the FlashCopy process.

    For performance reasons the number of LUNs allocated to one database should be kept low.

- ► The LUNs of the disk storage subsystem intended to be used as target volumes by the FlashCopy process must be accessible to the backup system.

- ► Each source and target volume pair must be the same size.

- ► Source and target volume pairs can be located in different storage devices within one SVC cluster.

- ► If SDD is installed, the correct vpath device configuration must be checked with lsvpcfg. On the production and backup systems, all pvids containing storage system volumes must be converted to vpath (hd2vp command, only in the case of SDD). Alternatively, SDDPCM with AIX MPIO can be used.

- ► IBM TotalStorage® SAN Volume Controller Master Console V4.2.1.822 (SVC Cluster 4.2.1 with incremental FlashCopy), V4.3.0.620 (SVC Cluster 4.3.0), V4.3.1.606 (SVC Cluster 4.3.1) and SVC 5.1.

    For up-to-date information about the recommended console and compatible cluster levels see:

    http://www-1.ibm.com/support/docview.wss?rs=591&uid=ssg1S100288

    FlashCopy Manager will only communicate with the SVC. It does not need to be aware of the storage systems attached to the SVC.

- ► The CIM Agent for SVC comes integrated with the master console code package, or in the SVC cluster (with SVC versions later than 4.3.0).

- ► The CIM Agent for SVC must be configured for https or http communication. An application user must be defined in the CIM agent for use by FlashCopy Manager. By default, SVC is configured for https communication and no changes are required in this configuration, and the following description can be ignored:

    For SVC version 4.2.1 or later the configuration of the CIMOM must be done with the `cimconfig` command, which can be found in C:\Program Files\IBM\svcconsole\cimom\pegasus\bin. For example, the following command sets the default HTTPS port to 5999:

    `cimconfig -s httpsPort=5999 -p`

- ► For SAN Volume Controller 4.2.1 or later, including the appropriate SVC Master Console 4.2.1 or later, the COPYSERVICES_USERNAME parameter as specified in init<SID>.fcs must be assigned the "Administrator" role when defined in the SVC Master Console.

CIM agent setup for SVC

After installing the SVC and its CIM agent, a default CIM-user is defined:

username: superuser
password: password

You can add a new CIM user with the SVC Web Interface.

The CIM user is used by FlashCopy Manager to connect to the CIM agent, and is the one you need to specify in the FlashCopy Manager profile parameter:

`COPYSERVICES_USERNAME`

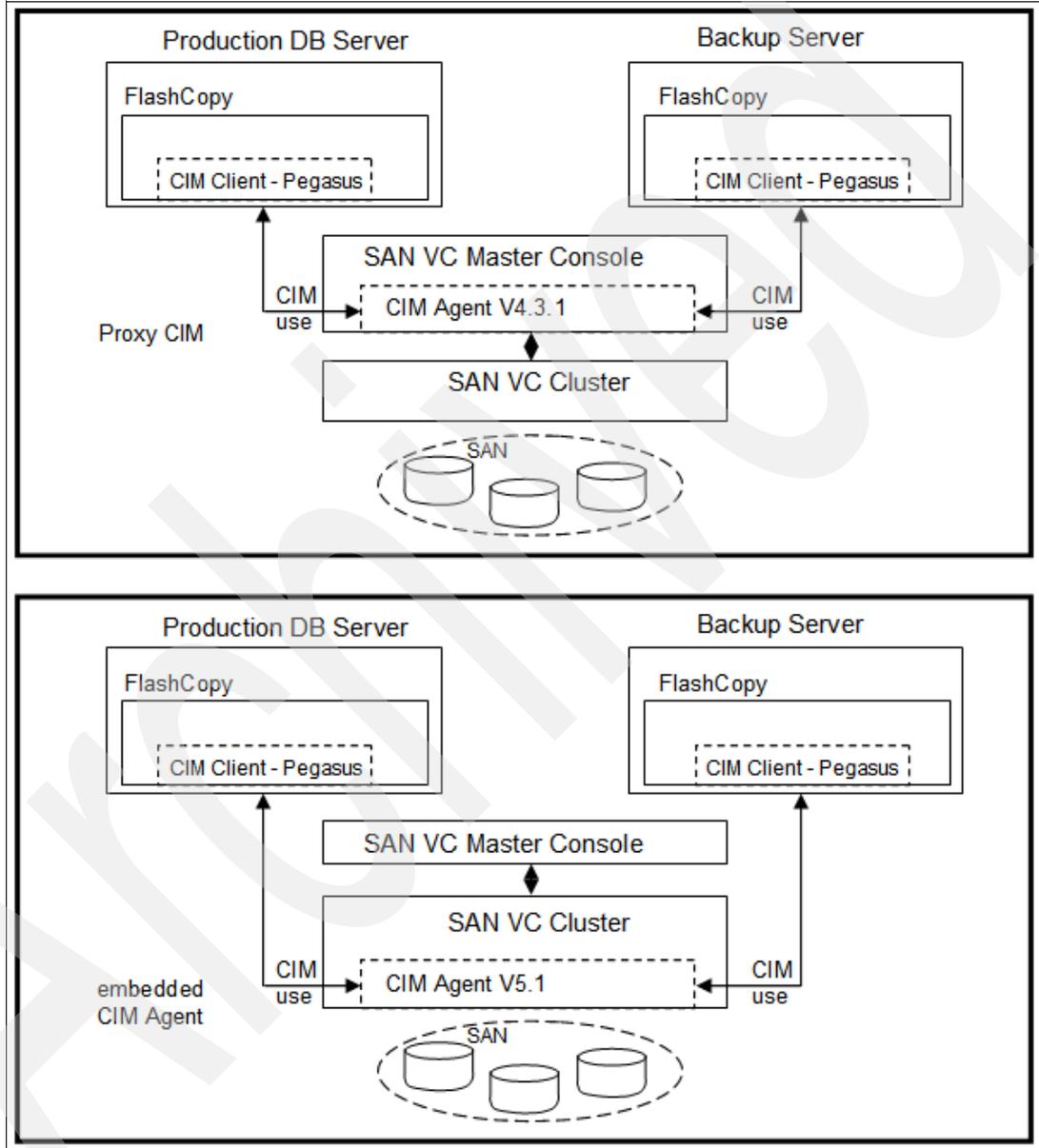Figure 3 shows the communication flow between FCM and SVC.

Figure 3   Communication flow diagram

FCM instant restore in an SVC environment

In this section we briefly describe FCM support for instant restore from SE target volumes in SVC 5.1. Note that this capability on AIX is different than on Windows.

On AIX

With SVC 5.1, Space Efficient Volumes can be defined as FlashCopy targets.

In mirrored environments, all target sets on each mirror must be either Space Efficient or fully allocated.

Space Efficient targets, just like full or incremental FlashCopies, can be destructively restored so long as the background copy operation has not completed, with these two caveats:

► Upon restore, the FlashCopy relations for the restored backup and all FlashCopy relations that were established later than the restored backup are stopped.

► Similarly, reusing a target set results in the deletion of all FlashCopy backups that were created before the target set's relationships,as well as the backup on the reused target set.

On Windows

The initial release of FCM on Windows has the following limited support for instant restore from SE target volumes:

► Instant restore from SE target volumes is allowed when there is only one SE backup version.

► If multiple SE backup versions exist, FCM performs a file copy restore (also known as Fast Restore).

► An SE backup version is defined by an FC map to an SE target volume that has a background copy rate = 0. (Use of SE target volumes with "autoexpand" enabled and a background copy rate > 0 does not create SE backup versions because the target volumes will grow to the allocated size of the source volumes when the background copy completes).

► The background copy rate is a configuration parameter of the VSS provider for SVC, *not* a parameter on a VSS snapshot request. It is not expected that customers will intermix snapshots with copy rate = 0 and copy rate > 0, nor is that supported by FCM. However:

 – Some accommodation is made for a transition from one to the other when customers switch from fully allocated targets to the use of SE targets or vice versa.

 – To enable multiple backup versions while minimizing storage costs and performance overhead, the standard configuration of background copies on the SVC cluster will be to configure SE target volumes for the VSS free pool, and set the VSS provider background copy rate to 0. This will avoid doing a background copy of blocks that do not change on the source volumes. We also recommend that autoexpand be enabled for the SE target volumes to avoid out of space conditions.

Note: Full support for instant restore from SE target volumes on SVC 5.1 when multiple SE targets exist requires additional changes in the VSS provider for SVC, which are planned for availability after GA of SVC 5.1 and FCM 2.1.

Basic implementation steps

This section guides you through the steps to install FlashCopy Manager. For a more detailed discussion of this process refer to the product documentation: *Tivoli Storage FlashCopy Manager Installation and User's Guide for Windows,* SC27-2504-00 or the *Tivoli Storage FlashCopy Manager Installation and User's Guide for AIX,* SC27-2503*.*

The screens shown here were captured during a typical installation in a Windows environment.

1. The installation wizard performs a check of the system to ensure that certain prerequisites are in place, including Microsoft.NET Framework 3.5. If Microsoft.NET Framework SP1 is not present on your server the installation will fail and the FCM console will not work.

   The panel shown in Figure 4 identifies the prerequisite packages.
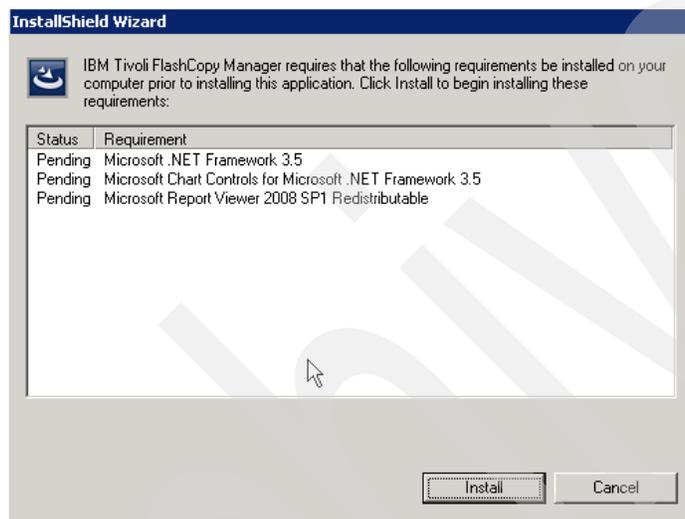
Figure 4   Installation packages

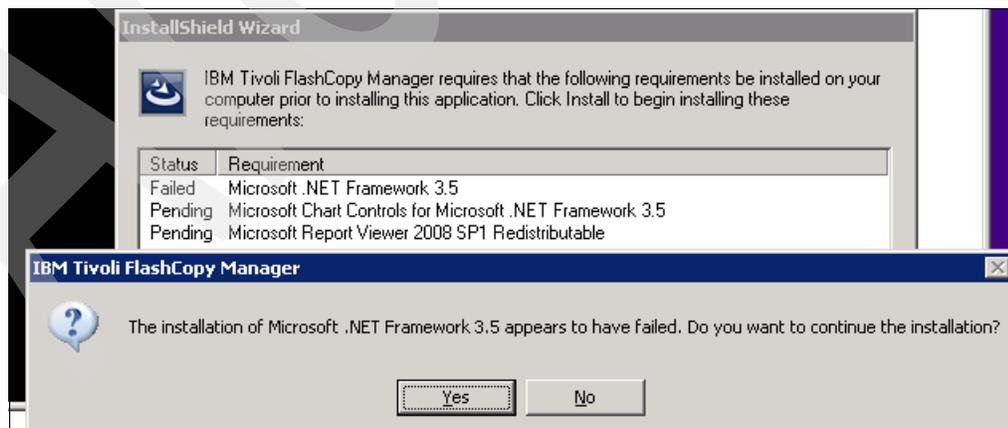2. Figure 5 and Figure 6 on page 11 show the messages returned if installation of the prerequisites is not completed.
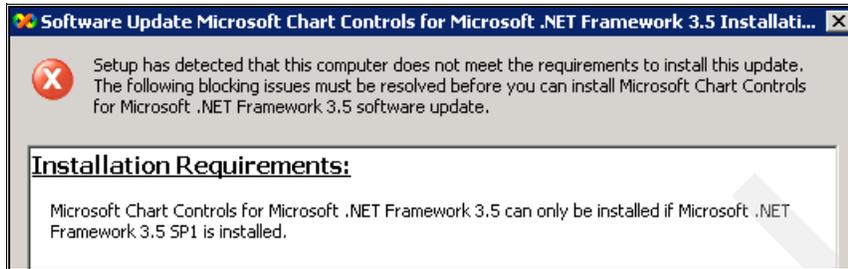

Figure 5   Missing package message window

Figure 6   Installation error

3. After all of the prerequisites have been met you can launch the FCM console. The configuration wizard panel shown in Figure 7 is displayed. Specify the environment on which you will be working: SQL or Microsoft Exchange.
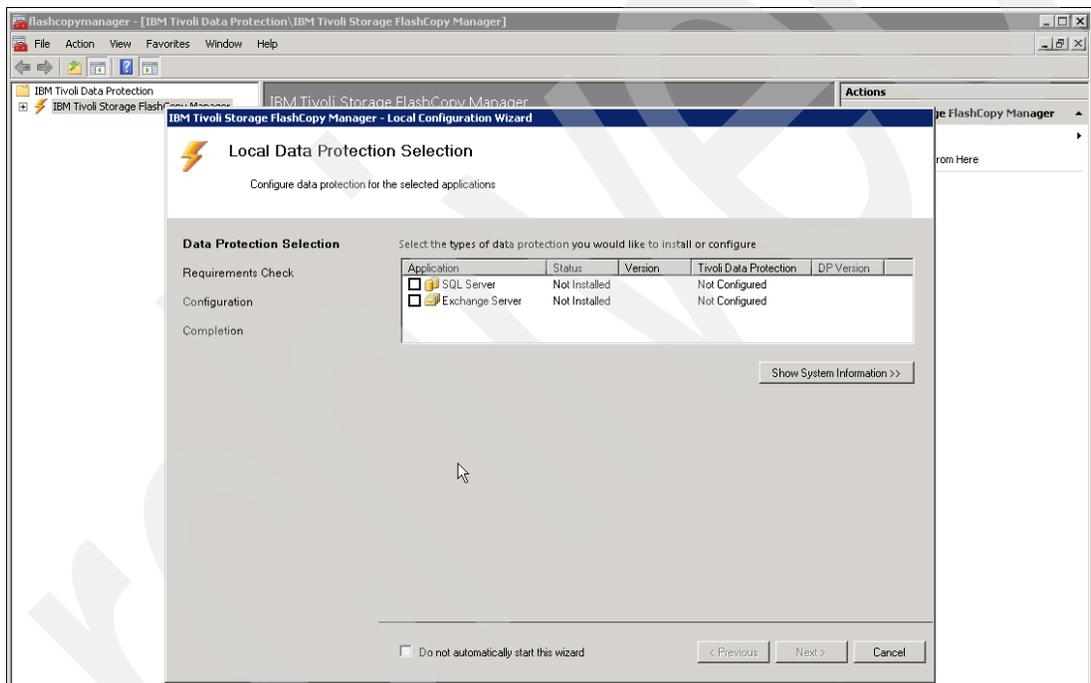

Figure 7   Configuration wizard

4. Figure 8 on page 12 shows the Requirements Check performed by the configuration wizard. As this figure shows, Windows HotFixes and the VSS Providers are required.
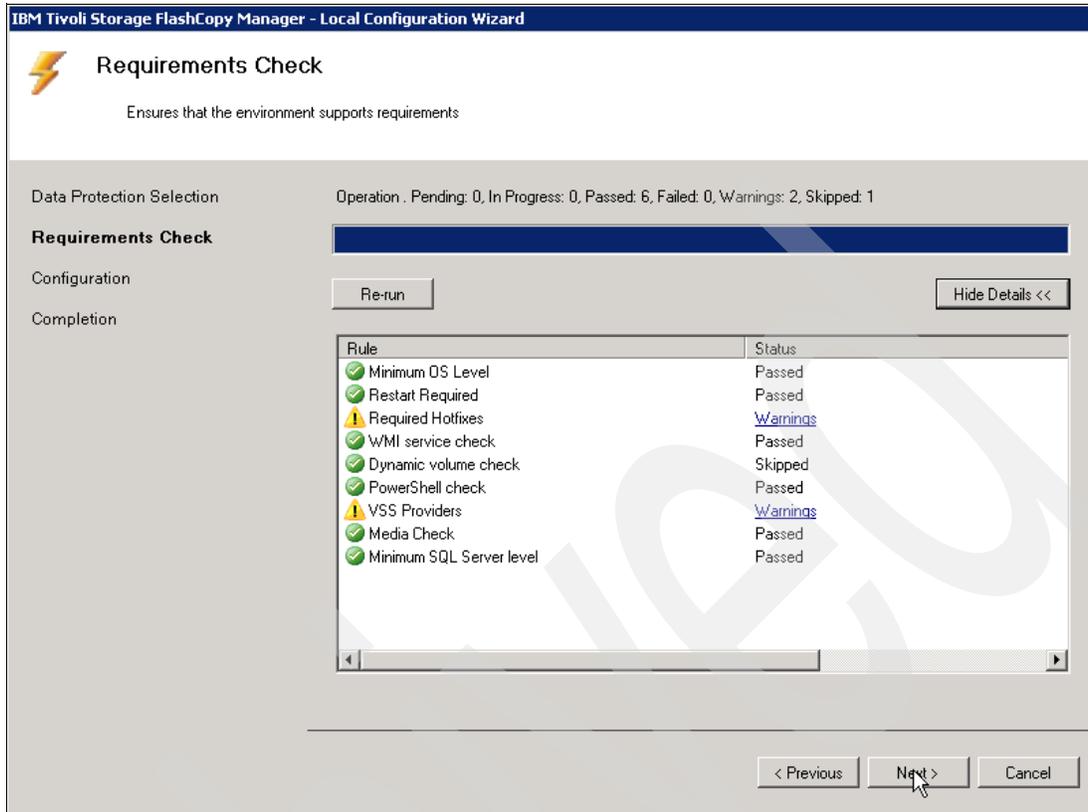
Figure 8   Requirements check panel

> **Note:** To install the VSS Provider for SVC, follow the instructions in the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide Version 5.1.0* SC23-6628-04.

5. The next two figures illustrate the VSS installation process. Select the CIM agent you want to connect to as shown in Figure 9 and click **Next**.
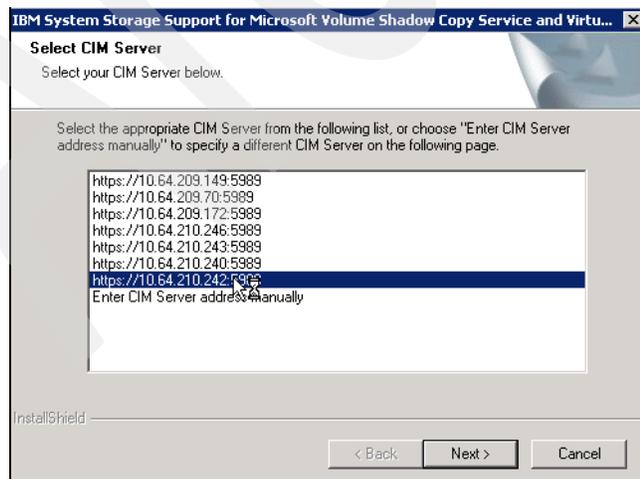

Figure 9   VSS CIM Agent selection

6. Enter your CIM Agent `userid` and `password` as shown in Figure 10.
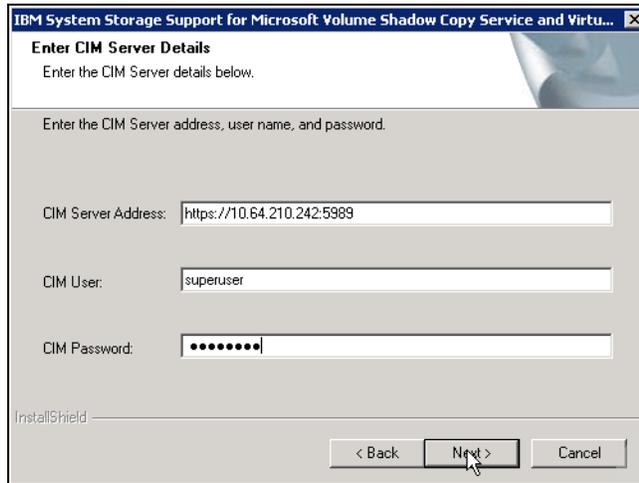

Figure 10   CIM Agent user and password

Important: Follow the VSS configuration procedure described in the chapter titled "IBM System Storage support for Microsoft Volume Shadow Copy Service and Virtual Disk Service for Windows" in the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide Version 5.1.0,* SC23-6628-04.

7. After implementing all the Windows HotFix and VSS requirements, return to the FCM configuration wizard. All the configuration check steps have now been passed, as shown in Figure 11.
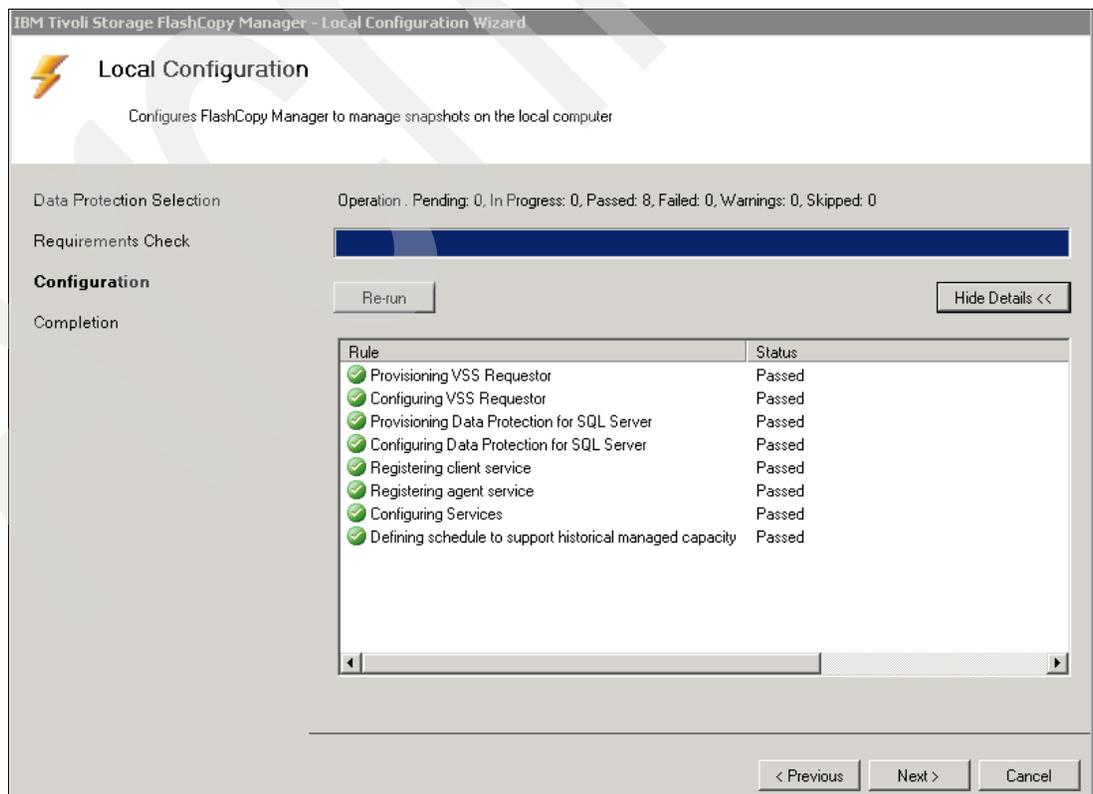

Figure 11   Check passed

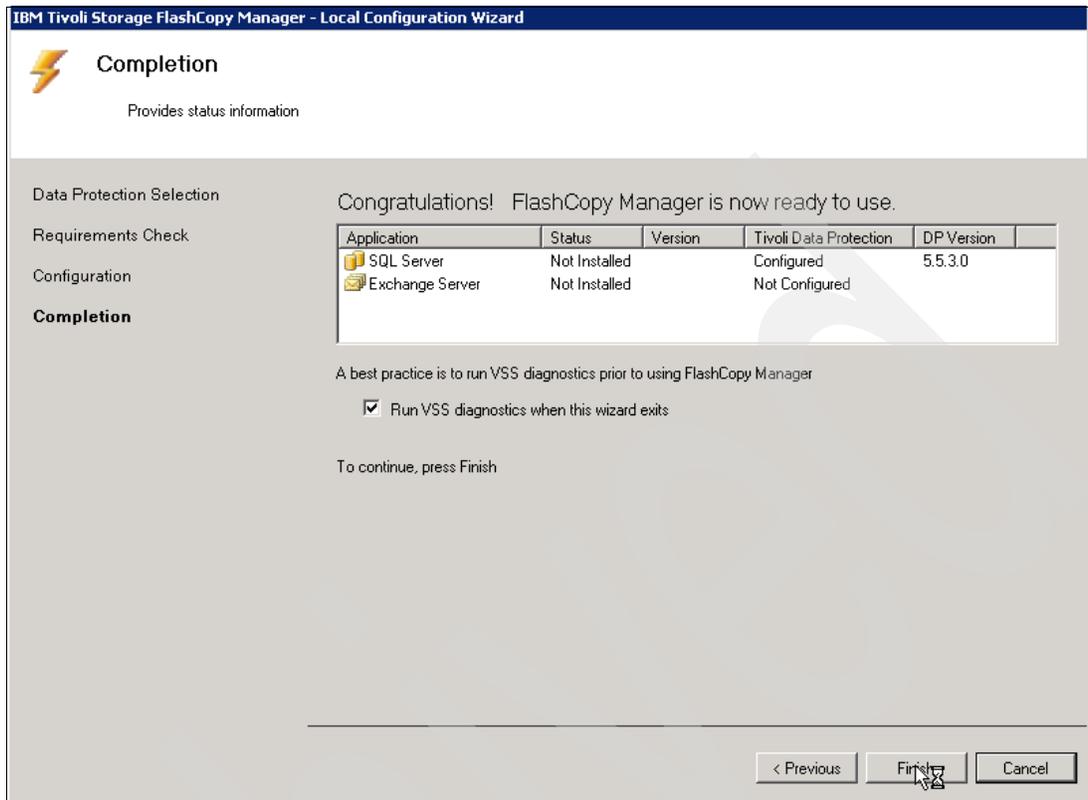8. Figure 12 shows the successful completion of installation and configuration.

Figure 12   Completion step

9. Click **Finish**. You will be redirected to the Snapshot Volume Selection for VSS test as shown in Figure 13. The test is aware of which type of database is installed on your LUNs, so the test will work only if you select the LUN where the database is installed.
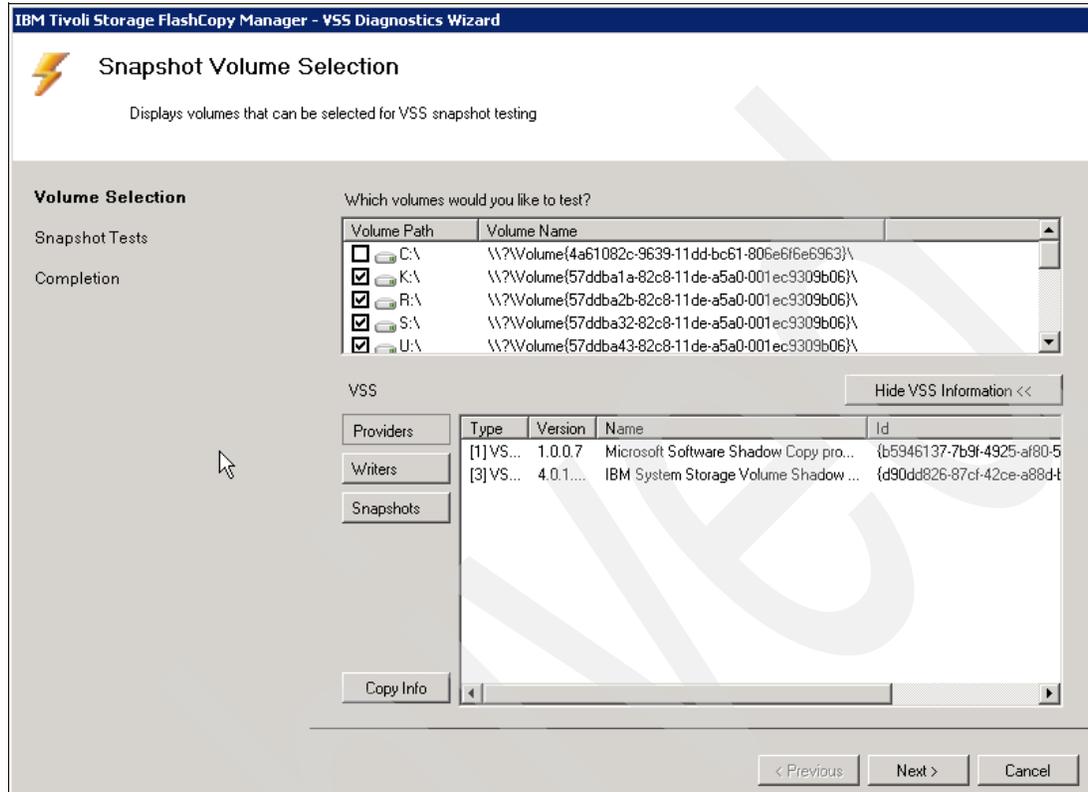

Figure 13   Snapshot Volume Selection

At the end of the VSS Test you will get the FCM Console as shown in Figure 14.
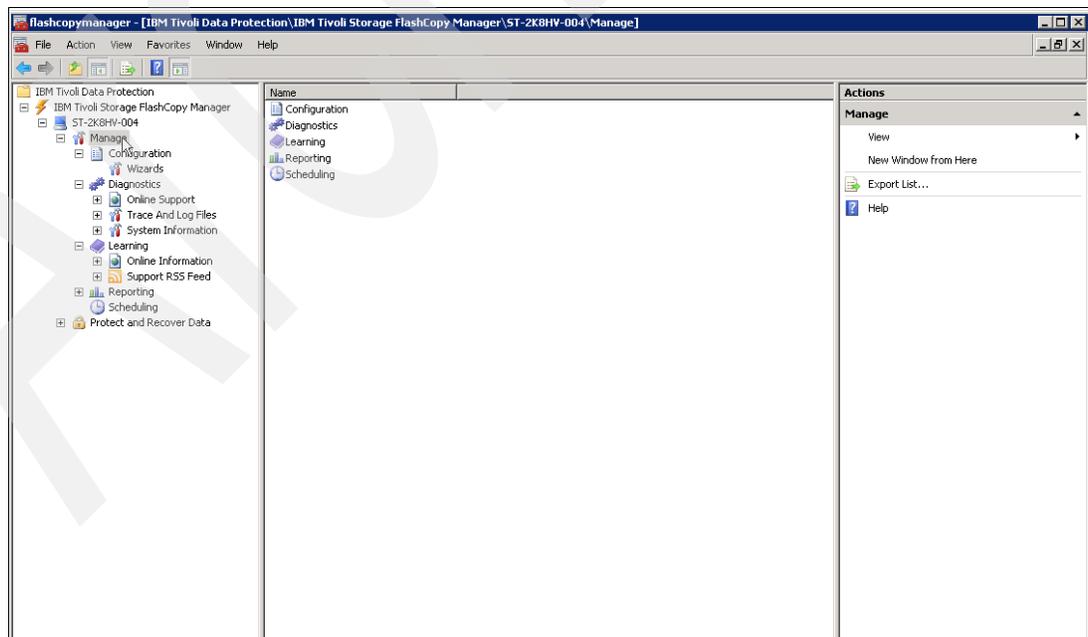

Figure 14   FCM Console

SVC and FCM in a Windows scenario

In this section we show how FCM and SVC can be integrated in a real SQL/Windows scenario where:

► The VSS free pool is configured with space efficient (thin provisioned) target volumes and the VSS provider background copy rate is set to 0

► The FCM backup policy is defined to maintain three backup versions

► One snapshot backup has been created (and one snapshot backup version exists)

► The customer will attempt to restore the available backup version and the result is that FCM will perform a FlashCopy (instant) restore.

Environment description

Our environment is composed of an SQL server with space allocated on two LUNs, one for the data and the second for the log, as shown in Figure 15 on page 16.

In this example disk K:>\ is DATA_S disk and disk L:> is the LOG_S disk.

There are counterpart disks for the FlashCopy mapping.
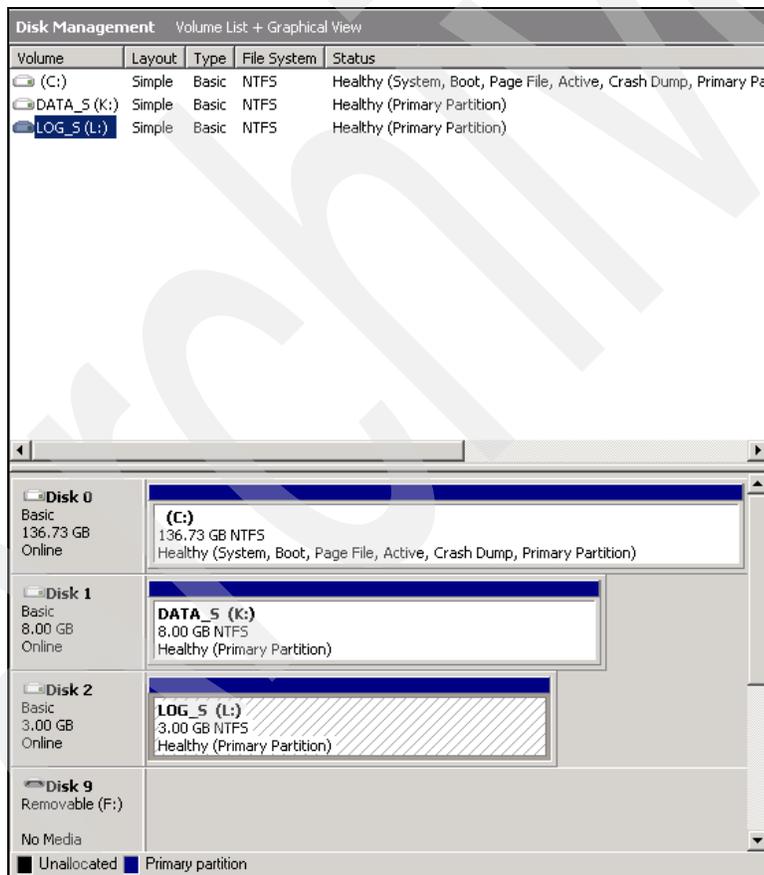

Figure 15   SQL Disk

Example 1 on page 17 shows the entire set of disks using the SVC CLI.

Example 1   Disk environment

```
IBM_2145:ITSO-CLS2:admin>svcinfo lsvdisk -filtervalue name=VD_L*
id              name              IO_group_id   IO_group_name   status
mdisk_grp_id mdisk_grp_name  capacity     type        FC_id         FC_name
RC_id         RC_name          vdisk_UID      fc_map_count   copy_count
fast_write_state
10              VD_LOG_S          0             io_grp0         online        0
MDG_DS47     3.00GB      striped
60050768018401BF280000000000001E 0           1              empty
17              VD_LOG_T_01       0             io_grp0         online        0
MDG_DS47     3.00GB      striped
60050768018401BF280000000000001B 0           1              empty
18              VD_LOG_T_02       0             io_grp0         online        0
MDG_DS47     3.00GB      striped
60050768018401BF280000000000001C 0           1              empty
19              VD_LOG_T_03       0             io_grp0         online        0
MDG_DS47     3.00GB      striped
60050768018401BF280000000000001D 0           1              empty
IBM_2145:ITSO-CLS2:admin>svcinfo lsvdisk -filtervalue name=VD_D*
id              name              IO_group_id   IO_group_name   status
mdisk_grp_id mdisk_grp_name  capacity     type        FC_id         FC_name
RC_id         RC_name          vdisk_UID      fc_map_count   copy_count
fast_write_state
8               VD_DATA_S         0             io_grp0         online        0
MDG_DS47     8.00GB      striped
60050768018401BF2800000000000012 0           1              empty
11              VD_DATA_T_01      0             io_grp0         online        0
MDG_DS47     8.00GB      striped
60050768018401BF2800000000000015 0           1              empty
13              VD_DATA_T_02      0             io_grp0         online        0
MDG_DS47     8.00GB      striped
60050768018401BF2800000000000017 0           1              empty
15              VD_DATA_T_03      0             io_grp0         online        0
MDG_DS47     8.00GB      striped
60050768018401BF2800000000000019 0           1              empty
IBM_2145:ITSO-CLS2:admin>svctask mkvdiskhostmap -host 0 8
```

Using FCM we want to create and manage three copies of data using three different sets of SE VDisks. Those VDisks will be identified by the "T" and the copy number in the name as shown in Table 2.

Table 2   FC and drive relationship

Windows drive letter	VDisk name	FC Copy 1	FC Copy 2	FC Copy 3
K:>\	VD_DATA_S	VD_DATA_T_01	VD_DATA_T_02	VD_DATA_T_03
L:>\	VD_LOG_S	VD_LOG_T_01	VD_LOG_T_02	VD_LOG_T_03

SQL database backup

Perform the following steps to trigger a disk database backup using FCM.

1. From the FCM console expand the Protect and Recover Data tree and right-click the SQL server icon to launch the FlashCopy Manager for SQL Server GUI as shown in Figure 16 on page 18.
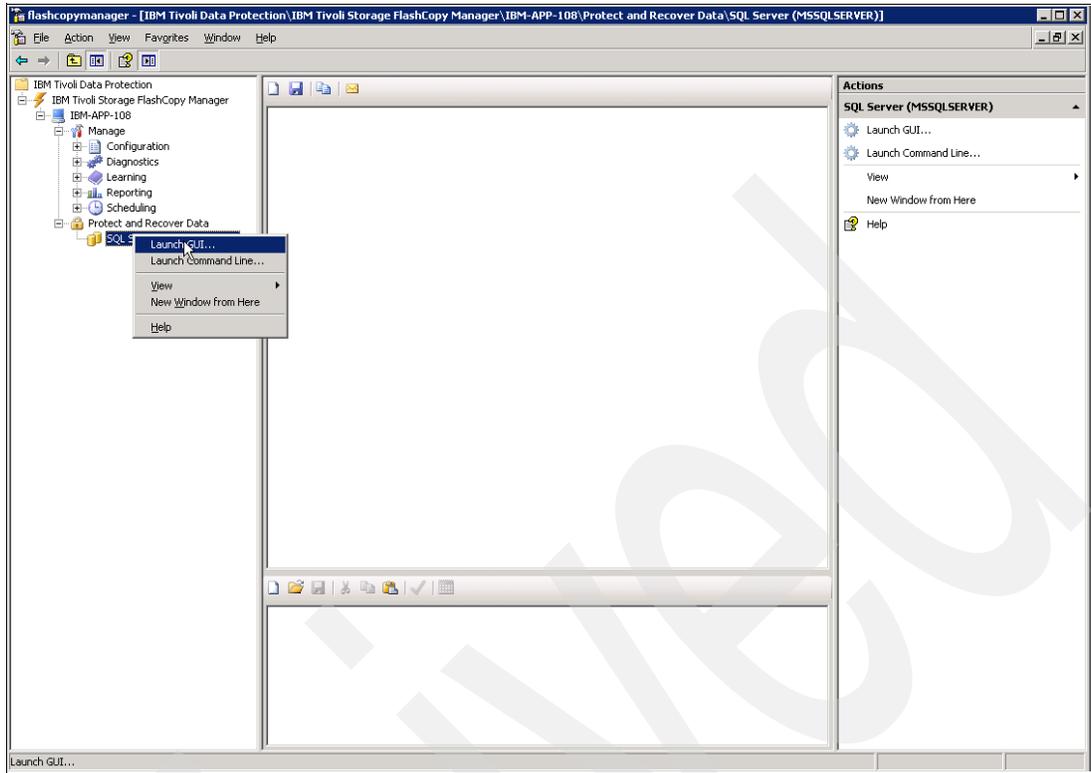
Figure 16   Launch the GUI

2. Your database is listed in the resulting panel (in our environment it is called MIO). As shown in Figure 17, two tabs are available, one for backup and one for restore.
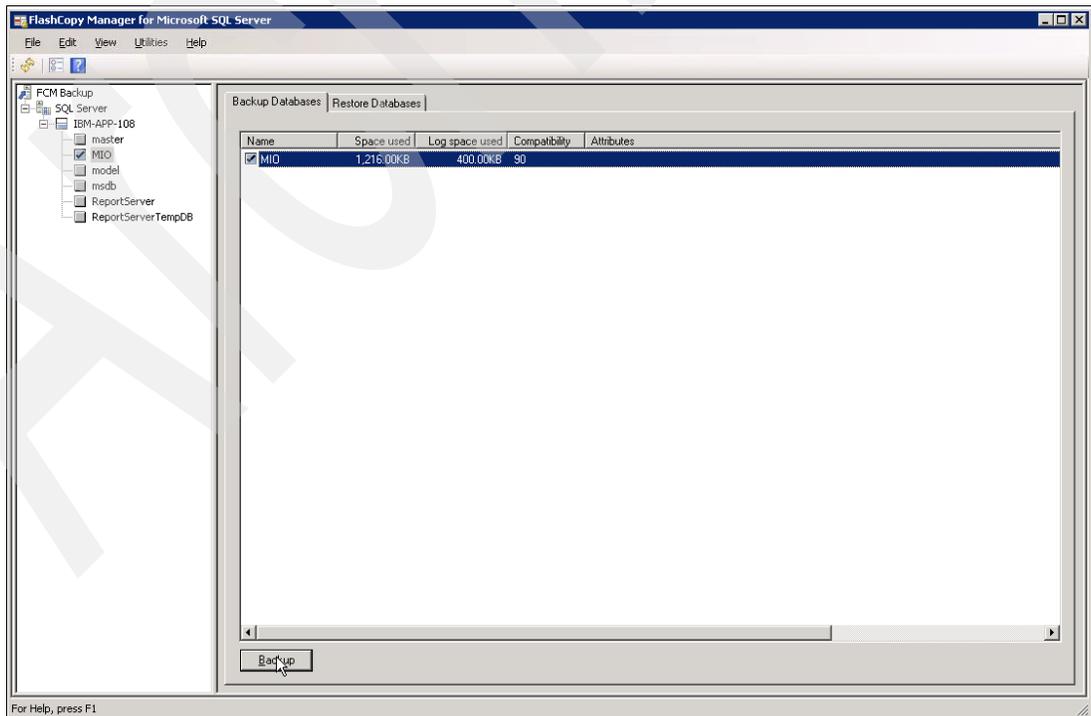

Figure 17   FCM for SQL GUI

3. Select your database and click the **Backup** button to start your database backup. A progress window is displayed as shown in Figure 18.
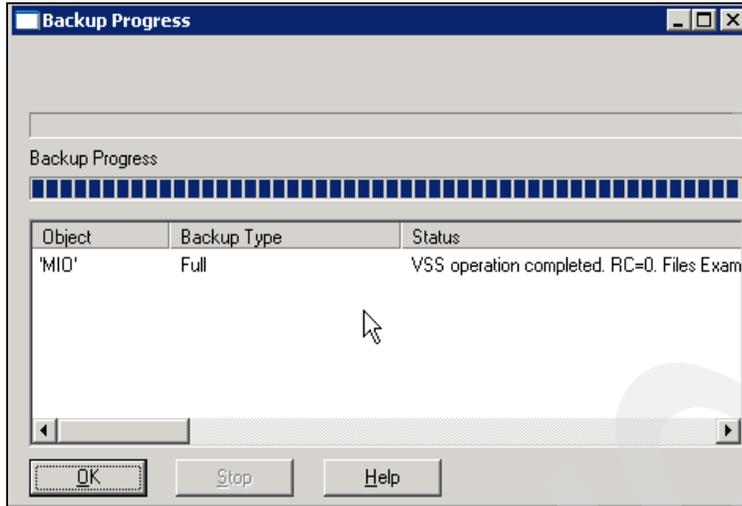

Figure 18   Backup progress window

4. Use the SVC GUI or the SVC CLI to check that FlashCopy mapping related to your database VDisks and your Target FlashCopy VDisk is in progress.

The Status field indicates when backup is complete.

SQL database restore

We configured FCM for our database from the Local Policy Management window to keep three FlashCopy snapshot versions in one day because we will run three backup processes every day, as shown in Figure 19.
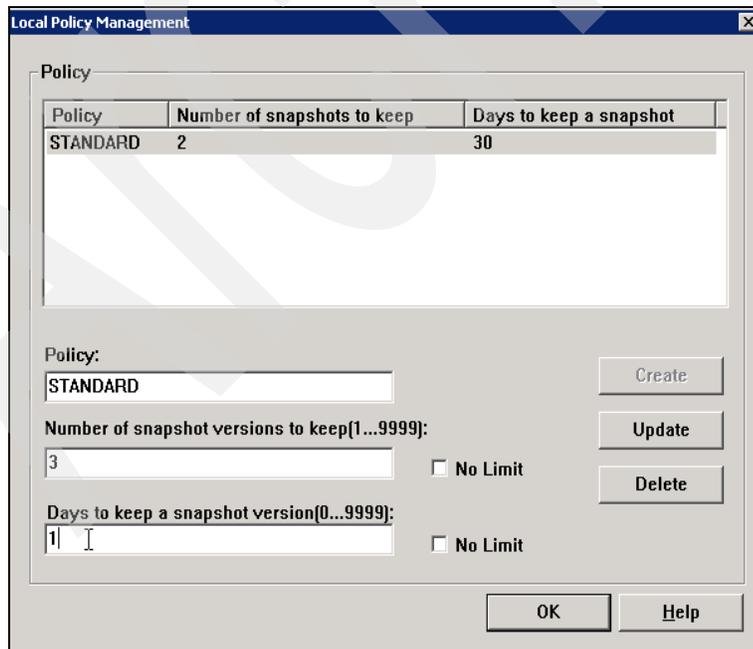

Figure 19   Local Policy Management panel

Perform the following steps to execute a restore procedure:

1. Click the **Restore Database** tab to view your last backup copy tree as shown in Figure 20. Select the copy you want to restore and click the **Restore** button.

Figure 20   Restore Database tab
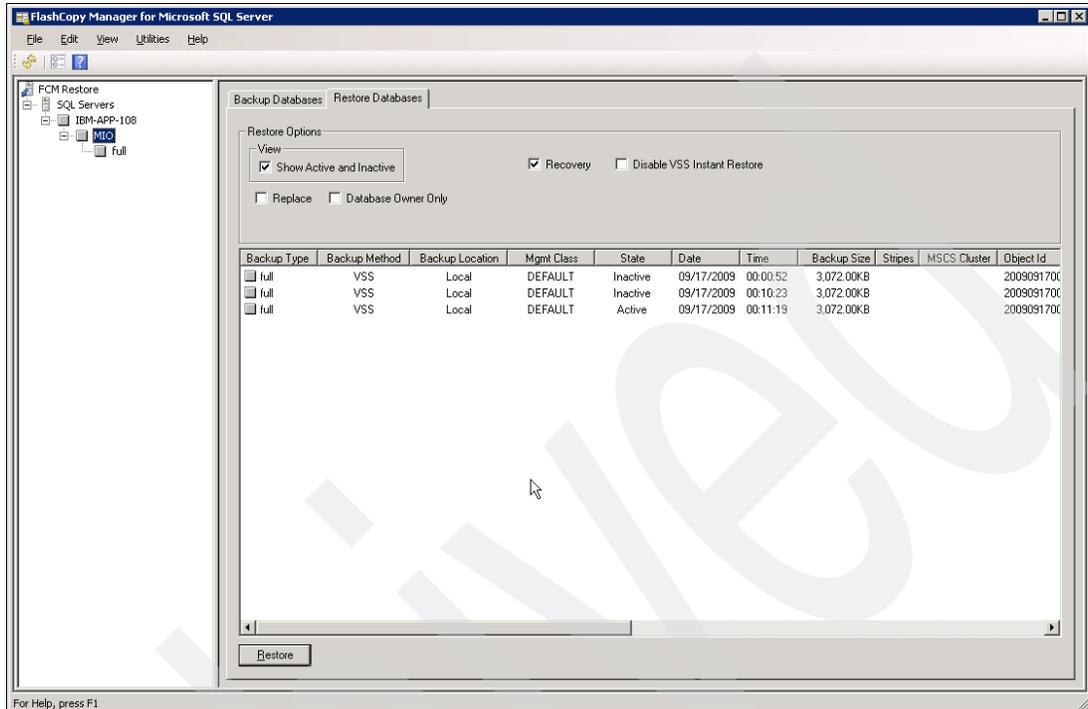
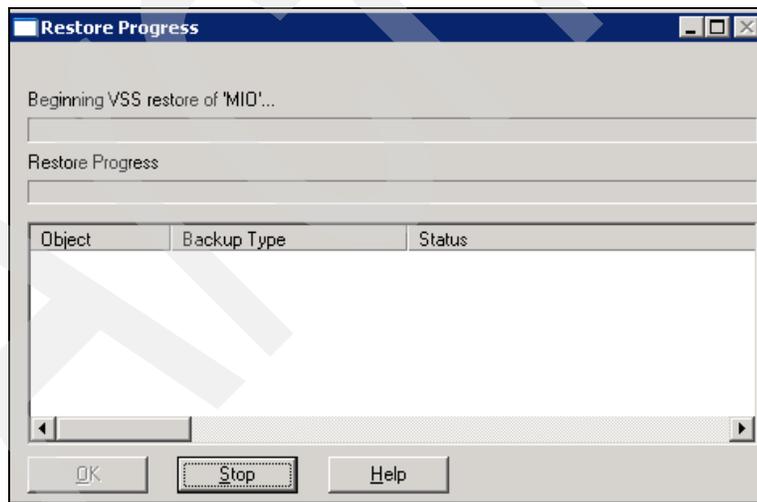2. The progress window shown in Figure 21 is displayed.

Figure 21   Restore database progress window

3. At the end of the restore process your data will be restored, as shown in Figure 22 on page 21. You can use the SVC GUI or the SVC CLI to check that FlashCopy mapping related to your database VDisks and your Target FlashCopy VDisk is in progress while the restore is running.
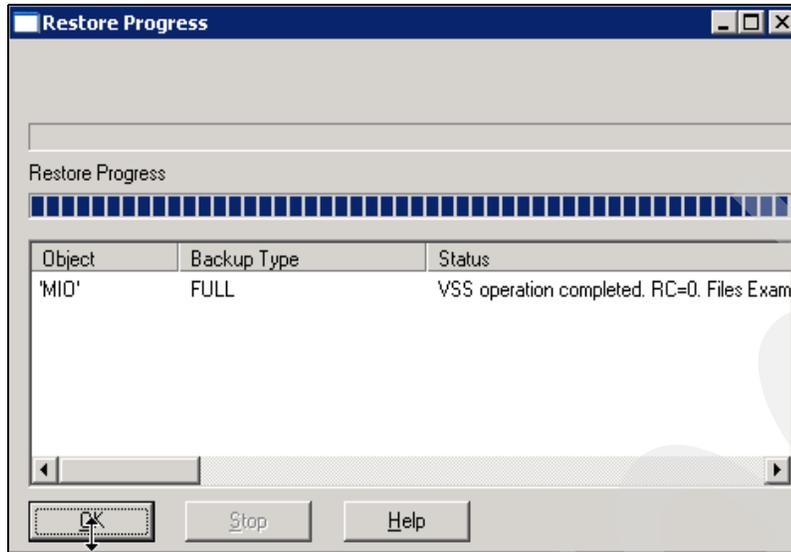
Figure 22   Restore completed

The database restore is now complete.

Related publications

IBM Redbooks publications:

► *Implementing the IBM System Storage SAN Volume Controller V5.1*, SG24-6423-07

Other publications:

► *IBM System Storage SAN Volume Controller Planning Guide*, GA32-0551

► *IBM System Storage SAN Volume Controller Hardware Installation Guide*, GC27-2132

► *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide*, SC23-6628

► *Tivoli Storage FlashCopy Manager for AIX: Installation and User's Guide*, SC27-2503

► *Tivoli Storage FlashCopy Manager Messages*, SC27-2505

► *Tivoli Storage FlashCopy Manager Quick Start Guide*, CF27SML

All of these documents are available from the IBM Publications Center at:

http://www-05.ibm.com/e-business/linkweb/publications/servlet/pbi.wss?SSN=1OBTJOOO 1139899335&FNC=SRH

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We are especially grateful for the contribution of:

Toni Ionescu, IBM Romania

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