

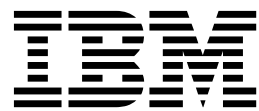
IBM Tivoli Storage FlashCopy Manager
for Custom Applications
Version 4.1.4

Installation and User Guide
UNIX and Linux



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Note:

Before you use this information and the product it supports, read the information in “Notices” on page 175.

Fourth edition (January 2016)

This edition applies to version 4, release 1, modification 4 of Tivoli Storage FlashCopy Manager for UNIX and Linux (product numbers 5608-W07, 5641-A06, and 5724-X94) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this publication

This publication provides information about installing, configuring, administering, and using IBM® Tivoli® Storage FlashCopy® Manager for UNIX and Linux.

Tivoli Storage FlashCopy Manager for UNIX and Linux is provided as a single installation package that supports the following database applications, storage systems, and operating systems:

- One of these applications:
 - DB2®, DB2 pureScale®, or DB2 in an SAP environment
 - Oracle or Oracle in an SAP environment
 - Custom applications such as file systems or other than DB2 or Oracle databases
- One of these storage systems or file systems that are used for the application:
 - IBM System Storage® DS8000®
 - IBM System Storage SAN Volume Controller
 - IBM XIV® Storage System
 - IBM Storwize® family and IBM Storwize V7000 Unified
 - IBM System Storage N series
 - NetApp Storage Systems
 - IBM General Parallel File System (GPFS™) in combination with DB2 pureScale and Custom Applications on any storage system
- One of these operating systems:
 - AIX®
 - Linux
 - Oracle Solaris
 - HP-UX

Tivoli Storage FlashCopy Manager performs online or offline backups of DB2, Oracle databases, or other applications that are on snapshot-oriented storage systems. Optionally, it performs backups to Tivoli Storage Manager storage by using IBM Tivoli Storage Manager for Enterprise Resource Planning, Tivoli Storage Manager for Databases, or Tivoli Storage Manager backup-archive client, as appropriate.

Tivoli Storage Manager is a client/server licensed product that provides storage management services in a multi-platform computer environment. It is required only if the offload backup function of Tivoli Storage FlashCopy Manager is needed.

Who should read this publication

This publication is intended for system programmers and administrators who are responsible for implementing a backup and cloning solution in one of the supported environments.

The following list identifies hardware and software solutions and tasks that can be used with Tivoli Storage FlashCopy Manager. The information that is presented in this publication assumes that you have an understanding of the following solutions and topics, as applicable.

- Storage systems or file systems that are used for the database or custom application:
 - IBM System Storage DS8000
 - IBM System Storage SAN Volume Controller or IBM Storwize family
 - IBM XIV Storage System
 - IBM System Storage N series
 - NetApp systems
 - IBM General Parallel File System (GPFS)
- Oracle or DB2 database administration
- Tivoli Storage Manager

Publications

The Tivoli Storage Manager product family includes IBM Tivoli Storage FlashCopy Manager, IBM Tivoli Storage Manager for Space Management, IBM Tivoli Storage Manager for Databases, and several other storage management products from IBM.

To view IBM product documentation, see IBM Knowledge Center.

New for Tivoli Storage FlashCopy Manager for Custom Applications Version 4.1.4

New features and enhancements are available in Tivoli Storage FlashCopy Manager Version 4.1.4.

New and changed information is indicated by a vertical bar to the left of the change.

Offload GPFS snapshots to the Tivoli Storage Manager server

Tivoli Storage FlashCopy Manager for Custom Applications Version 4.1.4 supports offload of local backups of GPFS snapshots to the Tivoli Storage Manager server.

For information about preparing for installing Tivoli Storage FlashCopy Manager for Custom Applications with GPFS file system, see “Preparing Tivoli Storage FlashCopy Manager for Custom Applications with GPFS” on page 30. For information about setting up Tivoli Storage FlashCopy Manager for Custom Applications with GPFS file system, see “Configuring Tivoli Storage FlashCopy Manager for Custom Applications for GPFS” on page 48.

“Query managed capacity” on page 156 for capacity licensing

Use the **managed_capacity** command to view the front-end and back-end capacity for snapshots. Print the output into a specified directory to save the report to an XML file.

SAN Volume Controller next generation adapter

Protect your application on SAN Volume Controller and Storwize family storage systems without manually preparing target volumes. The SAN Volume Controller and Storwize family next generation adapter uses dynamic target allocation during the backup operation to allocate target volumes.

New and modified parameters or functions

The following parameters are new for Tivoli Storage FlashCopy Manager V4.1.4:

In the OFFLOAD section of the profile file for Tivoli Storage FlashCopy Manager for Custom Applications in GPFS environments, the following parameters apply.

MMBACKUP_SERVER

In the **OFFLOAD** section of the profile file, **MMBACKUP_SERVER** is added and is required. The value of this parameter is the name of the Tivoli Storage Manager where offloads are sent.

MMBACKUP_OPTIONS

In the **OFFLOAD** section of the profile file, **MMBACKUP_OPTIONS** is added. After you configure Tivoli Storage FlashCopy Manager for Custom Applications for GPFS, the value of **MMBACKUP_OPTIONS** is empty. Use this parameter to specify options that are added to the **mmbackup** command, which is used to offload Tivoli Storage FlashCopy Manager backups to Tivoli Storage Manager. This parameter is optional.

MMBACKUP_MAX_RETRIES

| In the **OFFLOAD** section of the profile file, **MMBACKUP_MAX_RETRIES** is added. The
| value that is specified indicates the number of retries that are attempted when
| an **mmbackup** operation does not complete. The default value is 2.

DEVICE_CLASS Storwize family and SVC with dynamic target allocation (SVCDTA)

In the **DEVICE_CLASS device** section of the profile file, **DEVICE_CLASS Storwize family and SVC with dynamic target allocation (SVCDTA)** is added. This enables you to select dynamic target allocation as the method for allocating target volumes on SAN Volume Controller and Storwize family storage systems during a backup operation. For more information about this parameter, see “DEVICE_CLASS parameters for dynamic target allocation” on page 118.

Chapter 1. Overview

IBM Tivoli Storage FlashCopy Manager provides a method to back up and restore data by using the advanced snapshot technologies of storage systems.

Tivoli Storage FlashCopy Manager can back up DB2 databases, Oracle databases, or other applications that are on snapshot-oriented storage systems or file systems.

Tivoli Storage FlashCopy Manager backup operations are based on volume-level copy operations that are provided by the storage system. For GPFS in combination with DB2 pureScale, or Custom Applications, the backup operations are based on GPFS file sets. In this scenario, any storage solution that is supported by the GPFS file system can be used. Tivoli Storage FlashCopy Manager takes snapshots at a volume group or GPFS file set level for granular control.

When you use Tivoli Storage FlashCopy Manager with other Tivoli Storage Manager products, snapshots can be sent to the Tivoli Storage Manager server. Depending on the application, Tivoli Storage FlashCopy Manager can transfer snapshots by using IBM Tivoli Storage Manager for Enterprise Resource Planning, IBM Tivoli Storage Manager for Databases, or Tivoli Storage Manager backup-archive client. Tivoli Storage FlashCopy Manager uses Oracle RMAN Media Management API. Using RMAN maximizes the protection of Oracle data, and provides a comprehensive storage management solution. To send snapshot backups to Tivoli Storage Manager, you must configure a backup server or cluster.

The following list identifies the applications that can be protected and cloned with Tivoli Storage FlashCopy Manager.

- Protect the following database applications with Tivoli Storage FlashCopy Manager:
 - DB2, DB2 in an SAP environment, DB2 in a partitioned database environment, and DB2 pureScale environment. You can back up and restore data from single-partition databases, and logically or physically partitioned DB2 databases.
 - Oracle, Oracle with Automatic Storage Management (ASM), and Oracle in an SAP environment.
- Clone the following database applications with Tivoli Storage FlashCopy Manager:
 - DB2, DB2 in an SAP environment, DB2 with the Database Partitioning Feature included.
 - Oracle and Oracle in an SAP environment that is on a file system that is supported by Tivoli Storage FlashCopy Manager.
- Oracle with Automatic Storage Management (ASM)
- Back up and restore custom applications with Tivoli Storage FlashCopy Manager:
 - Any database application other than those database applications listed in the preceding list.
 - Any other applications that are on file systems that are supported by Tivoli Storage FlashCopy Manager.

Tivoli Storage FlashCopy Manager supports specific operating systems. All servers that have Tivoli Storage FlashCopy Manager installed must be at the same operating system release level. Certain high availability (HA) environments are supported.

The following list identifies the storage solutions or file systems that you can use with Tivoli Storage FlashCopy Manager software:

- IBM XIV Storage System
- IBM Storwize family
- IBM System Storage SAN Volume Controller
- IBM System Storage DS8000
- IBM System Storage N series
- NetApp Storage system
- GPFS file system in combination with DB2 pureScale
- GPFS file system in combination with Custom Applications

Backup and restore methods with FlashCopy and snapshots

A snapshot or FlashCopy is an instant, point-in-time copy of a logical unit (LUN) or a set of LUNs.

FlashCopy and snapshots

The term *FlashCopy* is used for IBM System Storage DS8000, IBM System Storage SAN Volume Controller, and IBM Storwize family storage devices. A FlashCopy creates a point-in-time copy in which the target volume represents an exact copy of the data on a source volume at the time the FlashCopy starts. Data that exists on the target volume is replaced by the copied data. When you create a FlashCopy of a source volume, Tivoli Storage FlashCopy Manager requires that the target volume must be the same size as the source volume. In addition, the target volume and source volume must have the same logical track format. The source and target volumes must also be on the same storage system.

For IBM XIV Storage System, IBM System Storage N series, NetApp, and file systems such as GPFS, the term *snapshot* is used. A snapshot represents a point-in-time copy of a volume or set of volumes without having to define a specific target volume. The source volumes and snapshots are located on the same storage system. Similarly, a file system snapshot represents a point-in-time copy of a file system or file set within a file system. The space that is required for the snapshot is allocated automatically within the same storage system or file system, and can increase over time.

Using a FlashCopy or snapshot you can back up data from source volumes to target volumes. Similarly, you can back up file systems or file sets within a file system. When data is restored, backup copies are retrieved and the data is copied to the source volume, or copied to the original location in the file system or file set.

Types of snapshot backups

There are two types of snapshot backups, a full copy snapshot and a space-efficient snapshot. The type of snapshot backups that are available depend on the storage environment. During a full copy snapshot, all blocks of data on the source volume are copied to the target volume. During a space efficient snapshot, only blocks of data that are overwritten on the source volume are copied.

Transferring snapshots to Tivoli Storage Manager

When you use Tivoli Storage FlashCopy Manager with Tivoli Storage Manager products, you can transfer snapshots to the Tivoli Storage Manager server. To send these snapshot backups to the Tivoli Storage Manager server, you must configure a backup server or cluster.

The following figure shows the relationship among the components in a production environment when you run a backup or restore snapshot.

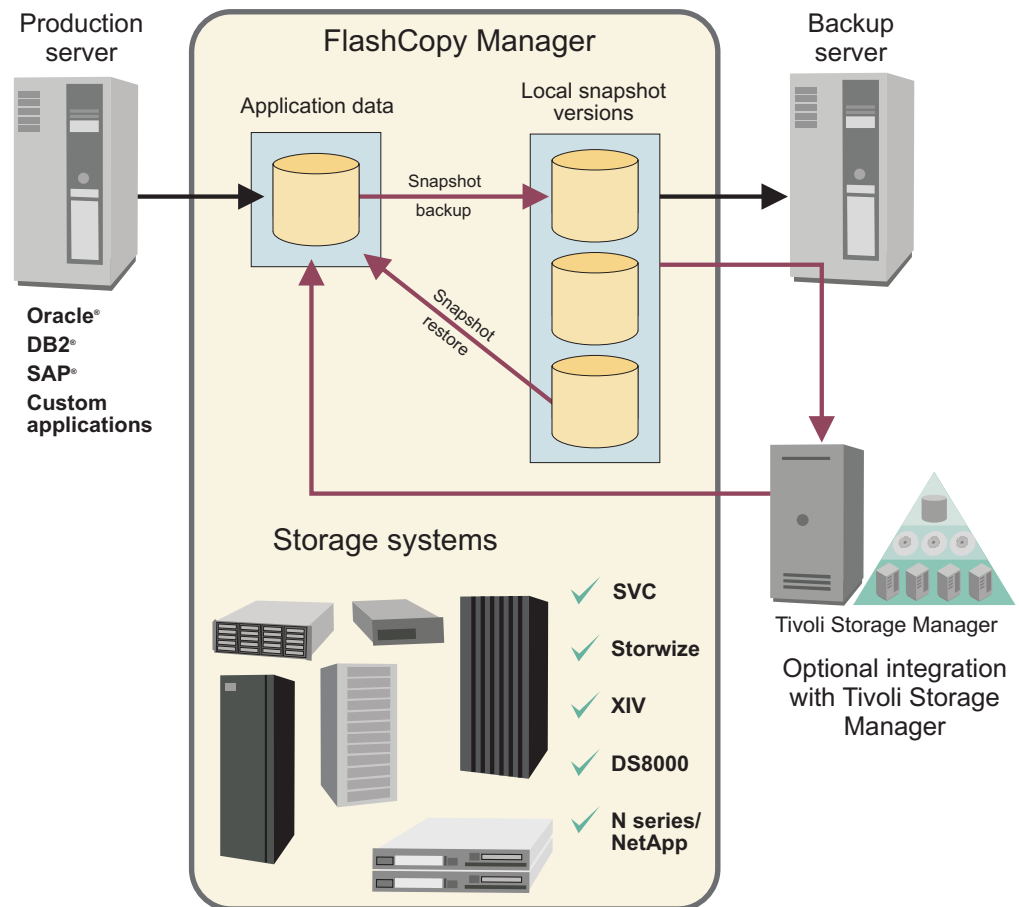


Figure 1. Tivoli Storage FlashCopy Manager backup and restore environment

Database cloning

The database cloning process creates an exact copy of a database to provide near-production data.

Tivoli Storage FlashCopy Manager uses the FlashCopy or snapshot function for database cloning. The following list identifies scenarios when you might clone a database:

- To create a test system before you introduce a new product release, or new functions into a production environment.
- To create an education system from a master training system. You can reset the cloned database before you start a new course.
- To create a dedicated reporting system to offload the workload away from the production environment.

Traditionally, the database cloning process redirected a restore operation to create the clone. This method has disadvantages, including system downtime and degraded system performance. Tivoli Storage FlashCopy Manager clones a database by using the storage system FlashCopy or snapshot capabilities to minimize the impact on the production database. A *clone server* or *clone system* is required by Tivoli Storage FlashCopy Manager to mount a cloned database.

The following figure shows how Tivoli Storage FlashCopy Manager creates and stores a cloned database on a clone server.

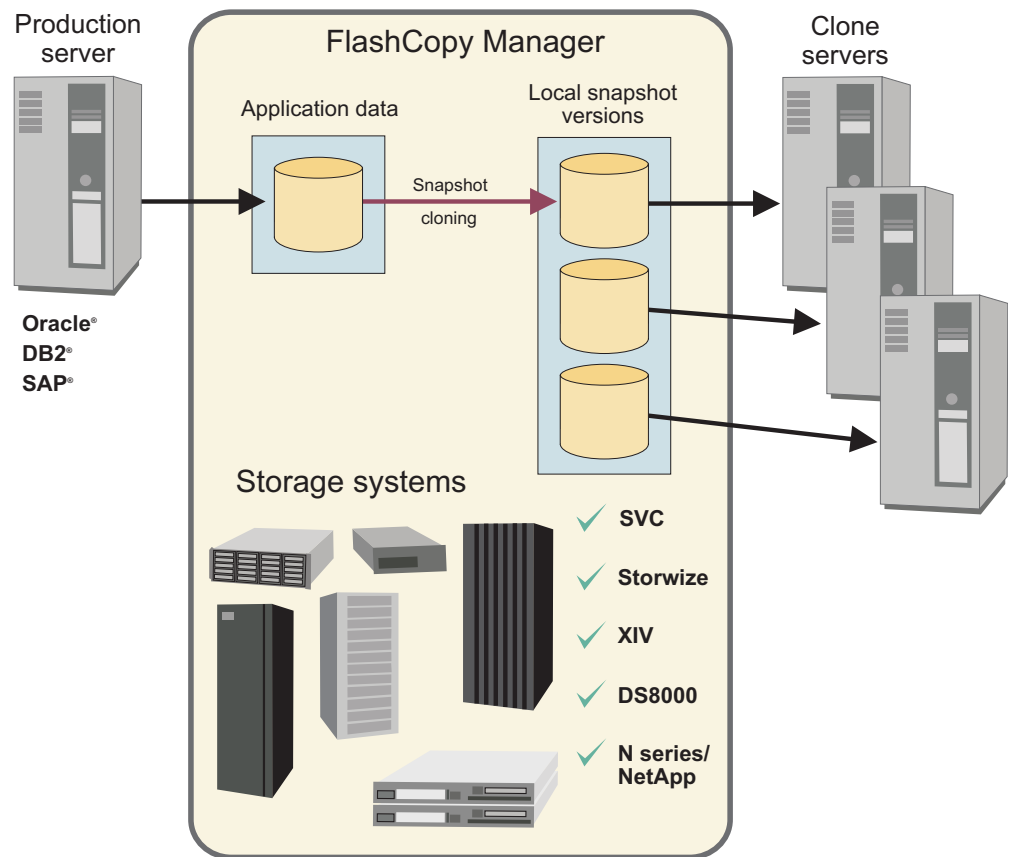


Figure 2. Tivoli Storage FlashCopy Manager and database cloning

Software components

Tivoli Storage FlashCopy Manager is composed of several software components.

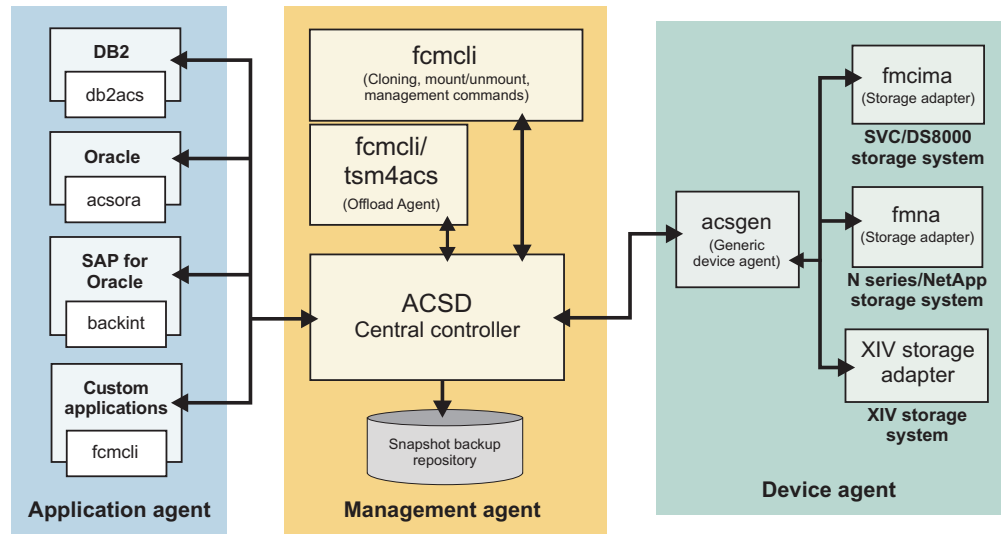


Figure 3. Tivoli Storage FlashCopy Manager system components

Application agent

The application agent provides the necessary support to implement snapshot-based backup and restore operations. This agent interacts with the applications and tracks when a Tivoli Storage FlashCopy Manager backup is created for a specific application.

Management agent

The management agent acsd coordinates all the components that are involved in backup, restore, and cloning operations. The agent controls the flow of information among the application and device agents, and other daemons. The agent provides access to the snapshot backup repository. This repository contains information about the snapshot backups and their relationships to snapshot-capable storage devices.

Device agent

The acsgen device agent is a generic agent that interacts with storage device-specific adapters and the central controller agent. This agent is also used to send and request updates of the progress and usability information that is stored in the local snapshot backup repository.

The following lists the storage device-specific agents that communicate with the acsgen agent:

- The CIM adapter fmcima is used with the generic device agent acsgen. This adapter issues commands to the supported storage device by using the CIM interface. Examples of supported storage include DS8000, Storwize family, and SAN Volume Controller.

Note: For Storwize family, and SAN Volume Controller storage systems, this communication using the CIM interface applies only in the case of static target allocation (device type SVC); the SVC adapter with dynamic target allocation (device type SVCDTA) uses the CLI interface via Secure Shell (SSH) rather than the CIM interface.

- The XIV system storage adapter is used with the generic device agent acsgen. This adapter communicates with the acsgen agent and issues commands to the XIV system Storage System by using the command-line interface XCLI.

- The N series and NetApp storage adapter `fmna` is used with the generic device agent `acsgen`. This adapter issues commands to the storage device by using the NetApp ONTAPI interface.

Offload agent

The offload agent `tsm4acs` is used to send an existing snapshot to Tivoli Storage Manager. This agent also calls the generic device agent for mount and unmount operations on a backup system. From the command-line interface `fccli`, you can manually start an offload backup to Tivoli Storage Manager.

Tivoli Storage FlashCopy Manager command-line interface

The command-line interface `fccli`, is used to issue various commands.

Chapter 2. Planning

Before you install Tivoli Storage FlashCopy Manager for UNIX and Linux, review the system, application, and storage requirements.

Review the Tivoli Storage FlashCopy Manager Pre-installation Checklist that is attached to the technote for the hardware and software requirements for Tivoli Storage FlashCopy Manager. The detailed hardware and software requirements are published as a part of the following technote: <http://www-01.ibm.com/support/docview.wss?uid=swg21427692>. From this technote, select the required software version and then select the required component link. The hardware and software requirements page contains the Pre-installation Checklist and an installation planning worksheet.

Note: The pre-installation checklist contains the most current requirement information, use this list to validate your environment. Tivoli Storage FlashCopy Manager depends on the correct setup of different subsystem components. The following conditions are the minimum environment requirements:

- A suitable disk layout of the application on the production server
- Correctly defined storage definitions on the storage system
- Connectivity from the production server to the storage system

The installation planning sheet helps you to determine the correct type of installation that is required for your environment. The following areas are covered in the planning sheet:

- How to determine the configuration mode for your environment.
- How to decide the parameters and settings for the specific application that you want to protect. The required parameters for each specific software application and custom application are outlined in the planning sheet.
- How to determine the parameters and settings for the specific storage system that you use in your environment.
- What passwords are required during the installation.

IBM FlashCopy Manager Prerequisite Checker

Run the IBM FlashCopy Manager Prerequisite Checker to check the compatibility of the operating system, and available software that is to be used by Tivoli Storage FlashCopy Manager in an AIX, or Linux environment. The Prerequisite Checker does not change the database or the system; it retrieves information from the operating system and database in preparation for installing Tivoli Storage FlashCopy Manager for DB2, and Tivoli Storage FlashCopy Manager for Oracle and Oracle in an SAP environment.

The IBM FlashCopy Manager Prerequisite Checker is a tool that automates checks for your environment that are documented in the Tivoli Storage FlashCopy Manager *Pre-installation Checklist*. That checklist is attached to the IBM Tivoli Storage FlashCopy Manager Hardware and Software Requirements technote.

The hardware and software requirements for Tivoli Storage FlashCopy Manager for UNIX and Linux are published in the following technote: <http://www.ibm.com/>

support/docview.wss?uid=swg21427692. Follow the link to the requirements technote for your specific release or update level. From there you will find the *Pre-installation Checklist* and the *Installation Planning Worksheet* for the most recent version of the product.

Capacity planning

Ensure that there is sufficient storage space before you install and use IBM Tivoli Storage FlashCopy Manager.

The storage space that is required for Tivoli Storage FlashCopy Manager can be divided into the following categories:

- Space that is required for the global product installation on the system.
- Space that is required to enable each individual database instance or custom application instance with Tivoli Storage FlashCopy Manager. This enablement is referred to as activation.
- Space that is required on the storage system or in the GPFS file system to store the actual snapshot backups or clones.

Space requirement for global product installation

The space that is required for the product installation of Tivoli Storage FlashCopy Manager varies depending on the underlying operating system. The following table shows the default installation paths and the average space requirements.

Table 1. Space requirements for a global product installation of Tivoli Storage FlashCopy Manager

Operating system	Default installation path	Space required (MB)
AIX	/usr/tivoli/tsfcm/acs_version_number	1100
Solaris	/opt/tivoli/tsfcm/acs_version_number	700
Linux	/opt/tivoli/tsfcm/acs_version_number	500
HP-UX	/opt/tivoli/tsfcm/acs_version_number	1900

Space requirement for database instance or custom application installation

Tivoli Storage FlashCopy Manager must also be installed on each database and custom application instance that is enabled for snapshot-based data protection or cloning. This process is called activation and occurs during the installation. During this process, all necessary files are copied from the installation path to a database instance-specific or custom application-specific installation directory. The space that is required for each Tivoli Storage FlashCopy Manager enabled application is equal to the amount of space that is required for the global product installation.

Tivoli Storage FlashCopy Manager must also be installed on application instances that are running on a backup server.

Extra space is required for Tivoli Storage FlashCopy Manager log files. Log files are written continuously by Tivoli Storage FlashCopy Manager without automatically deleting the older ones. You must monitor periodically the amount of space that is used by these log files and manually delete them if required.

Space requirement for snapshot copies

The snapshot copies of your application data or databases require the most space. The space that is required depends on the following factors:

- The total size of all storage system source volumes that are part of the volume group on the storage system. The volume groups contain the application data.
- The type of snapshot whether it is a full copy or a space-efficient snapshot.
- The number of backup copies.
- The number of changes that occur on the source volumes after a snapshot is taken. This factor applies to space-efficient snapshots only.
- In an IBM DB2 pureScale environment, snapshots are stored in the GPFS file system. Therefore, the GPFS file system must have sufficient free space to store all snapshots. The size of a snapshot depends on the number of changes to the GPFS file system content that occur after the snapshot was taken. As a consequence, space requirements for a single snapshot can increase over time.
- For Tivoli Storage FlashCopy Manager for Custom Applications, snapshots are stored in the GPFS file system. Therefore, the GPFS file system must have sufficient free space to store all snapshots. The size of a snapshot depends on the number of changes to the GPFS file system content that occur after the snapshot was taken. As a consequence, space requirements for a single snapshot can increase over time.

For remote mirroring with a XIV system, each backup copy uses space on the remote site storage and on the local site until it is deleted.

Use the **MAX_VERSIONS** parameter in the Tivoli Storage FlashCopy Manager profile configuration file to limit the number of snapshots that are stored on a storage system or in a GPFS file system.

On SAN Volume Controller, IBM Storwize family, and IBM System Storage DS8000, full snapshot copies require the same amount of space as the corresponding source volumes. If there is not enough storage space available, you can increase the capacity on the requested storage pool, or free up some items that are using existing capacity.

Required communication ports

Tivoli Storage FlashCopy Manager for UNIX and Linux uses ports for communication between its daemon processes on backup or cloning systems, and the production system, and the storage systems. Port numbers are defined during the installation of Tivoli Storage FlashCopy Manager for UNIX and Linux.

To determine the port number for the ports that are used for Tivoli Storage FlashCopy Manager for UNIX and Linux see the following table:

Table 2. Tivoli Storage FlashCopy Manager for UNIX and Linux port numbers.

TCP Port	Initiator: Out-Bound (From Host)	Target: In-Bound (To Host)
57328	Production server and backup/cloning server	ACSD port on production system

Table 2. Tivoli Storage FlashCopy Manager for UNIX and Linux port numbers (continued).

TCP Port	Initiator: Out-Bound (From Host)	Target: In-Bound (To Host)
5989 (HTTPS port) ^[1] 5988 (HTTP port) ^[1] Note: Not applicable if you are using the new SVC storage adapter, in which case port 22 must be accessible on SAN Volume Controller storage for SSH access.	Production server and backup/cloning server	SAN Volume Controller Storwize family cluster CIM agent
6989 (HTTPS port) ^[1] 6988 (HTTP port) ^[1]	Production server and backup/cloning server	DS8000 DS8000 CIM Agent
7778	Production server and backup/cloning server	XIV system XIV system CLI
443 (HTTPS port) ^[1] 80 (HTTP port) ^[1]	Production server and backup/cloning server	N series systems NetApp NetApp Manageability SDK/ONTAP
[1] Where COPYSERVICES_COMMPROTOCOL is the corresponding parameter name in the profile.		

Storage solutions

Before you install and configure Tivoli Storage FlashCopy Manager software, review the storage solution setup. In an IBM DB2 pureScale environment, Tivoli Storage FlashCopy Manager is independent of the underlying storage that is used by the GPFS file system. Therefore, no additional configuration other than what is required by DB2 pureScale is necessary. This is also the case for Tivoli Storage FlashCopy Manager for Custom Applications.

IBM XIV Storage System

When Tivoli Storage FlashCopy Manager creates a backup on an IBM XIV Storage System, a snapshot of all source volumes that belong to the protected application is created on the storage system. This snapshot is a space-efficient read-only copy of the application.

The storage device and its storage volumes must be accessible from either a storage area network (SAN) zone, network or both. During the Tivoli Storage FlashCopy Manager configuration process, if you set the **USE_WRITABLE_SNAPSHOTS** parameter to NO, the snapshots are not mounted directly on another host. Instead, Tivoli Storage FlashCopy Manager creates duplicates from the snapshots as part of the mount procedure, these duplicates are removed when the backup is unmounted. A duplicate is a space-efficient logical copy of the snapshot and this copy is writable.

The **USE_WRITABLE_SNAPSHOTS** parameter specifies whether writable snapshots can be used for mount or restore operations. If writable snapshots are used, no duplicates are created during mount operations and all changes that are applied to

the snapshot are preserved. Writable snapshots are only required in LVM mirroring environments. A typical IBM XIV Storage System profile entry is provided here:

```
>>>
DEVICE_CLASS                XIV01
COPYSERVICES_HARDWARE_TYPE  XIV
PATH_TO_XCLI                 path where XCLI is installed
COPYSERVICES_SERVERNAME     xiv_hostname
COPYSERVICES_USERNAME       admin
COPYSERVICES_REMOTE         YES
COPYSERVICES_PRIMARY_SERVERNAME xiv_hostname
COPYSERVICES_REMOTE_SERVERNAME xiv_remote_hostname
COPYSERVICES_REMOTE_USERNAME admin
USE_WRITABLE_SNAPSHOTS      AUTO
BACKUP_HOST_NAME            backup_host
<<<
```

To offload backups to Tivoli Storage Manager, Tivoli Storage FlashCopy Manager must be installed on a backup server. You must also configure the **TSM_BACKUP** profile parameter to YES and set the **BACKUP_HOST_NAME** profile parameter to the name of the hostname or cluster name as defined on the storage system.

For remote mirroring with a XIV system, each backup copy uses space on the remote site storage and on the local site until it is deleted.

Dependent software packages

Tivoli Storage FlashCopy Manager requires the IBM XIV Storage System command-line interface (XCLI) to be installed on all hosts, production, backup, or clone servers where Tivoli Storage FlashCopy Manager is installed.

Support for LVM mirroring (AIX only) and ASM failure groups

If AIX Logical Volume Manager (LVM) mirroring is used in the environment, Tivoli Storage FlashCopy Manager can create separate snapshots of either mirror. In an Oracle ASM environment, a snapshot of selected failure groups is created. However, there must be enough remaining failure groups to mount the corresponding disk group for this image to be created. Each mirror or failure group must be located on a different XIV Storage System.

In LVM mirroring environments, the use of writable snapshots is required. Tivoli Storage FlashCopy Manager uses IBM XIV Storage System capabilities to restore writable snapshots. For writable snapshots, a mount operation directly mounts the original snapshot to another host. All changes to the snapshot are preserved, and a subsequent mount or backup operation contains all changes that occurred to the snapshot while mounted. For more information about using writable snapshots, see information about the **USE_WRITABLE_SNAPSHOTS** parameter in “*DEVICE_CLASS device*” on page 109.

(AIX only) Support for virtual I/O

IBM XIV Storage System and Tivoli Storage FlashCopy Manager support virtual I/O with n-port ID virtualization. On the production server, Tivoli Storage FlashCopy Manager supports virtual I/O with N_Port ID Virtualization (NPIV) and Virtual I/O Server (VIOS). There is a one to one relationship between the virtual I/O logical volume and the storage LUN. On the backup server, Tivoli Storage FlashCopy Manager supports virtual I/O with NPIV only.

Remote access to snapshot backups

Tivoli Storage FlashCopy Manager allows mounting a backup image on another host. Unlike FlashCopy devices, Tivoli Storage FlashCopy Manager creates a duplicate from the snapshot, which is then mounted on the host. As the duplicate is effectively another image, changes to the duplicate are not reflected in the snapshot. As a result, the mounted image can be altered without affecting the backup image and any subsequent restore of that backup. Tivoli Storage FlashCopy Manager removes the duplicate during the unmount operation. All changes that were made on the duplicate are undone. A subsequent mount operation, presents the image as created when the snapshot occurred.

Best practices for Tivoli Storage FlashCopy Manager with IBM XIV 11.6 Real-time Compression

You can use IBM XIV 11.6 Real-time Compression with Tivoli Storage FlashCopy Manager. The usage of Tivoli Storage FlashCopy Manager with compressed volumes does not change. However, when you transform volumes managed by Tivoli Storage FlashCopy Manager from the uncompressed state to the compressed state (or if you transform from compressed to uncompressed), use the following list of behaviors as a guide:

1. When source volume transformation is in progress (from uncompressed to compressed, or compressed to uncompressed), most Tivoli Storage FlashCopy Manager operations (for example, back up, restore, and mount) fail. The XIV adapter returns the **FMM18137E** message. Perform the volume transformation at a time that does not overlap with scheduled backups or other Tivoli Storage FlashCopy Manager actions running on the volume that is being transformed.
2. With the XIV system, you can transform a volume from uncompressed to compressed state (or compressed to uncompressed state) using one of the following options:
 - With the `delete_source=yes` option, delete all volume backups. If you do not delete the volume backups, the transform is unsuccessful. You can use the Tivoli Storage FlashCopy Manager GUI or CLI to manually delete the backups before the transform operation runs.
 - With the `delete_source=no` option, the volume backups are retained. After the transform completes, the original (source) volume is hidden from the host system. The original volume is replaced by the transformed volume. Any instant restore operation completed with the backups made before the transformation are restored to the hidden volume on the storage device. The restore is not made to the volume seen by the host. Note that the restore to the volume seen by the host appears to be successful, but the source volume visible to the host system is unchanged.

When using Tivoli Storage FlashCopy Manager to protect volumes to be transformed, delete the existing snapshot backups, regardless of the `delete_source` option setting.

IBM System Storage N series and NetApp storage systems

When Tivoli Storage FlashCopy Manager creates backups on IBM System Storage N series and NetApp storage system, space efficient snapshots are created. The underlying storage can be network-attached storage (NAS) or storage area network (SAN). For Oracle with Automatic Storage Management (ASM), the underlying storage is storage area network (SAN) only.

In addition to creating snapshot backups you can also complete the following tasks:

- Offload backups to Tivoli Storage Manager by using an auxiliary or backup server.
- Restore data from DB2, Oracle, DB2 in an SAP environment, Oracle in an SAP environment, and custom applications snapshots.
- Create database clones, you cannot clone a custom application. For database cloning, a new independent volume is created from a snapshot. This new independent volume is similar to a complete copy. Database cloning is supported for SAN-attached storage only.

For SAN-attached storage, the production and backup servers must be connected by using Fibre Channel and TCP/IP. For NAS attached storage, the production and backup servers are connected by using TCP/IP only.

To offload backups to Tivoli Storage Manager, Tivoli Storage FlashCopy Manager must be installed on the backup server. You must also configure the **TSM_BACKUP** profile parameter to YES. In addition, you must set the **BACKUP_HOST_NAME** profile parameter to the name of the initiator group as defined on the storage system.

The following example shows a sample profile for IBM System Storage N series and NetApp storage solutions with SAN-attached storage:

```
>>>
DEVICE_CLASS          N6240
COPYSERVICES_HARDWARE_TYPE SAN_NSERIES
COPYSERVICES_SERVERNAME n6240_hostname
COPYSERVICES_USERNAME  root
BACKUP_HOST_NAME       backup_host
<<<
```

The following profile example, shows the same storage solutions but with NAS attached storage:

```
>>>
DEVICE_CLASS          N6240
COPYSERVICES_HARDWARE_TYPE NAS_NSERIES
COPYSERVICES_SERVERNAME n6240_hostname
COPYSERVICES_USERNAME  root
BACKUP_HOST_NAME       backup_host
<<<
```

Support for LVM mirroring (AIX only) and ASM failure groups

If AIX Logical Volume Manager (LVM) mirroring is used in the environment, Tivoli Storage FlashCopy Manager can create separate snapshots of either mirror. In an Oracle ASM environment, a snapshot of selected failure groups is created. However, there must be enough remaining failure groups to mount the corresponding disk group for this image to be created. Each mirror or failure group must be located in a different N series or NetApp Storage System.

Support for virtual I/O (AIX only)

IBM System Storage N series or NetApp storage solutions and Tivoli Storage FlashCopy Manager supports a virtual I/O with n-port ID virtualization. On the production server, Tivoli Storage FlashCopy Manager supports virtual I/O with N_Port ID Virtualization (NPIV) and Virtual I/O Server (VIOS). There is a one to one relationship between the virtual I/O logical volume and the storage LUN. On the backup server, Tivoli Storage FlashCopy Manager supports virtual I/O with NPIV only.

Remote access to snapshot backups

Tivoli Storage FlashCopy Manager allows mounting a backup image on another host. Unlike FlashCopy devices, Tivoli Storage FlashCopy Manager creates a duplicate from the snapshot, which is then mounted on the host. As the duplicate is effectively another image, changes to the duplicate are not reflected in the snapshot. As a result, the mounted image can be altered without affecting the backup image and any subsequent restore of that backup. Tivoli Storage FlashCopy Manager removes the duplicate during the unmount operation. All changes that were made on the duplicate are undone. A subsequent mount presents the image as created when the snapshot occurred.

SAN Volume Controller and Storwize family storage systems

IBM Tivoli Storage FlashCopy Manager can restore point-in-time copies from backups on SAN Volume Controller 6.1 or later, and Storwize family storage systems. You can also mount images on a remote server and back up the images to Tivoli Storage Manager.

SAN Volume Controller storage adapter device types

Tivoli Storage FlashCopy Manager for UNIX and Linux offers two backup solutions with Storwize family and SAN Volume Controller storage systems.

When you configure Tivoli Storage FlashCopy Manager, you can select one of the following device types (**COPYSERVICES_HARDWARE_TYPE**):

SVCDTA

Storwize family and SAN Volume Controller: dynamic target allocation. During the backup process, target volumes are created dynamically and allocated on demand.

SVC Storwize family and SAN Volume Controller: static target allocation. You must manually create target volumes on the storage system before the backup process.

The device type (**COPYSERVICES_HARDWARE_TYPE**) that you select is added to the device class section of the profile. The **COPYSERVICES_SERVERNAME** parameter stores the TCP/IP host name of the physical disk storage system.

For more information about configuring Tivoli Storage FlashCopy Manager, see 'Configuration tasks > Running the setup script' for the application that is being protected.

Restriction: Both SVC and SVCDTA values are considered as different hardware types so there are limitations when they are used on the same storage system. For more

information, see the 'Restriction' section in “Migrating from SVC with static target allocation to SVC with dynamic target allocation (SVCDTA)” on page 51

For a predefined target solution, before you start a backup operation you must ensure that the following tasks are completed:

- Target volumes are created on the storage system
 - Target sets for the volumes on the storage system are created
- A *target set* represents the mapping from the ESX host to the target volume on the storage system. You must specify a new target set for each backup generation to be retained on the storage system.

The following table provides a feature comparison between dynamic target volumes and predefined target volumes.

Table 3. Dynamic target volumes and predefined target volumes feature comparison

Feature	Dynamic target volumes	Static target volumes
Configuration interface	Storwize family or SAN Volume Controller command-line interface (CLI)	Common Information Model (CIM) interface
Number of FlashCopy snapshot images retained	No limit	Limited by the number of target sets defined
Selectively restore a single FlashCopy snapshot image	Yes	Yes, however any FlashCopy image in the target set that is newer than the FlashCopy restored is deleted

Support for LVM mirroring (AIX only) and ASM failure groups

If AIX Logical Volume Manager (LVM) mirroring is used in the environment, Tivoli Storage FlashCopy Manager can create separate FlashCopy images of either mirror. In an Oracle Automatic Storage Management (ASM) environment, a FlashCopy image of selected failure groups is created. However, there must be enough remaining failure groups to mount the corresponding disk group for this image to be created. Each mirror or failure group must be located in a different storage system.

Support for virtual I/O (AIX only)

DS8000, SAN Volume Controller, and Storwize family logical unit numbers (LUNs) can be attached to a host directly or by using Virtual I/O (VIO). Both setups are supported, when there is a 1-1 relation between VIO logical volumes and storage LUNs on the storage subsystem.

A VIO is a logical partition (LPAR) on a pSeries system that is controlled by the IBM Hardware Management Console (HMC) or IBM Integrated Virtualization Manager (IVM). It owns the hardware adapters and allows access for other logical partitions. This feature allows the device to be shared. The LPAR associated with the resources is the VIO Server and the logical partitions that use it are VIO Clients. For example, they can share one disk on the VIO Server instead of rebooting each logical partition from a Small Computer System Interface (SCSI) adapter and SCSI disk. This function eliminates the number of required adapters, adapter slots, and disks.

Tivoli Storage FlashCopy Manager uses virtual SCSI adapters to map disks from a VIO to a client LPAR. Physical volumes are required to be mapped from the VIO to the client. However, mapping logical volumes or storage pools is not supported. On the production server, Tivoli Storage FlashCopy Manager supports virtual I/O with N_Port ID Virtualization (NPIV) and Virtual I/O Server (VIOS). There is a one to one relationship between the virtual I/O logical volume and the storage LUN. On the backup server, Tivoli Storage FlashCopy Manager supports virtual I/O with NPIV. In addition, VIOS is supported when you configure the **BACKUP_HOST_NAME** parameter to use the **PREASSIGNED_VOLUMES** in the Tivoli Storage FlashCopy Manager profile file.

More details about supported combinations of operating system and storage subsystem levels, are available in the Pre-installation Checklist that is available at this URL <https://www.ibm.com/support/docview.wss?uid=swg21427692>. From this technote, select the required software version and then select the required component link. The hardware and software requirement page contains the Pre-installation Checklist and an installation planning worksheet.

Remote access to FlashCopy images

Tivoli Storage FlashCopy Manager allows mounting a FlashCopy backup image to another host. This image is writable and any changes that are made on that image are reflected in the backup and are included in the subsequent restore.

Related information:

 <https://www.ibm.com/support/docview.wss?uid=swg21427692>

Space-efficient multi-target FlashCopy on SAN Volume Controller and Storwize family

Space-efficient targets that are part of a multi-target FlashCopy cascade might be deleted by SAN Volume Controller and Storwize family if other targets of the same cascade are restored or overwritten by a new snapshot.

In a SAN Volume Controller or a Storwize family environment, the following situations might cause space-efficient targets to be deleted:

Backup operations and cloning operations

A Tivoli Storage FlashCopy Manager backup operation uses the oldest target set that is available for the specified **DEVICE_CLASS**. However, that target set might not be the oldest target set that is associated with the source volumes. This scenario is possible when more than one **DEVICE_CLASS** is specified in the Tivoli Storage FlashCopy Manager profile. When the FlashCopy backup that is available on the target set is not the oldest backup, then the older backups are deleted during the backup operation. The oldest target set is the set that is used for the oldest FlashCopy backup in a multiple target set configuration. This situation can also happen when a new FlashCopy cloning operation is started with the force option (-F).

Important: This does not apply if you select SAN Volume Controller and Storwize family dynamic target allocation.

Restore operation

A Tivoli Storage FlashCopy Manager restore operation deletes any FlashCopy backups that are newer than the backup that is being restored. In addition, the backup that is restored with the current operation can also be deleted.

Important: This does not apply if you select SAN Volume Controller and Storwize family dynamic target allocation.

Target volume storage space exceeded

When the available storage capacity of a space-efficient FlashCopy target volume is exceeded, the target volume is taken offline. The data on the target volume that is taken offline is deleted.

SAN Volume Controller and Storwize family

When you use SAN Volume Controller and Storwize family, Tivoli Storage FlashCopy Manager software can restore FlashCopy backups before completion of a background copy.

When you restore FlashCopy backups before completion of a background copy, space-efficient volumes can be enabled as backup targets. The background copy rate is set to zero to prevent the FlashCopy target from becoming fully allocated. When you use either SAN Volume Controller or Storwize family, and Tivoli Storage FlashCopy Manager software in this scenario, use the following guidelines for the environment:

Physical capacity

The physically allocated capacity of a space-efficient target volume must be large enough to contain all changes that occur to your production environment. Specifically, all changes that occur between the current and the subsequent backup. If the capacity is insufficient, the target volume goes offline and the corresponding backup becomes invalid.

SAN Volume Controller and Storwize family support the creation of automatically expanding target volumes. If you create target volumes that automatically expand, more storage is assigned to the target when storage capacity decreases. This additional storage ensures that sufficient capacity is available.

Tip: If you select SAN Volume Controller and Storwize family dynamic target allocation, all target volumes that were created dynamically will be auto-expandable.

FlashCopy relationships

During a restore, Tivoli Storage FlashCopy Manager software stops FlashCopy relationships. These relationships include relationships that are established at the time when the backup is created to any subsequent relationships that are created on the same source LUN. All backups to space-efficient targets that are newer than the backup used for restore, and the backup from which you are restoring, are deleted. If the background copy was not completed, the same restriction applies to full and incremental FlashCopy backups.

To check whether a backup is going to be deleted, query the usability state of Tivoli Storage FlashCopy Manager backups. If the backup is going to be deleted, during the restore process, the `DESTRUCTIVELY_RESTORABLE` state is set. Otherwise, the state is set to `REPETITIVELY_RESTORABLE`.

Important: This does not apply if you select SAN Volume Controller and Storwize family dynamic target allocation. With SVCDTA, no backups are deleted during a restore operation.

Target sets

Tivoli Storage FlashCopy Manager cannot reuse a target set for a new FlashCopy backup unless it corresponds to the last FlashCopy mapping in

a cascaded FlashCopy relationship. This scenario implies that when Tivoli Storage FlashCopy Manager reuses a target set, all backups that are created before this point in time are deleted. In a non-mirrored environment, all backups that are created before this point in time are deleted when the following conditions are met:

- The same profile for the Tivoli Storage FlashCopy Manager backups is used.
- This profile contains only one **DEVICE_CLASS** statement in the **CLIENT** section.

In a mirrored environment, all backups that are created before this point in time are deleted when the **CLIENT** section of the profile contains one **DEVICE_CLASS** statement for each LVM mirror. If multiple device classes are specified within this statement, each device class must manage the same number of target sets.

Important: This does not apply if you select SAN Volume Controller and Storwize family dynamic target allocation.

Recommendations for setting up the environment with static target volumes

When you set up the SAN Volume Controller and Storwize family environments for use with Tivoli Storage FlashCopy Manager software, the following list identifies guidelines for the environment:

- If space-efficient source volumes are used in combination with space-efficient target volumes, Tivoli Storage FlashCopy Manager can be configured to use **FLASHCOPY_TYPE COPY**, **INCR**, or **NOCOPY**. If fully allocated source volumes are used in combination with space-efficient target volumes, then Tivoli Storage FlashCopy Manager can be configured to use **FLASHCOPY_TYPE NOCOPY** only.
- Decide whether you want to use space-efficient or fully allocated backup targets. In mirrored environments, a different choice can be made for each mirror.
- For each mirror, use one **DEVICE_CLASS** statement for disk-only backups. In addition, use one **DEVICE_CLASS** statement for dual backups. A dual backup is a disk backup and tape backup. Make sure that the schedule is defined so that the target sets are reused cyclically across both device classes per mirror.

For example:

- Define three target sets in the **DISK_ONLY** device class. Schedule these disk only backups to occur at 6:00, 12:00, and 18:00.
- Define one target set in a **DUAL_BACKUP** device class. Set this schedule to create a disk and Tivoli Storage Manager backup at 00:15.

If you retain only one target set generation for dual backups, do not specify six target sets to retain disk only backups (created at 6:00, 12:00, and 18:00) for two days. The second dual backup operation attempts to reuse the target set of the previous dual backup. If the version policy specifies **ADAPTIVE**, this action results in a deletion of all disk-only backups that are taken before that point in time. Otherwise, the version policy causes the dual backup to fail if **retain** specifies seven versions.

- If a backup that is characterized as **DESTRUCTIVELY_RESTORABLE** is restored, the backup you are restoring and all backups that are taken after that point in time are deleted. The backup is not deleted when the backup is created with **FLASHCOPY_TYPE FULL** or **INCR**, and the background copy completed.

DS8000 storage system

For the DS8000 storage system, it is not possible to restore point-in-time copies when you set the **FLASHCOPY_TYPE** parameter to *NOCOPY* in the Tivoli Storage FlashCopy Manager profile file.

You can mount images on a remote server and back up the images to Tivoli Storage Manager when you use DS8000 storage systems.

CIM server

Starting with DS8000 R4.1 the Common Information Model (CIM) server is embedded with the storage device. It is not necessary to install and configure the CIM server separately. For earlier releases of DS8000, a proxy CIM server is required and must be configured to manage the necessary storage clusters. For more information about configuring a proxy CIM server, see the DS8000 documentation.

Tivoli Storage FlashCopy Manager requires that FlashCopy backup target volumes be created in advance on DS8000. To provide a target set definition to Tivoli Storage FlashCopy Manager, organize target volumes into target sets, where each target set represents one backup generation. Tivoli Storage FlashCopy Manager automatically matches source volumes to suitable target volumes. However, each target set must contain at least one suitable target volume for each source volume to be backed up. Additional target volumes in a target set are allowed, but these target volumes are ignored.

Support for LVM mirroring (AIX only) and ASM failure groups

If AIX Logical Volume Manager (LVM) mirroring is used in the environment, Tivoli Storage FlashCopy Manager can create separate FlashCopy images of either mirror. In an Oracle Automatic Storage Management (ASM) environment, a FlashCopy image of selected failure groups is created. However, there must be enough remaining failure groups to mount the corresponding disk group for this image to be created. Each mirror or failure group must be located in a different storage system.

DS8000 allows one incremental FlashCopy per source volume. When production volumes are mirrored by using Logical Volume Manager (LVM) mirroring or ASM failure groups, only one FlashCopy backup of this type per volume mirror is created. For incremental snapshots with DS8000 storage, only one target set can be specified in the target volumes file (.fct).

Support for virtual I/O (AIX only)

DS8000 logical unit numbers (LUNs) can be attached to a host directly or by using Virtual I/O (VIO). Both setups are supported, when there is a 1-1 relation between VIO logical volumes and storage LUNs on the storage subsystem.

A VIO is a logical partition (LPAR) on a pSeries system that is controlled by the IBM Hardware Management Console (HMC) or IBM Integrated Virtualization Manager (IVM). It owns the hardware adapters and allows access for other logical partitions. This feature allows the device to be shared. The LPAR associated with the resources is the VIO Server and the logical partitions that use it are VIO Clients. For example, they can share one disk on the VIO Server instead of

rebooting each logical partition from a Small Computer System Interface (SCSI) adapter and SCSI disk. This function eliminates the number of required adapters, adapter slots, and disks.

Tivoli Storage FlashCopy Manager uses virtual SCSI adapters to map disks from a VIO to a client LPAR. Physical volumes are required to be mapped from the VIO to the client. However, mapping logical volumes or storage pools is not supported. On the production server, Tivoli Storage FlashCopy Manager supports virtual I/O with N_Port ID Virtualization (NPIV) and Virtual I/O Server (VIOS). There is a one to one relationship between the virtual I/O logical volume and the storage LUN. On the backup server, Tivoli Storage FlashCopy Manager supports virtual I/O with NPIV. In addition, VIOS is supported when you configure the **BACKUP_HOST_NAME** parameter to use the **PREASSIGNED_VOLUMES** in the Tivoli Storage FlashCopy Manager profile file.

More details about supported combinations of operating system and storage subsystem levels, are available in the Pre-installation Checklist that is available at this URL <https://www.ibm.com/support/docview.wss?uid=swg21427692>. From this technote, select the required software version and then select the required component link. The hardware and software requirement page contains the Pre-installation Checklist and an installation planning worksheet.

Remote access to FlashCopy images

Tivoli Storage FlashCopy Manager allows mounting a FlashCopy backup image to another host. This image is writable and any changes that are made on that image are reflected in the backup and are included in the subsequent restore.

Related information:

 <https://www.ibm.com/support/docview.wss?uid=swg21427692>

Remote mirror integration

When you use storage solutions with mirror technologies and Tivoli Storage FlashCopy Manager, there are steps to complete for integrating backup and restore operations. For IBM System Storage SAN Volume Controller, mirror technologies are labeled Global Mirror and Metro Mirror. For IBM XIV Storage System, mirror technologies are labeled Synchronous Remote Mirroring and Asynchronous Remote Mirroring.

SAN Volume Controller

Tivoli Storage FlashCopy Manager can back up application data consistently on SAN Volume Controller storage solutions with volumes that are simultaneously used as Metro Mirror or Global Mirror sources. You can configure either the sources or the targets of the Remote Mirror to be selected as the sources for the FlashCopy backup. For environments with a SAN Volume Controller version 6.1 and earlier, Tivoli Storage FlashCopy Manager must stop and deactivate the Global Mirror or Metro Mirror before you run a restore operation. In addition, do not use FlashCopy targets as Global Mirror or Metro Mirror sources.

Restriction: The SVC storage adapter with dynamic target allocation does not support remote mirroring.

IBM System Storage DS8000

Tivoli Storage FlashCopy Manager can back up DS8000 storage solutions with volumes that are simultaneously used as Global Mirror or Metro Mirror sources. In contrast to SAN Volume Controller, you can configure

only the sources of the Global Mirror or Metro Mirror to be selected as the sources of the FlashCopy backup. When you use Tivoli Storage FlashCopy Manager in this environment, do not use FlashCopy targets as Global Mirror and Metro Mirror sources.

IBM XIV Storage System

Tivoli Storage FlashCopy Manager can back up application data consistently on XIV system storage solutions with volumes that are simultaneously used as Synchronous Remote Mirroring or Asynchronous Remote Mirroring sources. You can configure either the sources or the targets of the Remote Mirror to be selected as the sources for the FlashCopy backup.

For all storage solutions that use mirror technologies, when you use Tivoli Storage FlashCopy Manager, the following list describes the environment. If the environment setup differs from this description, Tivoli Storage FlashCopy Manager might not work as expected.

- The connectivity state must be online.
- The cluster partnership between the primary and secondary clusters must be configured before you use Tivoli Storage FlashCopy Manager. The following list identifies what you must configure when you are setting up the cluster partnership:
 - Tivoli Storage FlashCopy Manager is installed on the production and backup host on the local site (primary cluster).
 - Tivoli Storage FlashCopy Manager is installed on all systems, including the takeover and standby servers, running at the remote site (secondary cluster).
 - The local site contains the primary storage cluster for the production hosts. The primary cluster has data that is replicated to a secondary cluster on the remote site or to the same cluster.
 - For intersystem copying, the remote site contains the mirror volumes in another storage cluster. In addition, the remote site also hosts the takeover and standby servers.
 - SAN Volume Controller supports both intrasystem and intersystem Metro and Global Mirror.
 - For XIV system Synchronous Remote Mirroring and Asynchronous Remote Mirroring, configure either the source or the targets as a source for the snapshot backup.
- Tivoli Storage FlashCopy Manager uses a consistency group on the SAN Volume Controller and XIV system storage solutions for the FlashCopy or snapshot. A consistency group is a group of volumes that are associated with a FlashCopy pair. A FlashCopy pair is a group of two corresponding instant copies of data, that is, point-in-time copies of a volume. For the FlashCopy pair, the logically related data must be kept consistent across the volumes. The FlashCopy consistency group can be used for a consistent point-in-time copy for an application or database that spans multiple volumes. The following list identifies more information about using consistency groups with Tivoli Storage FlashCopy Manager:

SAN Volume Controller

- A consistency group contains a list of FlashCopy or Remote Copy relationships.
- The Tivoli Storage FlashCopy Manager software creates a FlashCopy consistency group on the secondary site to build a consistency unit between the source and target of the FlashCopy.

- You must define the consistency group for the mirror relationships between the master and auxiliary virtual disks.
- For Metro and Global Mirror, the state of the consistency group must be consistently synchronized.

Restriction: The SVC storage adapter with dynamic target allocation does not support remote mirroring.

XIV system

- The operational state of mirror must be operational.
- A consistency group contains a list of volumes.
- A consistency group that contains all of the remote copy target volumes must exist before starting the snapshot on the remote system. Apply the storage commands to the consistency group to simplify management.
- The mirror relationship between the master and slave volumes must be defined in the consistency group.
The master is where source volumes are located for the remote replication. The slave is where target volumes are located.
- For XIV system synchronous mirroring, the state of the consistency group must be consistently synchronized.
- For XIV system asynchronous mirroring, the state of the consistency group must be RPO_OK.
- For Metro Mirror and Synchronous Remote Mirroring, the write operation is committed to the host after the data is written to both the source and target volumes.
- For Global Mirror and Asynchronous Remote Mirroring, the write operation is committed to the host immediately after the data is written to the source volume.
- In terms of master and slave sites, the master site is where source volumes are located for the remote replication. The slave site is where target volumes are located. When a disaster occurs or when maintenance is necessary, the roles of master site and slave site can be changed.

The following figure illustrates the hosts and volumes that are involved in remote mirroring that uses Metro and Global mirrors.

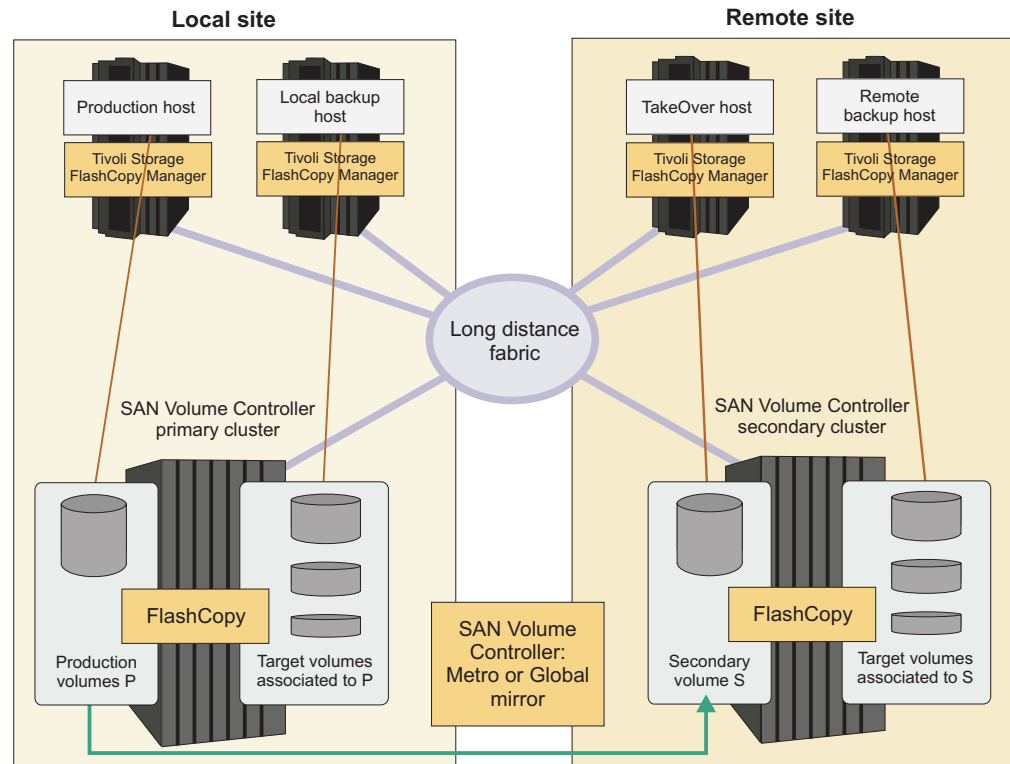


Figure 4. Remote mirroring using Metro Mirror and Global Mirror sources

Reconciliation of backups

Reconciliation is the process where Tivoli Storage FlashCopy Manager periodically verifies that backups on the storage system are valid.

Depending on the storage system, FlashCopy or snapshot backups can be deleted, withdrawn, or stopped by certain operations on the storage system. When these events occur, it invalidates the FlashCopy or snapshot backup. During reconciliation FlashCopy or snapshots backups that are no longer present or are invalid on the storage system are removed from Tivoli Storage FlashCopy Manager repository.

The reconciliation process removes Tivoli Storage FlashCopy Manager backups when the following events take place on storage systems:

All storage systems

Manual intervention causes the following events to occur:

- The source volume or target volume relationship is withdrawn.
- The snapshot or FlashCopy is deleted.
- The FlashCopy mappings are stopped.

IBM XIV Storage System

When there is no available space for snapshot backups, the XIV system Storage System deletes old snapshots to free space for new snapshots.

IBM System Storage N series and NetApp storage systems

When either of the following events occur:

- When there is no available space for snapshot backups, both of these storage systems delete old snapshots to free space for new snapshots.

- When a snapshot backup becomes invalid, because it was created after the creation of the original backup that was later restored.

IBM System Storage SAN Volume Controller and IBM Storwize family storage systems

When either of the following events occur:

- When a FlashCopy backup becomes invalid, because it was created after the creation of the original backup that was later restored. This issue applies to backups with space efficient target volumes or if the background copy process is not yet finished. In addition, the backup that is subject to restore can also be invalidated by the storage system.
- In this environment FlashCopy mappings of target volumes are used by the storage system for FlashCopy backups. When used in a specific FlashCopy backup, then previous FlashCopy backups can become invalid if they were dependent on the same mapping. This issue applies to backups with space efficient target volumes or if the background copy process is not yet finished.

Restriction: This does not apply for the SVC storage adapter with dynamic target allocation. Neither backup nor restore operations using the SVC DTA adapter will invalidate other backups.

IBM System Storage DS8000

When a source target relationship is withdrawn. This process cannot happen automatically in this environment.

Logical Volume Manager support (AIX only)

You can use Tivoli Storage FlashCopy Manager in environments where volume groups are mirrored between two storage clusters by using Logical Volume Manager (LVM) mirroring on AIX.

This support is provided on IBM System Storage DS8000, IBM System Storage SAN Volume Controller, IBM Storwize family, IBM XIV Storage System, IBM System Storage N series, and NetApp environments. When LVM mirroring is used to mirror volume groups between two storage clusters, a FlashCopy backup is created such that only one mirror is being copied.

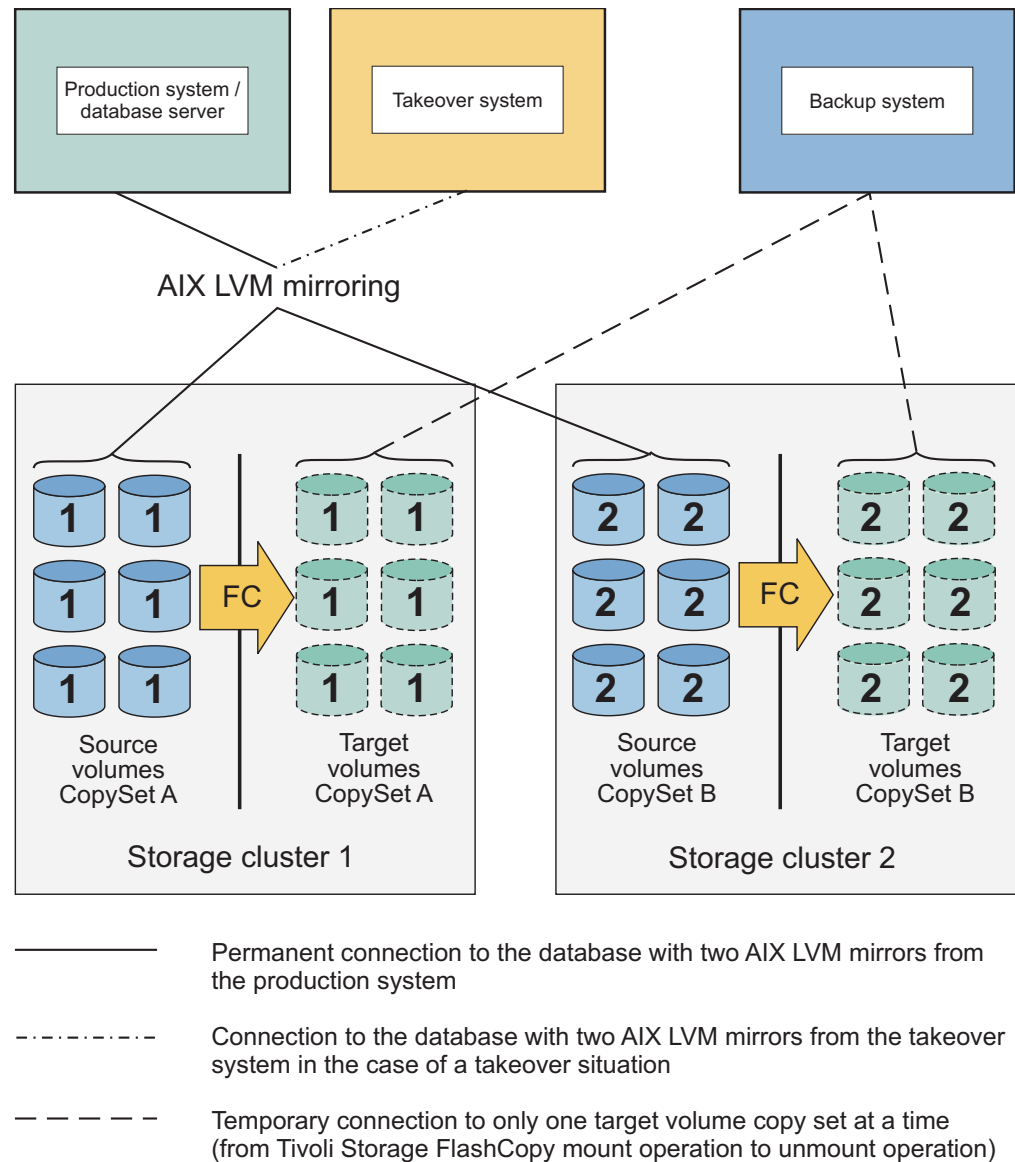


Figure 5. Tivoli Storage FlashCopy Manager in an LVM environment

AIX LVM mirroring provides these advantages:

- Only one of the two LVM mirrors are used in the FlashCopy process. Using one mirror saves the number of needed target volumes and reduces the time that is needed for the FlashCopy process.
- Avoids unnecessary performance degradation within the storage system.
- All LVM mirrors on the production system remain synchronized during the FlashCopy backup process.
- Online or offline FlashCopy backups can be created in both LVM mirrored and non-LVM mirrored environments. There is no change in the backup and restore procedures as provided in the applicable documentation.
- The FlashCopy backup process at no time compromises the high-availability purpose for which the mirrors were set up. It is not necessary to resynchronize the logical volumes after the FlashCopy backup request.
- Tivoli Storage FlashCopy Manager provides information about asymmetrical LVM mirror setups when encountered. This information can prevent the

FlashCopy backup from running in unfavorable situations but can also reveal a general deficiency of the high-availability setup as well.

Tivoli Storage FlashCopy Manager requires that the LVM mirroring sets are in different storage subsystems. For example, different SAN Volume Controller clusters, Storwize family, DS8000, or XIV system. Complete mirrors are recommended to be stored on both storage clusters. If this setting is not possible, Tivoli Storage FlashCopy Manager continues processing for those clusters where a complete image of the application can be found.

To configure Tivoli Storage FlashCopy Manager for LVM mirroring, define both storage subsystems within the Tivoli Storage FlashCopy Manager profile. Use the **DEVICE_CLASS** parameter to allow Tivoli Storage FlashCopy Manager to select the storage subsystem. At least one backup server is required so that Tivoli Storage FlashCopy Manager can mount a FlashCopy backup to verify the consistency of the backup and split the LVM mirrors.

During a restore operation, Tivoli Storage FlashCopy Manager runs all the commands that are required to prepare the LVM environment again for the second mirror. The administrator is informed by message FMM0755I in the detailed restore log file that the volume groups are ready for synchronization. The administrator can run this operation at a more suitable time for instance after completion of the database recovery.

Note: The administrator must examine the log files for these messages. They do not display on the screen.

Preparing applications that run on VMware or KVM virtual machines

Before you install Tivoli Storage FlashCopy Manager on VMware or KVM virtual machines that run Linux guest operating systems, you must verify the configuration of the application that you want to protect.

Before you begin

Different applications have specific Tivoli Storage FlashCopy Manager configuration requirements. For more information about application-specific requirements, see Chapter 2, “Planning,” on page 7.

Procedure

VMware

- Before you back up data or clone databases on VMware virtual machines, ensure that all source LUNs in the backup or clone operations are attached to the virtual machine with one of the following methods:
 - VMware physical mode raw device mapping (pRDM)
 - iSCSI
 - Network file system (NFS)
- Run a Tivoli Storage FlashCopy Manager restore operation from a snapshot to an existing pRDM disk. The operation does not create a virtual machine or pRDM definition as part of the restore process.

KVM

- Before you back up data or clone databases on KVM virtual machines, ensure that all source LUNs in the backup or clone operations are attached to the virtual machine with one of the following methods:
 - Block device mapping (BDM)
 - iSCSI
 - Network file system (NFS)
 - PCI Passthrough
- Run a Tivoli Storage FlashCopy Manager restore operation from a snapshot to an existing BDM disk. The restore operation does not create a virtual machine or BDM definition as part of the restore process.

Checking the KVM setup

Ensure that when the Tivoli Storage FlashCopy Manager KVM setup uses Block Device Mapping, the LUNs are mapped to the KVM guest as multipath devices. The LUNs must be visible as multipath devices inside the KVM guest. Run the **multipath** command to check your setup for KVM.

Procedure

To verify your KVM setup, run the **multipath** command from within the KVM guest. The command output looks similar to the following example:

```
kvm-guest:~ # multipath -ll
mpathat (360050768018205de4000000000001949) dm-7 IBM ,2145
size=2.0G features='1 queue_if_no_path' hwhandler='0' wp=rw
`-+- policy='service-time 0' prio=50 status=active
   `- 3:0:0:3 sdf 8:80 active ready running
```

In the example, *360050768018205de4000000000001949* is the LUN identifier. It is a unique number that must not be overwritten by the KVM stack. The product storage identifier must be visible inside the KVM guest. In the example, this identifier is *IBM ,2145*.

Chapter 3. Preparation for installation

Before you install Tivoli Storage FlashCopy Manager, review the hardware, software requirements, and application environment. You must complete the Pre-installation Checklist and Planning Worksheet before you install Tivoli Storage FlashCopy Manager for UNIX and Linux.

The hardware and software requirements for Tivoli Storage FlashCopy Manager for UNIX and Linux are published in the following technote: <http://www.ibm.com/support/docview.wss?uid=swg21427692>. Follow the link to the requirements technote for your specific release or update level. From there you will find the *Pre-installation Checklist* and the *Installation Planning Worksheet* for the most recent version of the product.

Before you start the installation process, complete the following tasks:

- Review the requirements and ensure that all requirements are met.
- Complete the *Pre-installation Checklist*.
- Complete the *Installation Planning Worksheet*.

Important: You must complete the *Pre-installation Checklist* and *Installation Planning Worksheet* before you install the product.

Before you install Tivoli Storage FlashCopy Manager, ensure that the volume and storage layout is correct for your application environment.

Preparing custom applications

Some prerequisites are necessary when you are preparing a custom application environment.

The preparation information is valid for environments on supported storage hardware as well as for environments in GPFS filesystems. For GPFS filesystems, when you see the term *volume group*, read that as *independent fileset*.

Tivoli Storage FlashCopy Manager performs snapshot backups of plain file systems on a volume group level. Therefore, ensure that the files you want to protect are stored in dedicated file systems and volume groups.

In addition to storing the data in dedicated volume groups, those volume groups must be on a file system type that is supported by Tivoli Storage FlashCopy Manager. Any other data that is stored on these volume groups, is also processed by Tivoli Storage FlashCopy Manager, and it is included in the backup images. When the backup image is restored, any additional data in the volume group that is updated or created after the backup is overwritten.

Attention: Do not store any data that you do not want to restore within volume groups that are being processed by Tivoli Storage FlashCopy Manager. If Tivoli Storage FlashCopy Manager detects such data in one of the volumes to be backed up, the backup operation can fail.

In situations where files not associated with the database are stored in a volume group that is used for backup and restore operations, use the **NEGATIVE_LIST**

parameter. This Tivoli Storage FlashCopy Manager profile parameter can be used to control file processing. For information about the NEGATIVE_LIST profile parameter, see the profile section “CLIENT” on page 103 for details.

Tip: To create a transaction-consistent backup of your custom application, configure Tivoli Storage FlashCopy Manager to run a pre-flash and post-flash command immediately before and after, the creation of the snapshot. These commands can suspend and resume the application to create a consistent backup. For more information about these commands, see “Backup and restore commands for custom applications” on page 143

Preparing Tivoli Storage FlashCopy Manager for Custom Applications with GPFS

If you plan to configure Tivoli Storage FlashCopy Manager for Custom Applications in a GPFS environment, some prerequisites are required before you start.

Before you configure Tivoli Storage FlashCopy Manager for Custom Applications with a GPFS setup, there are a number of preparatory steps as follows:

1. If you want to use Tivoli Storage FlashCopy Manager from all GPFS nodes in your environment, you must install it into a GPFS file system. You must prepare an independent file set or a GPFS file system for the installation that does not contain other application data that you want to protect. The Tivoli Storage FlashCopy Manager repository, configuration, and binary files are then shared between all nodes of your GPFS cluster.
2. Choose one GPFS management node in the cluster that runs the Tivoli Storage FlashCopy Manager daemons.
3. Choose a GPFS management node for offloading data to a Tivoli Storage Manager server. This can be the same node on which the daemons are running.
4. Choose the GPFS management nodes that participate in offloading operations. You must include the node that is used for offloading data to the Tivoli Storage Manager. Ensure that the Tivoli Storage Manager client is set up on all nodes that you choose.
5. Determine which Tivoli Storage Manager server or servers you are offloading backups to. Ensure that the Tivoli Storage Manager client is set up and configured for each of the Tivoli Storage Manager servers. For information about setting up Tivoli Storage Manager clients for cooperation with the GPFS **mmbackup** command, see http://www-01.ibm.com/support/knowledgecenter/STXKQY_4.1.1/com.ibm.spectrum.scale.v4r11.adm.doc/bl1adm_tsmreqs.htm%23tivolistoragemanagerreqs.
6. If you require different Tivoli Storage Manager settings for various GPFS independent file sets, plan to set up different Tivoli Storage FlashCopy Manager instances. A single instance manages all file sets that share a set of Tivoli Storage FlashCopy Manager and Tivoli Storage Manager parameters.
7. Where possible, place all data to be managed by Tivoli Storage FlashCopy Manager in independent file sets that are different from root file sets of the GPFS file system.

In a Tivoli Storage FlashCopy Manager GPFS setup, there is no backup server. Offload operations to the Tivoli Storage Manager server are run at the production cluster level.

Note:

Do not use the GPFS **mmbackup** command manually on data that is managed by Tivoli Storage FlashCopy Manager.

Make sure that all file systems in a backup are mounted to the default mount point. All file sets must be linked when an offloaded backup to a Tivoli Storage Manager server is run. When you are unlinking file sets or linking file sets to different paths, restrictions for the **mmbackup** command apply. For example, files that are contained in file sets that were unlinked during an offload operation are expired on the Tivoli Storage Managerserver.

To send backups to a Tivoli Storage Manager server, the GPFS **mmbackup** command is used. Rules and limitations that are documented in the GPFS documentation for the **mmbackup** command apply. For more information about the **mmbackup** command, see here http://www-01.ibm.com/support/knowledgecenter/STXKQY_4.1.1/com.ibm.spectrum.scale.v4r11.adm.doc/bl1adm_mmbackup.htm. For information about using the Tivoli Storage Manager and **mmbackup**, see here http://www-01.ibm.com/support/knowledgecenter/STXKQY_4.1.1/com.ibm.spectrum.scale.v4r11.adm.doc/bl1adm_backupusingmmbackup.htm?lang=en. For information about backing up file system data with the Tivoli Storage Manager, see here http://www-01.ibm.com/support/knowledgecenter/STXKQY_4.1.1/com.ibm.spectrum.scale.v4r11.ins.doc/bl1ins_tsm_bkupconsiderations.htm?lang=en.

Chapter 4. Preparing backup servers

The backup server is an auxiliary host where Tivoli Storage FlashCopy Manager can mount backups.

For custom applications on GPFS filesystems, Tivoli Storage FlashCopy Manager does not need any backup servers. For all other environments, a backup server is used to offload the workload from the production server where the protected application is running. You must configure a backup server when you want to offload snapshots to Tivoli Storage Manager. You can share one backup server among multiple applications or you can have multiple backup servers.

However, Tivoli Storage FlashCopy Manager does not allow backup images to be mounted directly on the production server. A backup server must be set up as a separate host.

Determining the number of backup servers in the environment

The number of required Tivoli Storage FlashCopy Manager backup servers is determined by the number of servers that are used to access backup images.

For example, to access backup images on either site of a disaster recovery environment, at least two backup servers are needed. A backup server can also simultaneously be used for multiple applications and multiple production servers. Tivoli Storage FlashCopy Manager can mount a backup image on a backup server. For the following scenarios, at least one backup server is required.

- Mount backup images on another server.
- When Tivoli Storage FlashCopy Manager is used with other products for example, IBM Tivoli Storage Manager for Enterprise Resource Planning to offload backups to Tivoli Storage Manager.
- When Tivoli Storage FlashCopy Manager requires a mount operation, during a backup operation because the following conditions exist:
 - The database is running in an LVM mirrored environment on AIX
 - FlashCopy cloning is used in supported environments only
 - Conditions that require a so called Tivoli Storage FlashCopy Manager forced mount operation for the different storage subsystem environments:

SAN Volume Controller, Storwize family, and DS8000

A forced mount is required if the option `PREASSIGNED_VOLUMES` is set for the profile parameter `BACKUP_HOST_NAME` and the operating system is Linux or Solaris.

DS8000

A forced mount is required if the option `PREASSIGNED_VOLUMES` is set for the profile parameter `BACKUP_HOST_NAME`. In addition, the following conditions must also exist a freeze and thaw action was not used for the file systems and the operating system is AIX or HP-UX.

Installation prerequisites for backup servers

For hosts that are used as a backup server, the operating system version and maintenance level must be the same as the production server

Backup server requirements

For the IBM Tivoli Storage FlashCopy Manager software to run correctly, the following settings are required on the backup server:

- The user name and group name of the application owner on the production server must be available on the backup server. The same user ID (UID) and group ID (GID) must be used.
- A database instance with the same version as the database instance on the production server must be installed on the backup server.

When Tivoli Storage FlashCopy Manager is used in an environment with IBM Tivoli Storage Manager, a backup server is required. This backup server is used to offload the backup workload from the production server to the backup server and sends the application critical backups to Tivoli Storage Manager.

Tivoli Storage Manager Backup-Archive client is used by Tivoli Storage FlashCopy Manager to initiate a subsequent backup to Tivoli Storage Manager and must be installed and configured on the backup server.

Update the Tivoli Storage Manager Data Protection client node password on the production server and all backup servers whenever it changes. When Tivoli Storage Manager is configured to use the **PASSWORDACCESS GENERATE** parameter, the password can change without notification. If the Tivoli Storage Manager Data Protection client is configured to use the **PASSWORDACCESS GENERATE** parameter, use the Tivoli Storage Manager proxy-node capability to avoid authentication errors when the password is reset. Create one data node on the Tivoli Storage Manager where all Data Protection clients from all backup and production servers are sending and retrieving data. Create one authentication node for each production server and backup server that is configured as proxy node to this data node.

Preparing backup servers for applications running on VMware or KVM virtual machines

If a backup server you are using is a VMware or KVM virtual machine, the storage device must be attached to the virtual machine with either iSCSI or Network file system.

Before you begin

If physical hosts are used as backup servers, see “Installation prerequisites for backup servers.”

Procedure

Verify that all target LUNs in backup operations are attached to the virtual machine with one of the following attachment methods:

- iSCSI
- Network file system (NFS)

Chapter 5. Installing and upgrading

To install Tivoli Storage FlashCopy Manager you must follow the installation steps, run the setup script for your component, activate the applications you want to protect, and configure the product. The first step is to install Tivoli Storage FlashCopy Manager on the production server. Depending on your environment, a separate installation of Tivoli Storage FlashCopy Manager can be required on a backup or clone server. If you choose to, you can upgrade your system from a previous version of Tivoli Storage FlashCopy Manager to version 4.1.4.

About this task

When you are installing Tivoli Storage FlashCopy Manager software, the installation process varies, depending on the environment.

The following set of tasks are required to complete the installation process.

Procedure

- Install Tivoli Storage FlashCopy Manager on the production server.
The production server is where Tivoli Storage FlashCopy Manager protects critical business applications by providing a method to back up and restore these applications.
- Activate the applications that you want to protect with Tivoli Storage FlashCopy Manager.

During the activation, all the necessary files are copied from the installation directory `FCM_INSTALL_DIR`, to the application-specific installation directory `INSTANCE_DIR`. The installation directory is referred to as the `FCM_INSTALL_DIR` directory, and the application-specific installation directory is referred to as `INSTANCE_DIR` directory. The default location for the `FCM_INSTALL_DIR` directory is one of the following:

- AIX: `/usr/tivoli/tsfcm/acs_4.1.4`
- Linux: `/opt/tivoli/tsfcm/acs_4.1.4`
- Solaris: `/opt/tivoli/tsfcm/acs_4.1.1`
- HP-UX: `/opt/tivoli/tsfcm/acs_4.1.1`

Note: Only instances that are selected during installation are activated.

- Configure Tivoli Storage FlashCopy Manager.

The following files and directories are created during the configuration process:

- An `ACS_DIR` configuration directory, if the `ACS_DIR` directory is not identical to the `INSTANCE_DIR` directory. The path for the `ACS_DIR` directory is specified in the Tivoli Storage FlashCopy Manager profile file.
- A profile file within the `ACS_DIR` configuration directory.
- A symbolic link is created from the `INSTANCE_DIR/profile` file that points to the `ACS_DIR/profile` file when the two directories are not identical.
- A password file within `ACS_DIR/shared` directory.
- An entry `/etc/inittab` for daemon processes if requested.

For Red Hat Enterprise Linux 6, the daemon processes are started automatically by using the `upstart` program when requested.

- Install Tivoli Storage FlashCopy Manager on a backup or clone server, if not automatically installed and configured. Backup servers or clone servers are auxiliary hosts that are required by Tivoli Storage FlashCopy Manager to mount backup images and clone databases. A backup or clone server also is required to offload backups to IBM Tivoli Storage Manager.

If Open Secure Shell (OpenSSH) is configured between the production and the backup or clone servers, Tivoli Storage FlashCopy Manager is installed and configured automatically. Otherwise, a separate installation on a backup or clone server is required.

Installing on the production server

To install Tivoli Storage FlashCopy Manager on the production server, you can use the graphical installation wizard, the console wizard, or the console in silent mode.

Before you begin

For the current requirements, review the *Hardware and Software Requirements* technote that is associated with the Tivoli Storage FlashCopy Manager release. This technote is available in the *Tivoli Storage FlashCopy Manager - All Requirement Documents* website at: <https://www.ibm.com/support/docview.wss?uid=swg21427692>. Follow the link to the requirements technote for your specific release or update level and review the pre-installation checklist and planning worksheet.

Tivoli Storage FlashCopy Manager installation packages are delivered as individual files. They are provided on an installation DVD or from an image that is downloaded from IBM Passport Advantage®.

The files for *OS-platform* AIX and Linux are named:

4.1.4-TIV-TSFCM-OS-platform.bin

The files for *OS-platform* Solaris and HP-UX are named:

4.1.1-TIV-TSFCM-OS-platform.bin

Procedure

To install Tivoli Storage FlashCopy Manager on the production server, complete the following steps.

1. Log on to the production server and use the root user ID. Change to the directory where you downloaded the package file or insert the DVD into the DVD drive. Use one of the following methods to start the installation:

Graphical user interface with the installation wizard

The installation wizard requires a graphical X Window System installation. Make sure the environment variable *DISPLAY* specifies *host:display*, where *host* identifies the host name of the X Server to be contacted and *display* is the display number. To use the graphical installation wizard, enter this command for AIX and Linux:

```
./4.1.4-TIV-TSFCM-OS-platform.bin
```

Enter this command for Solaris and HP-UX:

```
./4.1.1-TIV-TSFCM-OS-platform.bin
```

If the graphical X Window System is not present, the installation continues in console mode.

Console mode

To install in console mode, enter the following command for AIX or Linux:

```
./4.1.4-TIV-TSFCM-OS-platform.bin -i console
```

Enter this command for Solaris and HP-UX:

```
./4.1.1-TIV-TSFCM-OS-platform.bin
```

2. Follow the prompts to install Tivoli Storage FlashCopy Manager.
3. On the Summary page, review your installation settings. If an error occurs during the installation process, correct the errors and restart the installation procedure. Tivoli Storage FlashCopy Manager creates an `installation.log` file in the `FCM_INSTALL_DIR` directory. You can use the log file to troubleshoot installation errors.

What to do next

After the installation, you must configure the application to complete the installation.

To activate a custom application, complete the following steps:

1. Run one of the following commands to activate the custom application instance:

Environments other than GPFS

The default installation directory is `$HOME/acs`. `$HOME` is the home directory of the application backup user. The following command creates the `$HOME/acs` directory:

```
./setup_gen.sh -a install  
-d Application_owner_$HOME_directory
```

GPFS environments

```
./setup_gen.sh -a install  
-d Application_owner_$HOME_directory  
-t directory_in_shared_file_system
```

The `-t` parameter specifies a target directory within a shared file system, so that the Tivoli Storage FlashCopy Manager binary files are copied to the shared file system. These files are then available on all nodes of the GPFS cluster. Use a directory within an independent file set or a GPFS file system that does not contain other application data that you want to protect with Tivoli Storage FlashCopy Manager. A link that is named `$HOME/acs` is created targeting the specified directory. `$HOME` is the home directory of the application backup user. The link is only created on the local node and on the node that is used as a backup server. You must manually create that link on other GPFS cluster nodes to operate Tivoli Storage FlashCopy Manager from other nodes.

Related concepts:

“Configuring storage environments” on page 50

Related tasks:

“Running the setup script for custom applications” on page 45

“Configuring Tivoli Storage FlashCopy Manager for custom applications” on page 46

Adding or upgrading a new instance ID after installation

If you want to add or upgrade an instance ID after the global installation, you must configure the database instances to complete the action. During the installation with the installer, you input the instances to be activated and the directory for those instances. The installer automatically copies all the necessary files from the installation directory (FCM_INSTALL_DIR) to a database instance-specific installation directory (INSTANCE_DIR). The correct access rights for the directories are assigned.

Procedure

1. Log in to the production server and use the root user ID. Change to the FCM_INSTALL_DIR directory.
2. To activate any additional custom applications that were not selected during the installation, complete the following steps:

To activate a custom application, complete the following steps:

- a. Run one of the following commands to activate the custom application instance:

Environments other than GPFS

The default installation directory is \$HOME/acs. \$HOME is the home directory of the application backup user. The following command creates the \$HOME/acs directory:

```
./setup_gen.sh -a install  
-d Application_owner_$HOME_directory
```

GPFS environments

```
./setup_gen.sh -a install  
-d Application_owner_$HOME_directory  
-t directory_in_shared_file_system
```

The **-t** parameter specifies a target directory within a shared file system, so that the Tivoli Storage FlashCopy Manager binary files are copied to the shared file system. These files are then available on all nodes of the GPFS cluster. Use a directory within an independent file set or a GPFS file system that does not contain other application data that you want to protect with Tivoli Storage FlashCopy Manager. A link that is named \$HOME/acs is created targeting the specified directory. \$HOME is the home directory of the application backup user. The link is only created on the local node and on the node that is used as a backup server. You must manually create that link on other GPFS cluster nodes to operate Tivoli Storage FlashCopy Manager from other nodes.

Installing separately on backup servers

If Tivoli Storage FlashCopy Manager is not installed remotely on the backup clone server by using OpenSSH, use the following instructions to install Tivoli Storage FlashCopy Manager on a backup server.

About this task

If a setup using OpenSSH is not possible, install Tivoli Storage FlashCopy Manager for custom applications separately on the backup server. Information about when a backup server is needed is available at Chapter 4, "Preparing backup servers," on page 33.

Tip: If you are using self-signed certificates, you must manually copy the .arm file from the production server to the auxiliary server INSTANCE_DIR. You must also copy the contents in ../acs/shared must be copied to the backup system.

Procedure

1. Log on to the production server and use the root user ID. Change to the directory where you downloaded the package file or insert the DVD into the DVD drive. Use one of the following methods to start the installation:

Graphical user interface with the installation wizard

The installation wizard requires a graphical X Window System installation. Make sure the environment variable *DISPLAY* specifies host:display, where host identifies the host name of the X Server to be contacted and display is the display number. To use the graphical installation wizard, enter this command for AIX and Linux:

```
./4.1.4-TIV-TSFCM-OS-platform.bin
```

Enter this command for Solaris and HP/UX:

```
./4.1.1-TIV-TSFCM-OS-platform.bin
```

If the graphical X Window System is not present, the installation continues in console mode.

Console mode

To install in console mode, enter the following command for AIX or Linux:

```
./4.1.4-TIV-TSFCM-OS-platform.bin -i console
```

Enter this command for Solaris and HP/UX:

```
./4.1.1-TIV-TSFCM-OS-platform.bin
```

2. Follow the prompts to install Tivoli Storage FlashCopy Manager.

What to do next

After the installation and activation are completed, you must configure Tivoli Storage FlashCopy Manager for use with your environment.

1. Onsite Production System configuration with optional remote Backup System configuration.
2. Onsite Backup System configuration.

Installing in silent mode

To install Tivoli Storage FlashCopy Manager in silent mode you require a response or properties file.

About this task

You can generate a properties file during installation in either graphic or console mode by starting the executable file as follows:

```
./4.1.4-TIV-TSFCM-platform.bin [-i console]  
-DRECORDFILE=/tmp/installer.properties
```

Procedure

1. To install in silent mode, create the response or properties file, such as installer.properties, containing the following variables:

- a. The installation directory:

`USER_INSTALL_DIR=installation_directory`

where *installation_directory* has the value:

- AIX: `/usr/tivoli/tsfcm/acs_4.1.4`
- Linux: `/opt/tivoli/tsfcm/acs_4.1.4`
- Solaris: `/opt/tivoli/tsfcm/acs_4.1.1`
- HP-UX: `/opt/tivoli/tsfcm/acs_4.1.1`

- b. To create a log file during installation, set the variable:

`INSTALL_LOG_DESTINATION=installation_directory/log_file_name`

- c. Set the variable for the license file:

`LICENSE_ACCEPTED=TRUE`

- d. To define the product database component that is installed, set the following variable:

`CHOSEN_INSTALL_SET=InstallSet`

where *InstallSet* is

TSMFCMGEN (Custom application agent component)

2. Invoke the executable file with the `-i` silent option and the `-f` option to specify the properties file:

`./version-TIV-TSFCM-OS-platform.bin -i silent -f properties_file`

The *properties_file* specification must contain a full path.

Results

Here is a sample properties file for FlashCopy Manager for Custom Applications on a Linux system:

```
LICENSE_ACCEPTED=TRUE
CHOSEN_INSTALL_SET=TSMFCMGEN
USER_INSTALL_DIR=/opt/tivoli/tsfcm/acs_4.1.4
#ORACLE_HOME_FOLDER=
#DB2_INSTANCES_SELECTED=
LINUX_DISTRO=SLES11, RHEL5 or RHEL6
```

Upgrading

Use the Tivoli Storage FlashCopy Manager installation program to upgrade your current Tivoli Storage FlashCopy Manager version.

Before you begin

For the current requirements, review the *Hardware and Software Requirements* technote that is associated with the Tivoli Storage FlashCopy Manager release. This technote is available in the *Tivoli Storage FlashCopy Manager - All Requirement Documents* website at: <https://www.ibm.com/support/docview.wss?uid=swg21427692>. Follow the link to the requirements technote for your specific release or update level and review the pre-installation checklist and planning worksheet.

Tivoli Storage FlashCopy Manager installation packages are delivered as individual files. They are provided on an installation DVD or from an image that is downloaded from IBM Passport Advantage.

Procedure

1. Log on to the server and use the root user ID.
2. Determine the installation path of the current version of Tivoli Storage FlashCopy Manager. The following paths provide the default location of the installation files:
 - For AIX operating systems: `/usr/tivoli/tsfcm/acs_4.1.4`.
 - For Linux operating systems: `/opt/tivoli/tsfcm/acs_4.1.4`.
 - For Solaris, and HP-UX operating systems: `/opt/tivoli/tsfcm/acs_4.1.1`.
3. Run the appropriate command for your operating system from the installation path:
 - For AIX operating systems: `/usr/tivoli/tsfcm/acs_version_number/uninstall/uninstaller.bin`.
 - For Linux, Solaris, and HP-UX operating systems: `/opt/tivoli/tsfcm/acs_version_number/uninstall/uninstaller.bin`.

What to do next

Proceed to install Tivoli Storage FlashCopy Manager on the production server. For information about the procedure, see “Installing on the production server” on page 36

Migrating existing snapshot data

You can upgrade to IBM Tivoli Storage FlashCopy Manager and migrate data from Tivoli Storage Manager for Advanced Copy Services.

Migration from Tivoli Storage Manager for Advanced Copy Services 5.4 on SAN Volume Controller or DS8000

You can upgrade to IBM Tivoli Storage FlashCopy Manager and migrate data from Tivoli Storage Manager for Advanced Copy Services.

Tivoli Storage FlashCopy Manager and Tivoli Storage Manager for Advanced Copy Services 5.4 are separate products. Tivoli Storage FlashCopy Manager can preserve any incremental FlashCopy relations that are established with Tivoli Storage Manager for Advanced Copy Services 5.4. Tivoli Storage FlashCopy Manager does not restore backups that are created with Tivoli Storage Manager for Advanced Copy Services 5.4. You must use Tivoli Storage Manager for Advanced Copy Services 5.4.

The upgrade from Tivoli Storage Manager for Advanced Copy Services to Tivoli Storage FlashCopy Manager is processed as a new installation. The volumes file cannot be retained when you migrate to Tivoli Storage FlashCopy Manager. You must create new volumes files with **VOLUMES_FILE** syntax. For more information about **VOLUMES_FILE**, see “Target set definitions” on page 58. Use the following settings when you configure the **DEVICE_CLASS** section of the profile:

```
TARGET_SET VOLUMES_FILE  
VOLUMES_FILE .fct_files
```

Tivoli Storage FlashCopy Manager and Tivoli Storage Manager for Advanced Copy Services can be used concurrently. Both products cannot use the same target set definition file. Consider using Tivoli Storage Manager for Advanced Copy Services in emergency situations only. For example, use Tivoli Storage Manager for Advanced Copy Services to restore target sets unused by Tivoli Storage FlashCopy

Manager. Before you attempt this restore, ensure that Tivoli Storage FlashCopy Manager has not used the target sets that you want to restore. Check in the Tivoli Storage FlashCopy Manager summary log file message FMM1582I. This log file is in the logs directory and the path is specified by ACS_DIR parameter in the profile.

Note:

- In an AIX LVM mirrored environment, the **STORAGE_SYSTEM_ID** profile parameter must be added to the DEVICE_CLASS section of the profile.

Migration from Tivoli Storage Manager for Advanced Copy Services to Tivoli Storage FlashCopy Manager on an IBM XIV Storage System

For the IBM XIV Storage System, Tivoli Storage FlashCopy Manager retains the configuration and backup history of an existing Tivoli Storage Manager for Advanced Copy Services installation. The backups that are created separately for each instance with Tivoli Storage Manager for Advanced Copy Services can be restored with Tivoli Storage FlashCopy Manager.

The upgrade from Tivoli Storage Manager for Advanced Copy Services to Tivoli Storage FlashCopy Manager, uses the Tivoli Storage FlashCopy Manager installation program. During the installation, select the database instances to activate.

To upgrade dedicated database instances after you install Tivoli Storage FlashCopy Manager, run the setup utility separately and use the root user ID. Start the installation setup script as the database instance owner from the INSTANCE_DIR directory. This task updates the current configuration file and Tivoli Storage FlashCopy Manager can use the Tivoli Storage Manager for Advanced Copy Services profile file.

Note: Tivoli Storage FlashCopy Manager uses the production server to control offloaded backups to Tivoli Storage Manager. This behavior is different from Tivoli Storage Manager for Advanced Copy Services installation. Therefore, an OFFLOAD section must be defined in the profile configuration file on the production server. Any OFFLOAD section that is present in the backup system configuration file is discarded.

Migration from Tivoli Storage Manager for Advanced Copy Services 5.5 or later on SAN Volume Controller or DS8000

Tivoli Storage FlashCopy Manager and Tivoli Storage Manager for Advanced Copy Services Version 5.5 are separate products. However, Tivoli Storage FlashCopy Manager can preserve any incremental FlashCopy relations that are established with Tivoli Storage Manager for Advanced Copy Services 5.5, and reuse most of the Tivoli Storage Manager for Advanced Copy Services 5.5 profile.

Tivoli Storage FlashCopy Manager cannot restore backups that are created with Tivoli Storage Manager for Advanced Copy Services 5.5. These two products cannot be installed and configured simultaneously for the same database instance. However, the master copy of both products can be installed in the /usr/tivoli/ directory.

Before you configure Tivoli Storage FlashCopy Manager, follow these tasks:

- Create a copy of the existing Tivoli Storage Manager for Advanced Copy Services profile and repository directory. The repository directory is identified by the **ACS_REPOSITORY** parameter in the profile.
- When you run the installation setup script, update the **ACS_REPOSITORY** parameter with a new location for Tivoli Storage FlashCopy Manager metadata.
- Set the **TARGET_SETS** parameter to **VOLUMES_FILE**, and specify a valid .fct file.

After you install and configure Tivoli Storage FlashCopy Manager, all future operations are processed with Tivoli Storage FlashCopy Manager. In emergency situations, you can use Tivoli Storage Manager for Advanced Copy Services 5.5 or later to restore from target sets that are not used by Tivoli Storage FlashCopy Manager. In this scenario,

- Restore the original profile and the original Tivoli Storage Manager for Advanced Copy Services ACS_REPOSITORY directory.
- Run the Tivoli Storage Manager for Advanced Copy Services 5.5 setup script again for the current database instance.
- Before you restore with Tivoli Storage Manager for Advanced Copy Services 5.5, ensure that Tivoli Storage FlashCopy Manager has not used the target that you selected for the restore. To verify, check the Tivoli Storage FlashCopy Manager summary log file message FMM1582I. This log file is in the logs directory and the path that is specified by **ACS_DIR** parameter.

Note: In an AIX LVM mirrored environment, the **STORAGE_SYSTEM_ID** profile parameter must be added to the **DEVICE_CLASS** section.

Migrating from a proxy to an embedded CIMOM

Unlike LVM mirrored environments, there is no difference between the proxy CIMOM (Common Information Model Object Manager) and the embedded CIMOM. The following changes are required when migrating:

- The setup script updates the **COPYSERVICES_PRIMARY_SERVERNAME** parameter in the profile.
- The setup script updates the **COPYSERVICES_SECONDARY_SERVERNAME** parameter in the profile if specified.
- Reset the passwords.

Note: The minimum length of the master password is 8 characters. It must contain at least one number and one letter. The use of special symbols increases the strength of the password.

In LVM mirrored environments, you must use separate **DEVICE_CLASS** sections for each of the storage devices. Create a second **DEVICE_CLASS** statement in the profile. This statement can be identical to the first statement except for the **COPYSERVICES_PRIMARY_SERVERNAME** and **COPYSERVICES_SECONDARY_SERVERNAME** parameters. Both device classes now refer to separate target set definition files because of the following reasons:

- The device classes have a different value for the **VOLUMES_FILE** parameter.
- The naming conventions of volumes files are different, if the target sets are specified by using the **VOLUMES_FILE** parameter.

Make sure to separate the existing file into two files. Each file contains only those target sets that are eligible for the specific mirror. If the **VOLUMES_FILE** parameter is used in an LVM mirroring environment, the **STORAGE_SYSTEM_ID** parameter must be

specified in the `DEVICE_CLASS` sections. Make sure to add rules to the `CLIENT` section of the profile that control the mirror to be used for the next backup operation. For more information about `DEVICE_CLASS name`, see the `CLIENT` section for your database type “`CLIENT`” on page 103.

Editing `USE_CONSISTENCY_GROUP` before you upgrade from Tivoli Storage FlashCopy Manager version 3.1, or earlier

If you are upgrading from Tivoli Storage FlashCopy Manager, Version 3.1 you must set the `USE_CONSISTENCY_GROUP` parameter to `NO`, for version 3.2 or later of Tivoli Storage FlashCopy Manager to work. Tivoli Storage FlashCopy Manager Version 3.2 and later software requires the use of consistency groups.

Before you begin

Log in to the production server with the custom application user ID and go to the `INSTANCE_DIR` directory.

Procedure

1. Start the setup script by entering the following command:
 - For custom applications the default installation directory is `$HOME/acs`. `$HOME` is the home directory of the application backup user.
`./setup_gen.sh`
2. Follow the setup script instructions that are displayed. For each Tivoli Storage FlashCopy Manager, Version 3.1 profile configuration that has the `USE_CONSISTENCY_GROUP` parameter, repeat these steps to automatically remove the `USE_CONSISTENCY_GROUP` parameter.

Chapter 6. Configuring Tivoli Storage FlashCopy Manager

After the installation and activation procedure is complete, configure Tivoli Storage FlashCopy Manager. To configure Tivoli Storage FlashCopy Manager, use the setup script for your environment. The information that you enter is used to create the profile configuration file.

Before you begin

Review the installation planning sheet that is associated with the *Hardware and Software Requirements* technote. This sheet contains the required parameters for each specific software application and custom application that are required during the configuration.

For the current requirements, review the *Hardware and Software Requirements* technote that is associated with the Tivoli Storage FlashCopy Manager release. This technote is available in the *Tivoli Storage FlashCopy Manager - All Requirement Documents* website at: <http://www.ibm.com/support/docview.wss?uid=swg21427692>. Follow the link to the requirements technote for your specific release or update level. Use the *Pre-installation checklist*, and *Installation Planning worksheet* before you install Tivoli Storage FlashCopy Manager.

About this task

When you configure Tivoli Storage FlashCopy Manager, you are prompted to enter parameter values that are specific to your environment. Syntax and value ranges are checked during the setup. Also, you must enter password information that is used to create a password file. A separate Tivoli Storage FlashCopy Manager profile is created for each application.

Running the setup script for custom applications

Run the setup script `./setup_gen.sh` to configure Tivoli Storage FlashCopy Manager for custom applications.

Before you begin

Review the completed Tivoli Storage FlashCopy Manager installation sheet to ensure that the product installed correctly.

In most cases, configure Tivoli Storage FlashCopy Manager in basic mode. To display help for the parameters, enter the `?` character. The help is best viewed in a window that is set for at least 130 characters. If you choose to configure Tivoli Storage FlashCopy Manager in advanced mode, `-advanced` option, you can configure all parameters even ones that have default values. For this reason, the advanced mode takes longer to process.

Procedure

1. From the production server, log on as the application backup user.
2. Go to the installation directory: `INSTANCE_DIR: $HOME/acs/`
3. Start the setup script by entering the following command:
`./setup_gen.sh`

4. Follow the setup script instructions. For information about the configuration steps, see “Configuring Tivoli Storage FlashCopy Manager for custom applications.” For information about configuring Tivoli Storage FlashCopy Manager for custom applications in a GPFS environment, see “Configuring Tivoli Storage FlashCopy Manager for Custom Applications for GPFS” on page 48.

Results

The setup script creates the following directories on the instance directory:

- The \$HOME/acs directory contains the Tivoli Storage FlashCopy Manager binary files.
- The ACS_DIR directory is the Tivoli Storage FlashCopy Manager configuration directory. It contains the following files and subdirectories:
 - The profile configuration file.
 - The Tivoli Storage FlashCopy Manager repository.
 - The logs directory. All newly started daemons and active daemons processes are recorded in the summary log file.
 - The configuration wizard registers the Tivoli Storage FlashCopy Manager management daemon acsd and generic device agent acsgen in the /etc/inittab or creates and starts upstart jobs on the production server. These processes are started automatically even after a system restart.

Note: If you are installing Tivoli Storage FlashCopy Manager in an HA environment, these processes must be started from your HA environment. Add the processes to your HA startup scripts. In addition, you must ensure that these daemon processes are restarted if they are ended. In HA environments, nothing is added to /etc/inittab and no upstart jobs are created.

Configuring Tivoli Storage FlashCopy Manager for custom applications

After you run the setup script, the configuration wizard leads you through the configuration of the Tivoli Storage FlashCopy Manager for custom applications.

Before you begin

To start the configuration process, run the setup script for custom applications with the following command: `./setup_gen.sh`

If you are using the setup script to configure an onsite backup server and you do not use standard CA-signed certificates for server authentication, you must copy `fcmselcert.arm` from `INSTALL_DIR` on the production server to `INSTALL_DIR` on your backup or clone server. For information about IBM Global Security Kit configuration, see “IBM Global Security Kit configuration” on page 140.

If your custom application is in a GPFS cluster, the configuration instructions are here “Configuring Tivoli Storage FlashCopy Manager for Custom Applications for GPFS” on page 48.

About this task

For some parameters, you can create multiple entries with different values. To create these multiple entries, when prompted **Do you want to add another**

instance of this parameter?, enter y. To delete a parameter entry, when prompted for the parameter value, enter !d.

Procedure

1. Choose either (1) or (2) depending on the type of configuration you want:
 - (1) On-site Production Server configuration with optional remote Backup Server configuration.
This selection guides you through the configuration of Tivoli Storage FlashCopy Manager on the production server. It also provides the option to remotely activate and synchronize the configuration of one or more backup servers by using the OpenSSH protocol.
 - (2) On-site Backup Server configuration.
This selection guides you through the configuration of Tivoli Storage FlashCopy Manager on the backup server as a separate installation.
 2. Choose if you are going to run offload backups.
Are you going to perform offloaded backups to Tivoli Storage Manager?
[Y|N]
 - Specify Y to configure support for offloaded tape backups.
 - Specify N to configure support for disk-based snapshot backups only.
 3. Choose if you want to start offloaded tape backups after the snapshot.
Do you want to start offloaded tape backups after the snapshot? [Y/N]
 - Choose Y to start the offload immediately after the FlashCopy backup completes.
 - Choose N if you want to schedule the offload operation to run later by scheduling backups individually. The backup to Tivoli Storage Manager can be delayed until the necessary resources in Tivoli Storage Manager server are available. This answer requires the scheduled backup process to be started manually. For example, add a crontab entry. The default value is to run tsm4acs as a daemon process on the production server.
 4. Choose one of the following options:
 - Linux Do you want IBM Tivoli Storage FlashCopy(R) Manager to create and start the upstart jobs for you? [Y|N]
 - AIX, Solaris, and HP-UX Do you want FlashCopy Manager to create the inittab entries for you? [Y/N]
Specify N for the executable files that include command-line options not to be added to the /etc/inittab and not to create upstart jobs. You must make sure that they are started by your HA startup scripts and that they are restarted whenever they are ended.
Specify Y to enter the daemon processes in the /etc/inittab directory, or to create and start upstart jobs.
- Important:** After this procedure completes, you are prompted whether you want to deploy the configuration to one or multiple backup or clone systems. This deployment associates the device classes that are specified in the profile with the backup or clone systems. The following section describes the configuration of a backup system. When you configure a clone system, similar options are displayed.
5. Select the backup system to update or delete:
 - n) To configure a new backup system
 - b) Return to the previous menu

q) To quit the configuration

Tivoli Storage FlashCopy Manager requires a backup server to be available when the following conditions exist:

- Offload backups to Tivoli Storage Manager are run.
- FlashCopy backup consistency must be verified during a forced mount operation.

Select n to configure and activate Tivoli Storage FlashCopy Manager on a remote site by using OpenSSH. OpenSSH must already be available for remote connections from the production system to the backup system. You are prompted to specify the **DEVICE_CLASS** to be enabled on the backup system. Select one or more **DEVICE_CLASS** parameters from the list that is displayed on the console.

Enter q to quit the configuration of the backup system and exit the setup script if one of the following conditions exist:

- OpenSSH is not available.
- You want to configure the backup system in a separate step.

When a backup system is configured, it is possible to run several actions on this backup system. For example, update, stop, start, delete FlashCopy Manager agents that are running on the backup system or you can set up SSH key authentication to the backup system.

The following example illustrates these actions.

Select the backup system to update or delete:

- 1) acsback1
- 2) acsback2
- 3) acsback5

n) to configure a new backup system

q) to quit configuration

1

selected backup system: acsback1

The backup system on acsback1 is configured with the device class DISK_ONLY3.

Select the action you want to take on the backup system acsback1:

- 1) update IBM Tivoli Storage FlashCopy Manager installation
- 2) start IBM Tivoli Storage FlashCopy Manager services
- 3) stop IBM Tivoli Storage FlashCopy Manager services
- 4) uninstall IBM Tivoli Storage FlashCopy Manager
- 5) setup the SSH key authentication

b) return to the backup system selection

q) quit the configuration

Select one of the options.

The same set of functions is provided for the configuration of the clone instances with SSH.

| **Configuring Tivoli Storage FlashCopy Manager for Custom Applications for GPFS**

| Run the setup script to configure Tivoli Storage FlashCopy Manager for custom applications for a GPFS setup.

| **Before you begin**

| Before you run the setup script, you must know the name of the Tivoli Storage Manager server that you will offload snapshots to. If dsm.sys or dsm.opt is not

stored in the default path, you must specify the **DSM_DIR** during the setup configuration.

About this task

The configuration steps ask for the relevant information that is needed to configure Tivoli Storage FlashCopy Manager for Custom Applications. During the configuration in advanced mode, you are asked specific GPFS questions to differentiate the configuration for a GPFS setup.

For some parameters, you can create multiple entries with different values. To create multiple entries of a particular parameter, when prompted if you want to add another instance of a parameter, choose yes. If you want to delete a parameter entry, enter **!d**.

Procedure

1. When asked if your custom application is running on a GPFS file system, choose yes.
2. Choose to configure an onsite production server with the option of a remote backup server configuration. This option configures Tivoli Storage FlashCopy Manager on the production server. It also provides the option to remotely activate and synchronize the configuration of one or more backup servers by using the OpenSSH protocol.
3. If you are going to run offloaded backups to the Tivoli Storage Manager, choose to run offload backups. When you choose to offload backups to the Tivoli Storage Manager, you proceed to configure support for offloaded tape backups. Alternatively, you can choose to configure support for running snapshot backups in a GPFS file system only.
4. Choose if you want to start offloaded tape backups immediately after the snapshot completes. If you choose not to run offload operations immediately after the snapshot completes, you can schedule offload operations to run later by scheduling backups individually. Backups to Tivoli Storage Manager can be delayed until the necessary server resources are available. To run the scheduled backup process manually enter the command **fcmlcli -f tape_backup**. You can add a crontab entry to complete this action. The default value is to run tsm4acs as a daemon process on the production server.
5. Choose one of the following options:
 - In a Linux environment: decide if you want the upstart jobs to be created and started.
 - In AIX environments: decide if you want the inittab entries created.

If you specify no, the executable files that include command-line options are not added to the **/etc/inittab**, and the upstart jobs are not created. In this case, ensure that these items are started by your HA startup scripts, and that they are restarted whenever they are ended. If you choose yes, the daemon processes are entered in the **/etc/inittab** directory, or upstart jobs are created and started.

What to do next

After the configuration completes, you are asked if you want to deploy the configuration to a backup system. In a GPFS environment, a backup system is not required because all actions are carried out in the productive GPFS cluster. However, if you want to run offload backups to a Tivoli Storage Manager server you must configure a system where this operation is initiated. For example, the

local node where Tivoli Storage FlashCopy Manager is being installed, or any other management node in the GPFS cluster where the Tivoli Storage Manager client is set up and configured to cooperate with the GPFS command **mmbackup**. To configure such an offload system, choose to configure a new backup system.

Related reference:

“Profile configuration file” on page 97

Configuring storage environments

You must configure all storage devices that are storing backups from Tivoli Storage FlashCopy Manager, but IBM System Storage DS8000 storage devices require more configuration to prepare for source and target volume relationships. Similarly, IBM System Storage SAN Volume Controller and IBM Storwize family must be configured when you use predefined target volumes.

The Tivoli Storage FlashCopy Manager profile configuration file can contain one or more **DEVICE_CLASS** sections. This section is used to configure Tivoli Storage FlashCopy Manager for use with a particular storage solution. The parameters do not depend on the database or custom application that is protected. Follow the steps in the appropriate procedure for your disk storage environment. For your disk storage subsystem, data files must be defined on volume groups that are separate from the volume groups where the control files and redo logs are defined.

For more information about volume group layout requirements, see Chapter 3, “Preparation for installation,” on page 29.

Configuring for Storwize family and SAN Volume Controller dynamic target allocation (SVCDTA)

To allow dynamic volume creation during backup operations, you must enable access to the storage system command-line interface (CLI) with Secure Shell (SSH) keys.

Before you begin

Verify that OpenSSH client is installed on the production server, and the backup or clone server where Tivoli Storage FlashCopy Manager is installed. The OpenSSH client is installed by default on most AIX and Linux distributions. If it is not installed on your system, consult your AIX or Linux installation documentation.

About this task

The following steps are required to enable CLI access with SSH keys:

- A public and a private key must be generated as a pair
- A public key must be uploaded to the storage system
- Tivoli Storage FlashCopy Manager must be configured to authenticate with the private key

The method of connecting the SAN Volume Controller adapter for dynamic target allocation is not CIMOM based, but uses SSH keys for issuing the commands.

Important: There is a limit on the number of concurrent connections to the storage device, depending on the SAN Volume Controller version. Tivoli Storage FlashCopy Manager will retry the connection if the limit is reached temporarily.

Procedure

1. Generate an RSA key pair for the storage user name to access the storage system. On the production server and backup or clone server, issue a command that is similar to the following command:

```
ssh-keygen -t rsa
```

Tip: Issue the command as the application owner from the `$HOME/.ssh` directory.

This process generates two files, which you are prompted to name. If you select the name `svc_sshkey`, the files are named `svc_sshkey` and `svc_sshkey.pub`.

`svc_sshkey` is the name of the private key and `svc_sshkey.pub` is the name of the public key.

Tip: You are prompted to enter a passphrase for the file. To ensure that this works with SVCDTA dynamic target allocation, leave the passphrase empty.

2. Upload the public key to the storage system. For instructions about how to upload to the storage system, see the documentation that is provided for your storage system.

All online product documentation is now available in IBM Knowledge Center (<http://www.ibm.com/support/knowledgecenter>).

3. Run the Tivoli Storage FlashCopy Manager for UNIX and Linux setup script in advanced mode by entering the following command:

```
./setup_gen.sh -advanced
```

Note: It is also sufficient to run the setup script in basic mode if the private key file is placed in the default path `$HOME/.ssh`, and you do not want to use an alternative SSH binary.

4. When prompted to specify a **SSH_DIR** path, enter the path where the Secure Shell protocols and executable files are installed. The default location is `/usr/bin`.
5. When prompted to specify a **SVC_SSHKEY_FULLPATH** path, enter the path and the file name to the private key file. For example:

```
SVC_SSHKEY_FULLPATH    $HOME/.ssh/svc_sshkey
```

, where `$HOME/.ssh/svc_sshkey` is the default.

6. Follow the setup script instructions to save the profile and restart the Tivoli Storage FlashCopy Manager daemons.

What to do next

Place the private key files on the backup/cloning servers at the same path if applicable.

Migrating from SVC with static target allocation to SVC with dynamic target allocation (SVCDTA)

You can change an existing configuration of Tivoli Storage FlashCopy Manager for UNIX and Linux to use dynamic target allocation (COPYSERVICES_HARDWARE_TYPE: SVCDTA) without losing older backups. If the profile is using a device class that is configured for static target allocation (COPYSERVICES_HARDWARE_TYPE: SVC), you can create a new device class for SVCDTA and add it to the profile.

Before you begin

To start the configuration process, run the generic setup script with the following command: `./setup_gen.sh`

About this task

The following information demonstrates how to modify an existing Tivoli Storage FlashCopy Manager configuration profile to use a new device class with dynamic target allocation. In this example, the Client profile is modified to change the device class from 'STANDARD' to a new device class called 'STANDARD_DTA'.

Procedure

1. Choose (m) when presented with the following options:
 - (c)reate a new profile
 - (r)euse the profile unchanged
 - (m)odify the profile
2. The profile parameters for the configuration that is being modified are displayed, in this case, for the 'CLIENT' section. Within this section, for the DEVICE_CLASS parameter, replace STANDARD with STANDARD_DTA.

Note: These steps are applicable for the 'CLONING' profile section also.

3. You are asked if you want to delete the device class that is being replaced. Device section STANDARD is no longer referenced. Do you want to delete it? [y|n]

Choose n to ensure that the existing device class is not deleted.

Important:

The existing device class, in this case 'STANDARD', **must be retained** to allow for any existing backup snapshots to be mounted or restored.

4. The profile parameters for the new device class 'STANDARD_DTA' are displayed, starting with the COPYSERVICES_HARDWARE_TYPE. Change this setting from SVC to SVCDTA.

Tip:

If the MAX_VERSIONS parameter is set to 'ADAPTIVE', you must return to the CLIENT profile section, and change the MAX_VERSIONS parameter from ADAPTIVE to a fixed number.

5. Enter the existing server information for the storage system host name (COPYSERVICES_SERVERNAME). Because you are using the same storage system server, but with a different storage adapter, a warning message is displayed. This message lists the restrictions that are associated with configuring different device classes on the same server.
6. You are asked if you want to proceed with the current configuration. Enter (r) to retry or (i) to ignore and proceed.
 - Choose i if you want to proceed with the configuration, acknowledging that some restrictions apply.
 - Choose r if you want to change the configuration, and use a different storage system server.
7. Enter the user name for the primary storage device (COPYSERVICES_USERNAME). The default name is superuser.

8. Enter the path and the file name of the private SSH key file (SVC_SSHKEY_FULLPATH). For example:

```
SVC_SSHKEY_FULLPATH    $HOME/.ssh/svc_sshkey
```

, where \$HOME/.ssh/svc_sshkey is the default.

9. Accept the defaults for the remaining parameters, or change where necessary. For example, change the FlashCopy type from NOCOPY to COPY.
10. The profile is saved, and you are asked if you would like to specify a backup system or to quit the configuration.
Currently no backup system is setup. To configure a backup system please select option n.
 - Choose n if you want to specify a new backup system.
 - Choose q if you want to quit the configuration.

Results

Tivoli Storage FlashCopy Manager for UNIX and Linux is now configured to use the SAN Volume Controller storage adapter with dynamic target allocation on the SAN Volume Controller storage server that was already in use for device type SVC.

Restriction:

If a configuration uses both device types 'SVC' and 'SVCDDTA' on the same IBM Storwize v7000/IBM System Storage SAN Volume Controller server, the following limitations apply.

- No new backups can be created for the DEVICE_CLASS sections that use COPYSERVICES_HARDWARE_TYPE: SVC. If you attempt to create such a backup, a clear error message is displayed.
- Existing backups that were created with these DEVICE_CLASS sections can be mounted and restored, **but any newer backups are destroyed, even if they were created with the SVCDDTA adapter.**
- Existing device classes that use COPYSERVICES_HARDWARE_TYPE: SVC must not be deleted until all backups that were created using this device class are expired and deleted from the Tivoli Storage FlashCopy Manager repository, and also from the storage system.

Configuring the CIM adapter for SP 800-131A compliant encryption

CIM agents are provided by IBM System Storage SAN Volume Controller, IBM Storwize, and IBM System Storage DS8000 systems. Tivoli Storage FlashCopy Manager for UNIX and Linux communicates with a CIM agent through the CIM interface. You must configure the Tivoli Storage FlashCopy Manager CIM adapter to use the security standards, as defined in the National Institute of Standards and Technology (NIST) Special Publications (SP) 800-131A for encryption.

Before you begin

Ensure that the storage system is enabled for SP 800-131A standard encryption. For instructions about how to identify if the system is enabled, see the documentation that is provided for your storage system. For the new SVC adapter with dynamic

target allocation (type SVCDTA), compliance with SP 800-131A is provided by the OpenSSH client version that is installed on the same host as Tivoli Storage FlashCopy Manager for UNIX and Linux.

Note: For IBM System Storage SAN Volume Controller and IBM Storwize family, this configuration applies only in the case of static target allocation (type SVC); the new SVC adapter with dynamic target allocation (type SVCDTA) uses the CLI interface via Secure Shell (SSH) rather than the CIMOM interface.

Procedure

1. Extract the Secure Sockets Layer (SSL) certificate from the IBM storage system cluster. The certificate must be in the Privacy Enhanced Mail (PEM) format. From any Linux or UNIX system with a LAN connection to the storage system, run the following shell command,

```
echo | openssl s_client -connect ibm_storage_cluster_ip:5989 2>&1  
| sed -ne '/-BEGIN CERTIFICATE-/,/-END CERTIFICATE-/p'
```

where *ibm_storage_cluster_ip* specifies the IP address of the storage system, and 5989 specifies the port number for the HTTPS connection.

2. Save the output to a text file and place the file in a secure location on the Tivoli Storage FlashCopy Manager production and backup servers.
3. Run the Tivoli Storage FlashCopy Manager setup script in advanced mode by entering the following command:

```
./setup.sh -advanced
```

4. When prompted for the **COPYSERVICES_CERTIFICATEFILE** parameter for the storage system device class, enter the fully qualified path to the certificate file. For example:

```
COPYSERVICES_CERTIFICATEFILE    ACS_DIR/truststore/svc_cluster.cert
```

5. Follow the setup script instructions to save the profile and restart the Tivoli Storage FlashCopy Manager daemons.

Defining Logical Unit Numbers on DS8000 storage subsystems

Logical Unit Numbers (LUNs) must be defined for the DS8000 storage subsystem.

Before you begin

Before you start defining LUNs on the storage subsystem, verify that the following prerequisites are met:

- The LUNs are located where the production database or application is located.
- The size of the LUNs is dependent upon the size of the database or application.
- The size of the source volumes on the production server and size of the target volumes on the backup server must be the same.
- Both the source volume and target volume must be defined on the same storage subsystem.
- Assign the source volume to the DS8000 volume group that is associated with the production server.

Procedure

Perform these steps so that the correct LUNs are defined on both the production server and backup server.

1. Use the DS8000 Storage Manager to create two or more fixed block LUNs on the production server.
2. Use the DS8000 Storage Manager to create the same number of LUNs for the backup server as were created for the production server in the previous step.
Real-time manager (or Simulated manager)-> Configure storage -> Open systems -> Volumes-open systems
These LUNs must also be the same size as the LUNs created for the production server. Assign the target volume to the DS8000 volume group that is associated with the backup server.

3. Identify the serial numbers of the target LUNs by using the DS8000 Storage Manager.

Real-time manager (or Simulated manager)-> Configure storage -> Open systems -> Volumes-open systems

Select the target LUNs created on the backup server in Step 2. Identify the serial numbers with the matching size in the source LUNs. For example:

```
7501901
Nickname      Number Status Type GB
sandburr_3300 3300   Normal  DS  2.0
sandburr_3400 3400   Normal  DS  2.0
```

In this example, the serial numbers are 75019013300 and 75019013400.

4. Define the **TARGET_VOLUME** parameter in the target volumes file specified by the **VOLUMES_FILE** profile parameter with the appropriate serial numbers of the target LUN. For example:

```
TARGET_VOLUME 75019013300
TARGET_VOLUME 75019013400
```

This setting specifies the target volumes where the database or application is backed up.

Defining virtual disks on SAN Volume Controller and Storwize family

When you define virtual disks for the SAN Volume Controller and the Storwize family storage devices, you can use either the graphical user interface or the command-line interface.

Before you begin

Before you start defining virtual disks, verify that the following prerequisites are met:

- A storage area network is available.
- Storage disks are attached and available in the SAN Volume Controller or Storwize family environment.
- Subsystem Device Driver (SDD) or Subsystem Device Driver Path Control Module (SDDPCM) is installed and available on the host systems.
- A cluster is available in the SAN Volume Controller or Storwize family environment.
- Each host has at least two paths to the SAN Volume Controller or Storwize family storage device.

Procedure

To create virtual disks on the production server and backup server, complete the following steps.

1. From the graphical user interface, select **Work with Virtual Disks > Virtual Disks > Create Virtual Disks**. The virtual disks are created by using the managed disk group.
2. Map the virtual disk to the hosts that are created for the production server. To map the virtual disks to the backup server, in the Tivoli Storage FlashCopy Manager profile file, configure the **BACKUP_HOST_NAME** parameter by assigning one of the following values:
 - Assign the value **PREASSIGNED_VOLUMES** to use a static predefined map.
 - Assign the *backup_server_hostname* to allow Tivoli Storage FlashCopy Manager to dynamically map the target virtual disks when needed.

Note: The value **PREASSIGNED_VOLUMES** is not allowed if you select SAN Volume Controller and Storwize family dynamic target allocation.

3. Define the **TARGET_VOLUME** parameter in the target volumes file (.fct). This name is specified by the **DEVICE_CLASS > TARGET_SETS > VOLUMES_FILE** parameter with the appropriate virtual disk names of the target LUNs in the profile configuration file. For example:

```
TARGET_VOLUME A01pro1_1_t1
TARGET_VOLUME A01pro1_2_t1
```

In this example, the source volume names are A01pro1_1 and A01pro1_2 with target set named 1.

Alternatively, you can define the target names by using the **TARGET_NAMING** parameter in the Tivoli Storage FlashCopy Manager profile file.

Note: The parameter **TARGET_SETS** in the device class section is not allowed if you select SAN Volume Controller and Storwize family dynamic target allocation.

Select the FLASHCOPY_TYPE

DS8000, SAN Volume Controller, and Storwize family storage solutions support various FlashCopy types that provide different capabilities for your backup strategy.

Using different FlashCopy types for different backup generations is a valid strategy for Tivoli Storage FlashCopy Manager. To implement such a backup strategy, define multiple **DEVICE_CLASS** sections in the profile, where each section specifies the same storage device. The only difference is that each section specifies a different FlashCopy type. These **DEVICE_CLASS** section definitions allow rules to be defined in the **CLIENT** profile section. These rules allow Tivoli Storage FlashCopy Manager to select the appropriate **DEVICE_CLASS** section for the next backup. For more information about the **DEVICE_CLASS** parameter, see the **CLIENT** section.

If the **FLASHCOPY_TYPE** is changed for one **DEVICE_CLASS**, complete the following steps:

1. Unmount the backup if it is mounted on a backup system.
2. Delete the backup with the delete force option.
3. Change the **FLASHCOPY_TYPE** in the **DEVICE_CLASS** and run a new backup with the new **FLASHCOPY_TYPE**.

Note: If you use SAN Volume Controller and Storwize family dynamic target allocation you do not have to delete any old backups.

Table 4. Selecting the **FLASHCOPY_TYPE** for DS8000, SAN Volume Controller, and Storwize family

FLASHCOPY_TYPE	DS8000	SAN Volume Controller Storwize family
COPY	Can be used for backup and restore. Protects from physical failures of the source volumes when the background copy completes.	Can be used for backup and restore. Protects from physical failures of the source volumes when the background copy completes. For more information, see Note 1 in this table.
INCR	Same characteristics as COPY FLASHCOPY_TYPE but with fewer COPY activities in the background. DS8000 allows at most 1 incremental FlashCopy per source volume. In mirroring environments, this setting allows it to retain 1 backup generation per mirror. For DS8000, there must be only one target set specified in the target volumes file (.fct) for incremental snapshots. CIM errors might occur when more than 1 target set is specified.	Same characteristics as COPY FlashCopy but with fewer COPY activities in the background. For more information, see Notes 1 and 2 in this table.
NOCOPY	Can be mounted remotely, but cannot be restored.	Can be mounted remotely and can be restored. Can be used to create a FlashCopy to a space-efficient target, but does not offer protection from physical failures to the source volume. Space-efficient target volumes can reach capacity limits in which case they go offline. In this scenario, you lose the current backup and all older backups that are not at FULL_COPY. You can choose to create space-efficient targets with the AUTOEXPAND option. In this scenario, the target is allocated more physical storage to prevent it going offline.
<p>Note 1: If space-efficient source volumes are used in combination with space-efficient target volumes, Tivoli Storage FlashCopy Manager can be configured to use FLASHCOPY_TYPE COPY, INCR, or NOCOPY. If fully allocated source volumes are used in combination with space-efficient target volumes, then Tivoli Storage FlashCopy Manager can be configured to use FLASHCOPY_TYPE INCR, or NOCOPY. These options are available when the profile parameter ALLOW_ALL_FLASHCOPY_TYPES is set to YES. The default value of ALLOW_ALL_FLASHCOPY_TYPES is NO. When the default value is used, only FLASHCOPY_TYPE NOCOPY is possible.</p> <p>Note 2: The information in Note 1 only applies if you use SAN Volume Controller and Storwize family static target allocation. If you use SAN Volume Controller and Storwize family dynamic target allocation, then FLASHCOPY_TYPE INCR and profile parameter ALLOW_ALL_FLASHCOPY_TYPES are not available.</p>		

The types of snapshots that are supported by Tivoli Storage FlashCopy Manager, depending on the storage solution and operating system, are indicated in the following table.

Table 5. Supported storage subsystems and FlashCopy types

Device	COPY	INCR	NOCOPY	Space-efficient snapshots	Changes made to a mounted snapshot backup
IBM System Storage DS8000	Yes	Yes	Yes	N/A	Remains persistent and alters the content of the backup.

Table 5. Supported storage subsystems and FlashCopy types (continued)

Device	COPY	INCR	NOCOPY	Space-efficient snapshots	Changes made to a mounted snapshot backup
IBM System Storage SAN Volume Controller IBM Storwize family with static target allocation	Yes	Yes	Yes Includes space-efficient copies if configured so.	N/A	Remains persistent and alters the content of the backup.
IBM System Storage SAN Volume Controller IBM Storwize family with dynamic target allocation	Yes	No	Yes	N/A	Reverted during unmount and does not alter the backup.
IBM XIV Storage System	N/A	N/A	N/A	Yes	Reverted during unmount and does not alter the backup or remains persistent and alters the content of the backup.
IBM System Storage N series NetApp systems	N/A	N/A	N/A	Yes	Reverted during unmount and does not alter the backup.

Target set definitions

Tivoli Storage FlashCopy Manager requires target sets to be defined for SAN Volume Controller, Storwize family, and DS8000.

Define targets by using target set definition files (SAN Volume Controller, Storwize family, and DS8000) or by using a naming convention (SAN Volume Controller and Storwize family only). This convention determines the name of the target for both the source volume name and the target set name as specified for the current operation.

Tip: There is no requirement to define target volumes, if you select SAN Volume Controller and Storwize family dynamic target allocation.

Target set definition files

A target set definition file contains a list of target volumes that are organized into target sets.

During the backup process, Tivoli Storage FlashCopy Manager software matches source volumes to suitable targets within a target set. To determine source target relations, associate a source name with a target name in a target set definition file. In this scenario, the relationship between the source and target is required. Backup processing fails if one of the targets is unavailable for the specified source. For details on the target selection algorithms, see “Target set and target volumes” on page 133.

If Tivoli Storage FlashCopy Manager attempts to mount the target set, the volumes within the target set must be assigned to a backup host. For example, the target set is mounted to create a backup to Tivoli Storage Manager. Because all target volumes within a single target are mounted to the same host, assign all target volumes within a target set to the same host. When you use multiple backup servers within your environment, use multiple target set definition files.

For SAN Volume Controller and Storwize family storage solutions, Tivoli Storage FlashCopy Manager can assign the target volumes dynamically during the mount operation. In this case, you must not assign the target volumes in advance of the mount operation.

```
>>> TARGET_SET SET_1 # FCM determines a suitable target for every source
TARGET_VOLUME 40913158
TARGET_VOLUME 40A13158
TARGET_VOLUME 40B13158
<<<
>>> TARGET_SET SET_2 # For every source the target is mandated in the target set
                        # definition (source name following target name)
TARGET_VOLUME 40C13158 40613158
TARGET_VOLUME 40D13158 40713158
TARGET_VOLUME 40E13158 40813158
<<<
```

Referring to target set definitions from the profile

The target set definition file must be specified in the **DEVICE_CLASS** section of the profile.

The following example is a section from a Tivoli Storage FlashCopy Manager profile file that shows the association between **TARGET_SETS**, **VOLUMES_FILE**, and *name of target set definition file* parameters.

```
>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE DS8000
COPYSERVICES_PRIMARY_SERVERNAME <hostname> #
TARGET_SETS      VOLUMES_FILE
VOLUMES_FILE    name of target set definition file
FLASHCOPY_TYPE    INCR
<<<
```

If multiple **DEVICE_CLASS** configuration sections are specified within the profile, each **DEVICE_CLASS** section must be associated with a unique target set definition file. The target set names must be unique across all target set definition files. If all target sets within the target set definition file are assigned to the same host and associated with one **DEVICE_CLASS**, they are mounted on the same host.

Target set definitions using the naming convention

Target set definitions can also be provided by using a naming convention on SAN Volume Controller and Storwize family.

Tivoli Storage FlashCopy Manager supports using a naming convention, instead of a definition file, for target set definitions on SAN Volume Controller and Storwize family storage systems. Tivoli Storage FlashCopy Manager determines the target volume names from the name of the target set, used for the current backup, and the name of the source volume.

Target sets are specified directly in the **DEVICE_CLASS** configuration section of the profile for example, **TARGET_SETS 1 2 3**. The names are generated from **TARGET_SETS** and are sequentially numbered, 1, 2, 3, 1, 2, and so on. When target sets are defined in the profile, the name must be unique in the entire defined device class section of the profile. For example, you cannot have the **TARGET_SETS** parameter, set to t1 for more than one device class. The following example shows multiple device classes that are named in the **DEVICE_CLASS** configuration section of the profile:

```
>>> Device_Class SVC_01
.
.
TARGET_SETS t1 t2
```

```

.
.
<<<
>>> Device_Class SVC_02
.
.
TARGET_SETS t3 t4
.
.
<<<
>>> Device_Class SVC_03
.
.
TARGET_SETS t5 t6
.
.
<<<

```

A TARGET_NAMING rule is also specified to determine the name of the target volume from the name of the source. For example, TARGET_NAMING %SOURCE_bt%TARGETSET. If the application is stored on a volume named *db_vol*, the targets required by Tivoli Storage FlashCopy Manager are *db_vol_bt1*, *db_vol_bt2*, and *db_vol_bt3*. These targets depend on the target set that is selected for the current backup.

```

>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME <hostname>
TARGET_SETS 1 2 3
TARGET_NAMING %SOURCE_bt%TARGETSET
FLASHCOPY_TYPE NOCOPY
<<<

```

The given TARGET_SETS or TARGET_NAMING definition results in the following target volume names:

```

    name of source volume_bt1
    name of source volume_bt2
    name of source volume_bt3

```

LVM mirroring environments

In a Logical Volume Manager (LVM) mirroring on AIX environment, multiple DEVICE_CLASS configuration sections are required. One section per storage cluster or LVM mirror is required.

The storage system ID must be specified in the Tivoli Storage FlashCopy Manager DEVICE_CLASS configuration section. For example:

```

>>> DEVICE_CLASS MIRR_1
COPYSERVICES_HARDWARE_TYPE DS8000
COPYSERVICES_PRIMARY_SERVERNAME DS8000_1
STORAGE_SYSTEM_ID 7513158
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE <name of target set definition file 1>
FLASHCOPY_TYPE INCR
<<<
>>> DEVICE_CLASS MIRR_2
COPYSERVICES_HARDWARE_TYPE DS8000
COPYSERVICES_PRIMARY_SERVERNAME DS8000_2
STORAGE_SYSTEM_ID 7512067
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE <name of target set definition file 2>
FLASHCOPY_TYPE INCR
<<<

```

The **STORAGE_SYSTEM_ID** parameter is required when ASM failure groups are distributed across multiple storage devices. Each device section in the profile requires this parameter to specify the storage subsystem ID. Do not specify this parameter when all failure groups are on the same storage subsystem. For information about this parameter, see the **DEVICE_CLASS** device section of the profile configuration file.

Related reference:

“**DEVICE_CLASS device**” on page 109

Backup and clone server assignment

With Tivoli Storage FlashCopy Manager software, you can mount backup images and clone images. Each backup image and clone image is mounted on a server. However, you cannot mount a backup image or a clone image on more than one server at one time.

Tivoli Storage FlashCopy Manager mount operation can be started by one of the following methods:

- By issuing a mount command from the command-line interface.
- By issuing a create or refresh clone command from the command-line interface.
- When Tivoli Storage FlashCopy Manager is used with Tivoli Storage Manager and you offload backups to Tivoli Storage Manager.

The information that you enter during the installation and configuration of Tivoli Storage FlashCopy Manager is used to create a profile configuration file. The **DEVICE_CLASS** section of this profile specifies the backup host name where the backup or clone images are mounted. There can be multiple **DEVICE_CLASS** sections. The **CLIENT** section specifies the **DEVICE_CLASS** to use for backup and offload operations. The **CLONING** section specifies the **DEVICE_CLASS** to use for cloning operations.

FlashCopy or snapshot target volumes are mounted and assigned to selected backup or clone server. Depending on the storage system and profile configuration the following assignments occur:

IBM XIV Storage Systems, IBM System Storage N series, and NetApp storage systems

The assignment automatically occurs during the mount request.

SAN Volume Controller and Storwize family

If the **BACKUP_HOST_NAME** parameter is specified as *backup_server_hostname* in the **DEVICE_CLASS** section, the target volumes are mapped dynamically from the storage system to the backup and clone server.

DS8000, SAN Volume Controller, and Storwize family

If the **BACKUP_HOST_NAME** parameter is specified as *PREASSIGNED_VOLUMES* in the **DEVICE_CLASS** section, the target volumes must be preassigned to a specific backup or clone server before you issue a mount command. Ensure that the target volumes of all target sets associated with a specific **DEVICE_CLASS** are assigned to the same hosts. If target set definition files are used, assign all volumes within one target set definition file to the same host. This setting ensures that targets associated with a single device class are mounted from the same backup or clone server.

For all Tivoli Storage FlashCopy Manager mount operations, there can be only one backup or clone server for each device class. If the identified servers have not mounted a backup or clone image, the mount request is propagated to those servers. The backup or clone is then mounted.

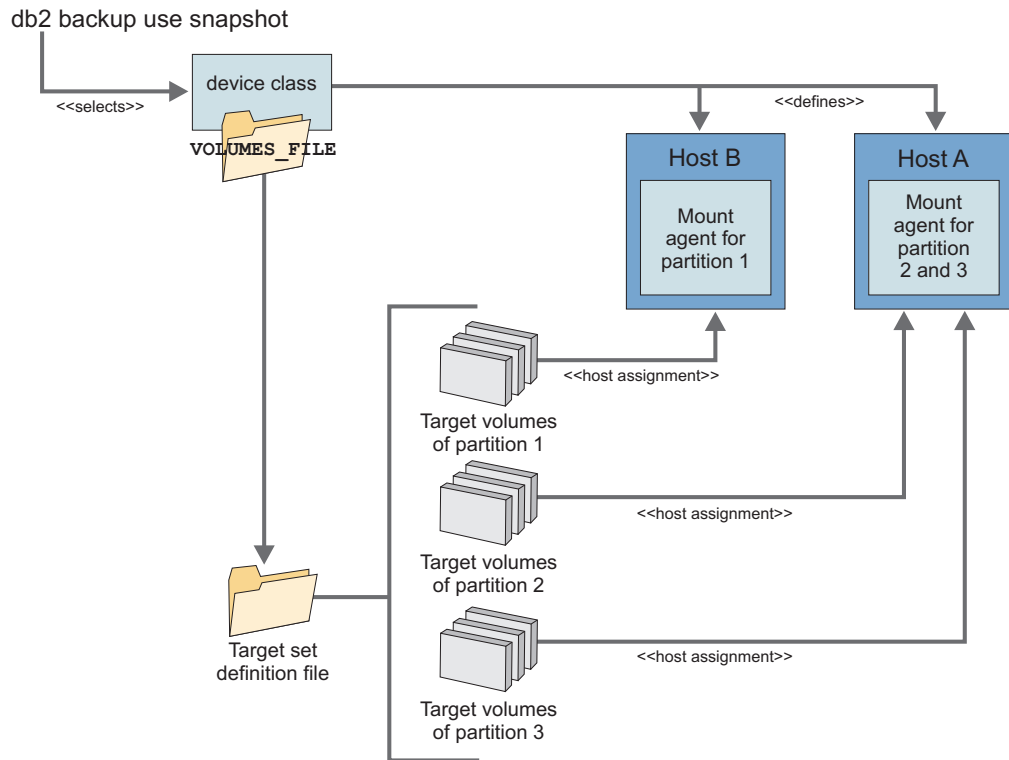


Figure 6. Tivoli Storage FlashCopy Manager host assignments. This example shows a DB2 configuration.

Managing backups with the **DEVICE_CLASS** parameter

Use the **DEVICE_CLASS** parameter in the CLIENT section of the Tivoli Storage FlashCopy Manager profile file to select the storage device configuration for backups.

The Tivoli Storage FlashCopy Manager **DEVICE_CLASS** profile parameter can be used as a filter to determine these backup criteria:

- Partition number
- Day of week
- Time of backup
- Cloning only: Clone database name

When used in this manner, the **DEVICE_CLASS** parameter provides access to a specific storage device. This device is identified by the copy services type, user name, and server name that is defined by the corresponding **DEVICE_CLASS** profile section. It also provides a backup policy that is device-specific. For example, this device-specific backup policy might be defined by these factors:

- List of target sets on DS8000, SAN Volume Controller, or Storwize family
- The type of FlashCopy backup to be completed (for example, incremental or copy)

- The mount location of the backup
- Whether a backup to Tivoli Storage Manager server storage is created from the snapshot

The **DEVICE_CLASS** parameter is specified in the client section of Tivoli Storage FlashCopy Manager profile file. The settings for this parameter can be overridden with a command-line option during backup operations. Use the following command-line option:

`-s device class` on the `fccli -f backup` command.

The **DEVICE_CLASS** parameter cannot be specified with the **restore**, **mount**, **unmount**, and **delete** commands. You can specify the backup ID, if it is not specified the latest backup is used. Tivoli Storage FlashCopy Manager automatically uses the **DEVICE_CLASS** that was used for the selected backup at backup time.

Examples of how to use DEVICE_CLASS filters

This example creates alternating backups to each mirror. Device classes **MIRROR_1** and **MIRROR_2** refer to two separate storage clusters. Only those backups that are created to **MIRROR_2** are backed up to Tivoli Storage Manager server storage:

```
>>> CLIENT
TSM_BACKUP LATEST USE_FOR MIRROR_2
DEVICE_CLASS MIRROR_1 MIRROR_2
[...]
<<<
```

This example creates backups to **MIRROR_1** on Monday (1), Wednesday (3), and Friday (5). It creates backups to **MIRROR_2** on Sunday (0), Tuesday (2), and Thursday (4), and Saturday (6). All backups are stored on Tivoli Storage Manager server storage:

```
>>> CLIENT
TSM_BACKUP LATEST
DEVICE_CLASS MIRROR_1 USE_AT Mon Wed Fri
DEVICE_CLASS MIRROR_2 USE_AT Sun Tue Thu Sat
[...]
<<<
```

This example creates disk only backups during the specified period of the day. These disk only backups are considered space-efficient. A full backup is also created at midnight that is stored on Tivoli Storage Manager server storage. Although the **DAYTIME** and **MIDNIGHT** device classes might have the same configuration, two different device classes are used. This setting is used even if both device classes point to the same SAN Volume Controller cluster:

```
>>> CLIENT
TSM_BACKUP LATEST USE_FOR MIDNIGHT
DEVICE_CLASS DAYTIME FROM 1:00 TO 23:59
DEVICE_CLASS MIDNIGHT FROM 0:00 TO 0:59
[...]
<<<

>>> DEVICE_CLASS DAYTIME
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY
[...]
<<<

>>> DEVICE_CLASS MIDNIGHT
COPYSERVICES_HARDWARE_TYPE SVC
```

```
FLASHCOPY_TYPE INCR
SVC_COPY_RATE 80
[...]
```

Note: The time period that is specified cannot span midnight for a device class. If a device class time period is required to span midnight, you must specify two time periods for the device class. The first time period must end with a value 1 minute before midnight and the second time period must start at midnight. The following example shows how to specify a time period that spans midnight for a device class:

```
DEVICE_CLASS myClass FROM 20:00 TO 23:59
DEVICE_CLASS myClass FROM 00:00 TO 06:00
```

Configuring for remote mirroring

When you configure Tivoli Storage FlashCopy Manager, you can set the configuration parameters to create snapshots by using target volumes of remote mirroring relationships. These target volumes are used to create application consistent snapshot backups.

Before you begin

Before, you configure Tivoli Storage FlashCopy Manager to use target volumes that are associated with remote mirroring one of the following technologies must be deployed:

- SAN Volume Controller or Storwize family Global Mirror and Metro Mirror
- IBM XIV Storage System Synchronous Remote Mirroring and Asynchronous Remote Mirroring

Note: The following does not apply if you select to use Tivoli Storage FlashCopy Manager with SAN Volume Controller and Storwize family dynamic target allocation.

Procedure

1. To configure Tivoli Storage FlashCopy Manager with SAN Volume Controller or Storwize family Global Mirror and Metro Mirror, complete the following steps:
 - a. On the SAN Volume Controller or Storwize family system, create a partnership between the primary and auxiliary cluster. For example, you can run the following commands from the command-line interface:


```
ssh -i/dir/ssh-identity username@hostname or ip_primary_cluster
svctask mkpartnership -bandwidth bandwidth_in_mbps remote_cluster_name
or remote_cluster_id
```
 - b. Start the Global Mirror and Metro Mirror relationship by using either the graphical user interface or command-line interface. If you use the command-line interface, the following commands are provided as an example:


```
ssh -i/dir/ssh-identity username@hostname or ip_primary_cluster
svctask chpartnership -start remote_cluster_name or remote_cluster_id
```
 - c. Verify the following information about the environment:
 - Production volumes are on the primary storage system.
 - Production volumes are in a remote mirror relationship with the remote volumes that are either in the auxiliary cluster, or in the same cluster. All the remote mirror relationships are defined in a consistency group.

- d. Run the setup script to configure a dedicated device class for the snapshot backups on the remote cluster. When you configure the new `DEVICE_CLASS` section with the setup script, look for the following prompt:

Is the FlashCopy/Snapshot taken from the mirror volumes {COPYSERVICES_REMOTE}.

Enter *yes*. The **COPYSERVICES_REMOTE_SERVERNAME**, **COPYSERVICES_REMOTE_USERNAME**, and **TAKEOVER_HOST_NAME** parameters are also required for remote mirroring.

- e. On the remote cluster of the SAN Volume Controller or Storwize family, specify for each source the corresponding FlashCopy target volumes. To specify the FlashCopy target volumes, use one of the following options:

- Parameter **TARGET_SETS** with **VOLUMES_FILE**. For example:

```
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE /<component database>/DS0/acs/volumes/STANDARD_gm.fct
```

- Parameter **TARGET_SETS** with **TARGET_NAMING**. For example:

```
TARGET_SETS dc2 dc3 dc4 dc5
TARGET_NAMING %SOURCEx%TARGETSET
```

2. To configure Tivoli Storage FlashCopy Manager with XIV Synchronous Remote Mirroring and Asynchronous Remote Mirroring, complete the following steps:

- a. Define a coupling between peer volumes on the master and subordinate XIV systems, which creates a mirror relationship between the two.
- b. Activate the XIV remote mirror couplings.
- c. Define a coupling between peer consistency groups on the master and subordinate XIV systems, which creates a mirror relationship between the two.
- d. Add volume mirror couplings to the consistency group couplings.
- e. Run the setup script to configure a dedicated device class for the snapshot backups on the remote cluster. When you configure the new `DEVICE_CLASS` section with the setup script, look for the following prompt:

Is the FlashCopy/Snapshot taken from the mirror volumes {COPYSERVICES_REMOTE}.

Enter *yes*. The **COPYSERVICES_REMOTE_SERVERNAME**, **COPYSERVICES_REMOTE_USERNAME**, and **TAKEOVER_HOST_NAME** parameters are also required for remote mirroring.

3. At the end of the setup script configuration process, verify the user name and password. When you see the following prompt, enter *yes*:

Do you want to continue by specifying passwords for the defined sections?

Example

The following information is provided as an example of how a team can complete asynchronous remote mirror configuration across two sites:

To configure Tivoli Storage FlashCopy Manager with IBM XIV Storage System with Asynchronous Remote Mirroring at both sites, certain ports must be open within the firewalls:

- On the production system, the production host, backup host, and primary XIV system must have ports open within the firewall.
- On the takeover system, the takeover host, backup host, and secondary XIV system must have ports open within the firewall.

For both the primary and secondary sites, the following ports must be open within the firewall:

- TCP port 3260 (iSCSI) open within firewalls for iSCSI replication
- Ports: http, https, ssh, and telnet
- TCP/IP ports: 55697, 5997, 5998, and 7778

All ports must be bidirectional.

Setting up the daemons on the production and backup systems

Before manually starting the Tivoli Storage FlashCopy Manager daemon processes, identify the daemons that must run on the production, backup, and cloning systems.

Procedure

You can manually set up the daemon processes. The following list specifies where the daemons can run.

- Run the following daemons on the production system only:
 - *INSTANCE_DIR/acsd* (management agent)
 - *INSTANCE_DIR/acsgen -D* (generic device agent)
- If offloaded backups are configured, run the following daemon on the production server:


```
INSTANCE_DIR/fcmcli -D (offload agent)
```
- Run the mount agent on all backup servers or cloning servers:


```
INSTANCE_DIR/acsgen -D -M [-s deviceclass[,deviceclass]] [-H hostname]
```

Postinstallation and configuration

After you install and configure Tivoli Storage FlashCopy Manager, you can set up extra backup and clone servers.

You can use the setup script to update the profile and configure Tivoli Storage FlashCopy Manager on multiple backup servers from the production server when you install Open Secure Shell (OpenSSH) to enable backup servers for remote installation and configuration from the production server. NFS shares between the production server and backup server are not required for this type of remote installation.

Upgrades and reconfiguration must be run only from the master production server node.

If OpenSSH is not available, follow the instructions for “Installing separately on backup servers” on page 38 and run the setup script. Choose **On-site Backup server configuration** as the configuration type. Before you run the setup script on a backup or clone server, stop Tivoli Storage FlashCopy Manager on the production server. For details about how to stop an activated Tivoli Storage FlashCopy Manager instance, see Tivoli Storage FlashCopy Manager commands and scripts.

Typically, it is not necessary to run the setup script on the backup server after the initial configuration. Exceptions to this rule include:

- The use of alternative storage hardware might require a reconfiguration of Tivoli Storage FlashCopy Manager on the backup server.
- Changes to the scheduling policy for offloaded Tivoli Storage Manager backups might require you to configure the backup server again.

- If self-signed certificates are used, all changes to the certificates require a reconfiguration of the backup server.
- If OpenSSH is not used, you must copy the `fcmselcert.arm` file to the backup server before the setup script is run to configure the backup server again.

In these cases, stop Tivoli Storage FlashCopy Manager on the production server before reconfiguration of the backup server. Otherwise, you are prompted to stop Tivoli Storage FlashCopy Manager on the production server.

Chapter 7. Backing up data

Instructions about how to back up data and applications using Tivoli Storage FlashCopy Manager are provided.

About this task

While Tivoli Storage FlashCopy Manager focuses on snapshot backups, the software can be integrated with Tivoli Storage Manager clients for offloaded backups to Tivoli Storage Manager.

Backing up file systems or custom applications

Tivoli Storage FlashCopy Manager software provides an application agent, the FlashCopy Manager for Custom Applications to back up file systems and custom applications.

You can use Tivoli Storage FlashCopy Manager to create a consistent snapshot image of a file system and custom application on a production system. Custom applications are applications that are on file systems that are supported by Tivoli Storage FlashCopy Manager and that are not explicitly supported. Examples of custom applications are Domino®, MAX DB, and WebSphere®. The snapshots are managed as backup versions by using the version management policies of Tivoli Storage FlashCopy Manager. The snapshots can be used as a source for snapshot restore operations.

Except for backups in a GPFS environment, you can mount snapshot backups on a secondary server. In a Tivoli Storage Manager environment, you can use the Tivoli Storage Manager backup archive client to initiate a subsequent backup to a Tivoli Storage Manager server.

You can use the `fccli -f backup` command to protect any application on a file system that is supported by Tivoli Storage FlashCopy Manager.

The following scenario explains the backup of a Tivoli Storage Manager server. In this scenario, the custom application is the Tivoli Storage Manager server:

1. Create a list of files and directories that you want to back up. Save the list to a file that is later used by Tivoli Storage FlashCopy Manager as an input *infile* file. This file can contain a list of the directories for the DB2 table spaces, and the online redo logs. If the storage device supports space-efficient snapshots, include the Tivoli Storage Manager disk storage pools. For example, include file pools and the active storage pool. This solution provides you with a consistent image of the system as of the time when the snapshot is created.
2. Create a `preflash.sh` and `postflash.sh` script files to shut down and restart the Tivoli Storage Manager server. Use the Tivoli Storage FlashCopy Manager configuration setup script to add these scripts to the `CLIENT` section of the Tivoli Storage FlashCopy Manager profile as values for the `PRE_FLASH_CMD` and `POST_FLASH_CMD` parameters.
3. Enter the following command to create a snapshot backup of the environment:
`fccli -f backup -I infile -p profile`

Tivoli Storage FlashCopy Manager calls the `preflash.sh` script. After Tivoli Storage FlashCopy Manager creates the snapshot on the storage system it calls the `postflash.sh` script to restart the Tivoli Storage Manager server. The snapshot represents an offline backup of the Tivoli Storage Manager database. The Tivoli Storage Manager server is offline only for a short time.

4. Depending on the value of the parameter **TSM_BACKUP** in the Tivoli Storage FlashCopy Manager profile file, Tivoli Storage FlashCopy Manager can start a Tivoli Storage Manager backup of the snapshot image by using the backup-archive client.

The snapshot must be backed up to another Tivoli Storage Manager server to obtain a useful backup.

Important: Using some storage systems, the snapshot backup requires a certain amount of available space on the target storage pool, so that it can create the snapshot. If there is not enough storage space available, you can increase the capacity on the requested storage pool, or free up some items that are using existing capacity. Check the message for the exact amount of storage space that is required.

FlashCopy backup of individual mirrors

Tivoli Storage FlashCopy Manager supports mirroring.

Mirroring using the AIX logical volume manager (LVM mirroring)

Tivoli Storage FlashCopy Manager provides LVM mirroring support for DS8000, IBM XIV Storage System, Storwize family, SAN Volume Controller, IBM System Storage N series, and NetApp. For those devices, Tivoli Storage FlashCopy Manager creates a FlashCopy backup where only one of the mirrors is copied during the backup. When LVM is used to mirror the database across sites, you can create offloaded tape backups on either site with Tivoli Storage FlashCopy Manager. In this situation, you do not have to transfer the backup image across sites. To complete this task, a backup server is required on either site where backup images can be mounted to transfer them to secondary backup media. For DS8000, you can create at most one INCREMENTAL FlashCopy per source volume. However, in LVM environments, each source volume is mirrored. Therefore, Tivoli Storage FlashCopy Manager can create two INCREMENTAL FlashCopy backups for DS8000.

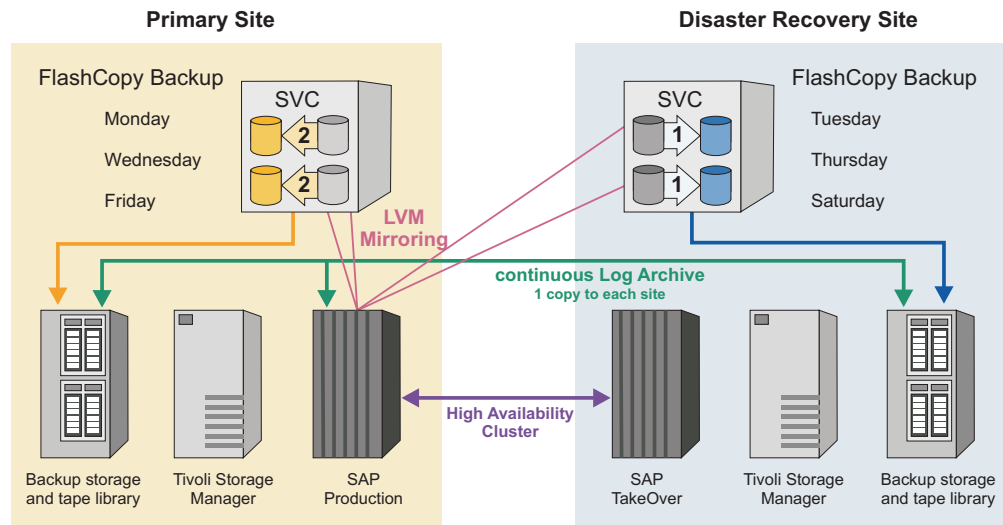


Figure 7. Cross-site mirrored SAP® database protected with Tivoli Storage FlashCopy Manager and Tivoli Storage Manager.

Support of AIX enhanced concurrent capable volume groups

To support high-availability environments, Tivoli Storage FlashCopy Manager supports enhanced concurrent capable volume groups.

Heterogeneous device mirroring

Tivoli Storage FlashCopy Manager does not require the storage devices of different mirrors to be at the same version level.

Backing up data with remote mirroring

When you back up data with remote mirroring, you can create local and remote snapshot backups. Note however, that SAN Volume Controller and Storwize family with dynamic target allocation does not support remote mirroring.

About this task

The local and remote snapshot backups can be created for Custom applications that use a generic backup agent. This agent creates snapshots of other applications or databases that are on file systems that are supported by Tivoli Storage FlashCopy Manager.

These steps can be applied to the following scenarios:

- SAN Volume Controller FlashCopy backup at the auxiliary cluster with either Metro Mirror or Global Mirror.
- XIV system snapshot backup at the remote site with either Synchronous Remote Mirroring or Asynchronous Remote Mirroring.

To create local application-consistent snapshot backups with the source volumes of the system that is running remote mirroring, verify that one `DEVICE_CLASS` section is configured for the primary cluster. The production volumes are on the primary cluster. You can run the setup script to create or change `DEVICE_CLASS` sections. From the production host, start the local snapshot backup. There are no additional requirements.

To create application-consistent remote snapshot backups with the target volumes of the storage system that is running remote mirroring, complete the following steps. The first few steps do not include all details that are needed to complete the step. These steps are usually completed before you start the following procedure. The information is provided for your convenience. You can verify that you have the environment set up completely before the backup begins.

Procedure

1. Verify Tivoli Storage FlashCopy Manager is installed in a supported environment. You must have a supported custom application that is running on the primary cluster. The primary cluster is mirrored to a remote cluster with the storage feature for remote mirroring.
2. Use the setup script wizard to configure Tivoli Storage FlashCopy Manager for remote mirroring. When configuring for remote mirroring, the following parameters are set in the `DEVICE_CLASS` section:
 - `COPYSERVICES_REMOTE` YES
 - `COPYSERVICES_REMOTE_SERVERNAME` *SERVER_NAME*
 - `COPYSERVICES_REMOTE_USERNAME` *USER_NAME*
 - `TAKEOVER_HOST_NAME` *HOST_NAME*
3. At the end of the setup script wizard, the following question is displayed:
Do you want to continue by specifying passwords for the defined sections?
Enter *y* for yes.
4. Verify that the `DEVICE_CLASS` section, created for remote mirroring during the configuration process, is selected. To verify, go to the `CLIENT` section of the profile. In the `CLIENT` section, the `DEVICE_CLASS` to use is selected. When backing up data stored on Oracle in an SAP environment databases, the `DEVICE_CLASS` is specified in the SAP backup `.utl` file.
5. From the production host, start the remote snapshot backup by typing in the following command:

Custom application agent, remote FlashCopy backup

```
fccli -f backup
```

When a FlashCopy backup is attempted, but the remote mirroring relationships are not synchronized, the backup fails and an error message is displayed. Before you can back up data, the mirroring relationships must be in the consistent synchronized state.

There is a FlashCopy consistency group created in the remote cluster. The target of the mirroring relationships is the source of this new FlashCopy consistency group.

Important: Using some storage systems, the snapshot backup requires a certain amount of available space on the target storage pool, so that it can create the snapshot. If there is not enough storage space available, you can increase the capacity on the requested storage pool, or free up some items that are using existing capacity. Check the message for the exact amount of storage space that is required.

6. To verify that the backup is complete, from a command prompt window, enter the following command:

```
fccli -f inquire_detail
```

What to do next

When you have completed the steps, you can mount and unmount the backup with the following commands:

- Mount the backup, from a command prompt window, by entering the following command: **fccli -f mount**
- Unmount the backup, from a command prompt window, by entering the following command: **fccli -f unmount**

Usability states of snapshot backup operations

To view the usability states of a snapshot backup, use the **-f inquire_detail** command option with the application-specific commands for example **fccli**, **acsora**, or **backint**.

Table 6. Usability states

Usability state value	Meaning
REMOTELY_MOUNTABLE	Backup data can be mounted from a remote system.
REPETITIVELY_RESTOREABLE	Backup data can be restored. The image can be used multiple times.
DESTRUCTIVELY_RESTOREABLE	Data can be restored. After the restore, other backups and possibly the backup to be restored can potentially be deleted.
SWAP_RESTOREABLE	Restore is possible by using the backup volumes directly rather than copying the data back to the source volumes.
PHYSICAL_PROTECTION	The snapshot ensures protection from physical failures on the source volumes, there is no longer a dependency on the source volumes. This state does not necessarily mean that a FULL_COPY must be created with each snapshot. For example, block-level continuous data protection (CDP) mechanisms typically replicate the data only once, and then record changes only.
FULL_COPY	A full copy of the data was generated.
INCOMPLETE	A portion of the data that was backed up is deleted and can no longer be restored. This situation can happen, for example, after a partial restore of an old backup that is only DESTRUCTIVELY_RESTOREABLE .
MOUNTING	A mount operation was requested on the backup server.
MOUNTED	This backup is mounted on a backup server.
DELETING	Indicates that a backup is marked for deletion. The deletion was requested.
DELETED	Indicates that the backup was deleted.

Table 6. Usability states (continued)

Usability state value	Meaning
BACKGROUND_MONITOR_PENDING	Indicates that a required background copy process is not yet active or not yet finished. The device agent checks for backups with this state and monitors the associated volumes until the background copy is finished. This state is then replaced by FULL_COPY .
TAPE_BACKUP_PENDING	Indicates that a requested tape backup is not yet started or is not yet finished successfully. The offload agent checks for backups with this state, and runs the requested tape backup. After the tape backup finishes successfully, this state is reset. If the tape backup stops with an error, the TAPE_BACKUP_PENDING state remains set, TAPE_BACKUP_IN_PROGRESS is reset, and a <i>retry</i> counter is incremented.
TAPE_BACKUP_IN_PROGRESS	Indicates that the requested tape backup was started by the Tivoli Storage FlashCopy Manager offload agent. If the backup fails, this state is reset.
TAPE_BACKUP_COMPLETE	Indicates that the requested tape backup is finished by the Tivoli Storage FlashCopy Manager offload agent.
TAPE_BACKUP_FAILED	Indicates that the tape backup of the Tivoli Storage FlashCopy Manager offload agent was not successful.
CLONE_DATABASE	Indicates that a Tivoli Storage FlashCopy Manager cloning operation was run.
RESTORING	Indicates that a Tivoli Storage FlashCopy Manager restore operation was run.

Usability state diagrams

The following usability state diagrams show the state changes during different operations. The green arrows are used for actions that you can start. The blue arrows are used for actions that are done automatically by Tivoli Storage FlashCopy Manager. The black arrows indicate Tivoli Storage FlashCopy Manager operations that you can use to change usability states.

Snapshot backup

The first state diagram shows the usability state changes during a Tivoli Storage FlashCopy Manager snapshot backup operation. Depending on the storage system (DS8000, SAN Volume Controller, XIV system, IBM System Storage N series, and NetApp) some states differ.

For example, on XIV system, IBM System Storage N series, and NetApp, the snapshot backup is immediately restorable and the restore can be repeated multiple times. On DS8000 and SAN Volume Controller the snapshot backup requires a background monitoring operation (**acsngen -D**) that removes the **BACKGROUND_MONITOR_PENDING** state and instead sets the **FULL_COPY** and

PHYSICAL_PROTECTION state. This requirement depends on the FlashCopy type that was used for the snapshot backup. Background monitoring operations (**acsgen -D**) are automatically running.

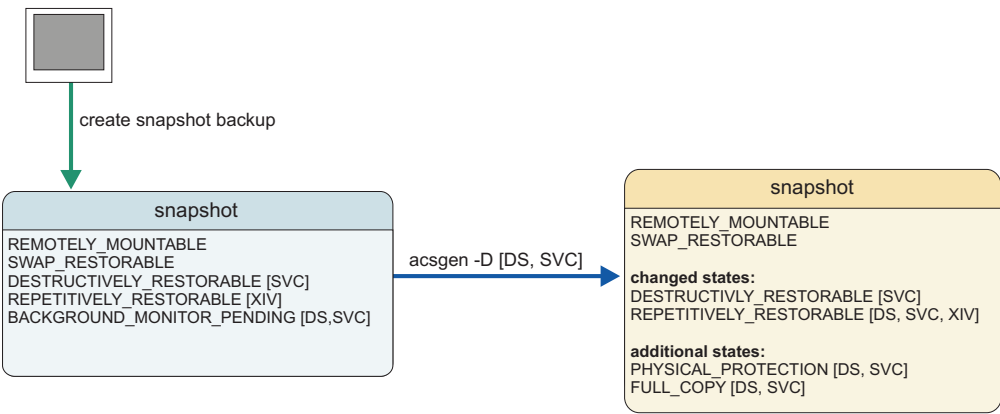


Figure 8. Usability States during snapshot backup

Snapshot restore

The second state diagram shows the usability state changes during a Tivoli Storage FlashCopy Manager snapshot restore operation. On the DS8000 and SAN Volume Controller storage systems, the usability states change during a snapshot restore operation.

For DS8000 and SAN Volume Controller systems, the **BACKGROUND_MONITOR_PENDING** state is turned on and in a **RESTORING** state. The background monitor process (**acsgen -D**) resets both states when the copy process in the storage system finishes. Background monitoring operations (**acsgen -D**) are automatically running.

For XIV system, IBM System Storage N series, and NetApp, there is no usability state change. However, in IBM System Storage N series, and NetApp environments, when you use an existing snapshot in a restore operation more recent existing snapshots become unusable. The reconcile process detects the unusable snapshots and removes the backups from the repository.

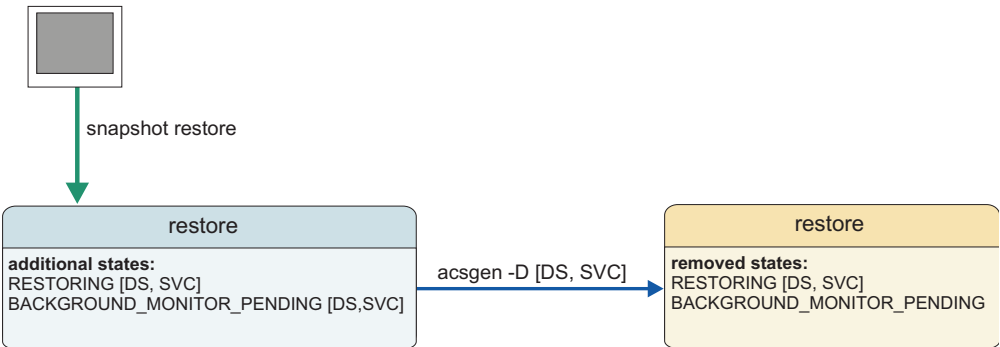


Figure 9. Usability states during snapshot restore

Snapshot delete

The next state diagram shows the usability state changes during a Tivoli Storage FlashCopy Manager snapshot delete operation. There are two types of delete

operations: delete and delete with force option. For both types, the snapshot backup is marked with the **DELETING** state and a background monitoring operations (**acsgen -D**), which is running automatically in background, switches the states to **DELETED**. On the XIV system, IBM System Storage N series, and NetApp storage solutions the snapshot in the XIV system, IBM System Storage N series, and NetApp is deleted by the background monitor agent and the snapshot backup is also deleted from the Tivoli Storage FlashCopy Manager repository.

On the DS8000 and SAN Volume Controller storage systems, the FlashCopy relations are not deleted by the background monitor operation unless the delete force option was used on the delete command. On the DS8000 and SAN Volume Controller systems, the snapshot backup is not deleted from the Tivoli Storage FlashCopy Manager repository. Instead, a deleted snapshot backup can be reused by a new creation of a snapshot backup.

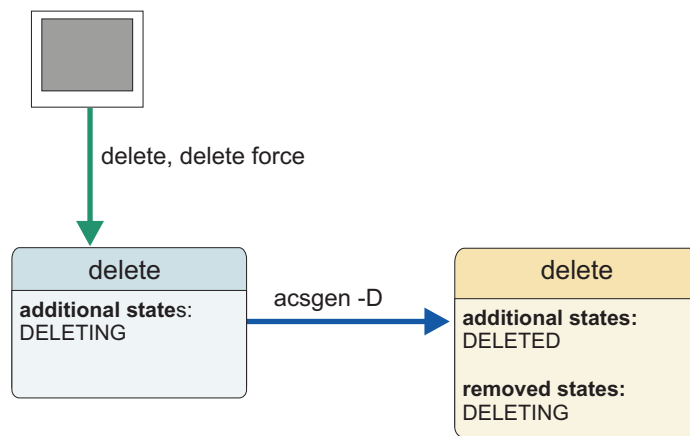


Figure 10. Usability states during snapshot delete

Snapshot mount

The next state diagram shows the usability state changes during a Tivoli Storage FlashCopy Manager snapshot mount operation. You can start a snapshot mount operation by using the mount function of the FlashCopy Manager command-line interface or start it automatically during the creation of a snapshot backup. In the latter case, it is named a forced mount operation. In either case, the mount operation first changes the state to **MOUNTING**. If the mount operation finishes successfully, the state changes from **MOUNTING** to **MOUNTED**. If the mount operation fails, the state stays **MOUNTING**. The only operation that is allowed to remove a **MOUNTING** or **MOUNTED** state is a successful Tivoli Storage FlashCopy Manager unmount operation. If the unmount operation finishes successfully, the **MOUNTING** or **MOUNTED** state is removed. If the unmount operation fails, the state remains as **MOUNTING** or **MOUNTED**. An unmount force operation is not needed for unmounting unless an offloaded tape backup is in progress.

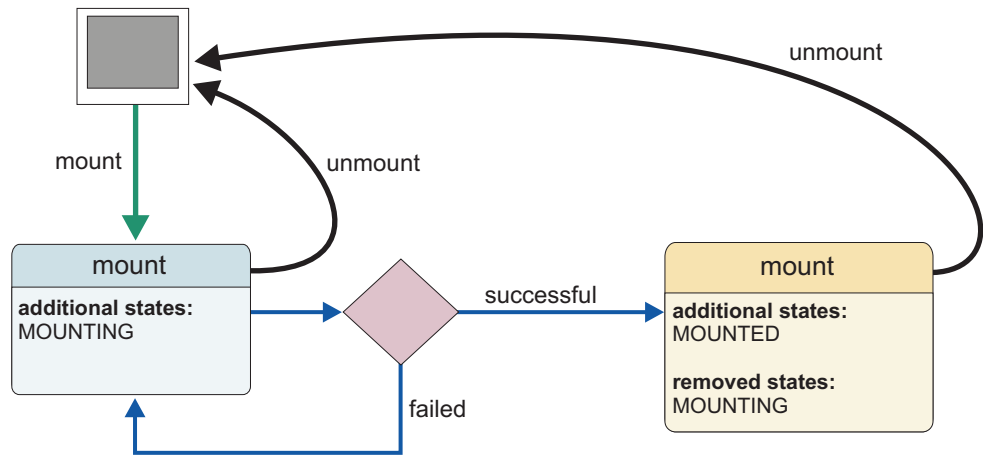


Figure 11. Usability states during snapshot mount

Snapshot offload

The last state diagram shows the usability state change during a Tivoli Storage FlashCopy Manager snapshot offload operation. You can start a snapshot offload operation with the **tape_backup** function of the FlashCopy Manager command-line interface. Alternatively, run it automatically with the offload agent that is running in the background (**fcmccli -D**). If the snapshot backup is not already mounted successfully, a mount operation is started automatically. The mount operation changes the state first to **MOUNTING** and then to **MOUNTED**. After that or in case that the snapshot backup was already mounted, the offload operation adds the state **TAPE_BACKUP_IN_PROGRESS** and runs the offloaded tape backup. If this operation is successful, the state switches from **TAPE_BACKUP_IN_PROGRESS** to **TAPE_BACKUP_COMPLETE**. Otherwise, the **TAPE_BACKUP_IN_PROGRESS** state switches to a **TAPE_BACKUP_FAILED** state and the **TAPE_BACKUP_PENDING** state persists. In either case, the automatic unmount operation is started and the **MOUNTED** state is removed when the operation completes successfully. If the mount operation fails, or the tape backup operation stops then the **MOUNTED** or **MOUNTING** state remains. The only operation that can remove these states is a successful Tivoli Storage FlashCopy Manager unmount operation. If the unmount operation finishes successfully, the **MOUNTED** or **MOUNTING** state is removed. If the unmount operation fails, the states are not removed. An unmount force operation is only needed for unmounting when an offloaded tape backup is in progress (**TAPE_BACKUP_IN_PROGRESS** is still set). The unmount force operation resets the **TAPE_BACKUP_IN_PROGRESS** state when it successfully completes the unmount operation.

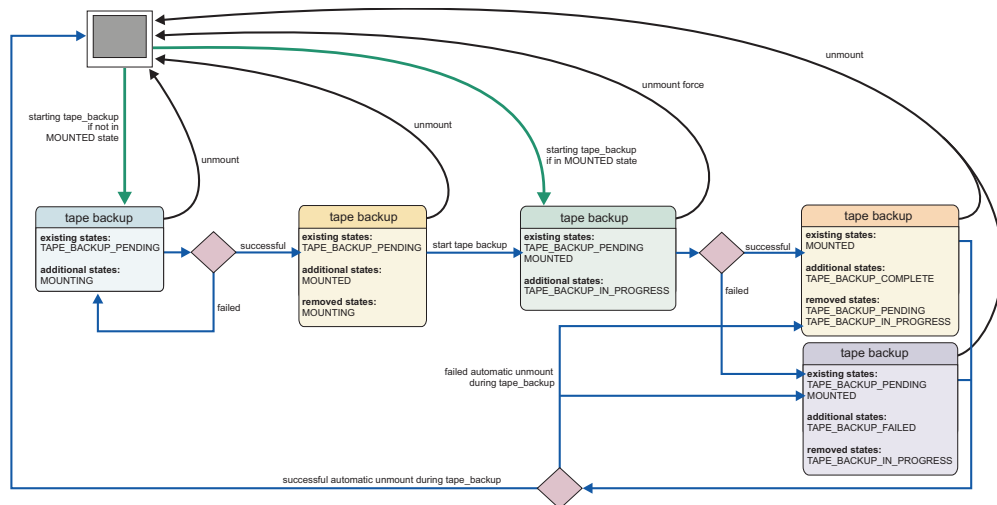


Figure 12. Usability states during snapshot offload

The usability state **TAPE_BACKUP_PENDING** can be removed by using the Tivoli Storage FlashCopy Manager function **update_status** with the option **-S TSM_BACKUP=NO**. This state is also removed by starting a new snapshot backup with the option **TSM_BACKUP[_FROM_SNAPSHOT] LATEST**. This option automatically removes the usability state **TAPE_BACKUP_PENDING** from all snapshot backups that exist in the Tivoli Storage FlashCopy Manager repository.

Chapter 8. Restoring data

Restore databases with Tivoli Storage FlashCopy Manager by restoring from a snapshot on the storage subsystem, or restoring data from Tivoli Storage Manager.

Restoring file systems or custom applications

You can use the `fccli -f restore` command to restore a file system or custom application that you backed up.

The following examples illustrate the processes that are involved in restoring file systems and custom applications.

Before you begin a restore operation, query Tivoli Storage FlashCopy Manager for all of the snapshot backups that are taken, use the `fccli -f inquire` command. To restore a file system or custom application, complete the following steps:

1. Specify what data you want to query. Use one of the following methods:
 - Specify `#NULL` to query Tivoli Storage FlashCopy Manager for a list of all backups.
 - Specify a backup ID to query the details of a particular snapshot backup.
 - Use the `fccli -f inquire_detail` function to query extra information about the backup. For example, the type of snapshot or the background copy progress.
2. After you run the query, use the `fccli -f restore` command to perform a full or partial snapshot restore of the data that was backed up.
 - To perform a full snapshot restore, provide Tivoli Storage FlashCopy Manager with a backup ID from the query that you ran. If you want to restore the latest backup, you can specify `#NULL`.
 - To restore only a portion of the data, specify a list of files explicitly by using the `-I <infile>` option, where the *infile* file contains a list of files or directories that you want to restore. Although Tivoli Storage FlashCopy Manager performs restores at a volume level, extra data might be restored as part of the volume restore operation. You can use the **NEGATIVE_LIST** parameter to specify what actions Tivoli Storage FlashCopy Manager takes in these situations.

You can use the backup-archive client to query and restore data from the Tivoli Storage Manager server. Although Tivoli Storage FlashCopy Manager assists in creating a Tivoli Storage Manager backup from a snapshot, Tivoli Storage FlashCopy Manager cannot be used for the restore operation. You can use the following options to facilitate the restore:

MODE FULL or MODE DIFF

You can correlate a Tivoli Storage Manager backup with the corresponding FlashCopy backup. Compare the Tivoli Storage FlashCopy Manager backup ID with the name of the file list that is backed up as part of the Tivoli Storage Manager backup.

MODE ARCHIVE

You can correlate a Tivoli Storage Manager backup with the corresponding

FlashCopy backup. Compare the Tivoli Storage FlashCopy Manager backup ID with the name of the archive description of the Tivoli Storage Manager backup.

Restore files from GPFS snapshots from the Tivoli Storage Manager

File retrieval from the Tivoli Storage Manager server is done with the BA Client. The files that are offloaded from the GPFS file set snapshot are not grouped on the server by their snapshot IDs as other custom application backups are. A restore operation of all files in a file set can be done based on the file set junction path within the file system.

File backup dates in Tivoli Storage Manager show the date when the offloaded tape backup operation was run. This date is not the date that the file set snapshot was created by the Tivoli Storage FlashCopy Manager backup operation. There are two types of restore operation as follows:

- Restoring a specific version of a single file that is earlier than the latest one available. Use the B/A client GUI to access the date when the file was last modified or accessed.
- Restoring files in bulk from a specific snapshot version that is earlier than the latest snapshot version. Use the point-in-time date `pitdate` and point-in-time time `pittime` options of the B/A client.

Use the Tivoli Storage Manager backup log file in `ACS_DIR/logs/details` directory to identify the time stamp when the **mmbackup** command finished moving the required file set. Identify a message such as: `mmbackup: Backup of <fileset_path> completed successfully at <timestamp>`.

When you want to restore data in a specific backup that was created by Tivoli Storage FlashCopy Manager and that consists of various GPFS file systems or file sets, look for message FMM9096I in the backup log file in the `ACS_DIR/logs/details` dir. This message states that the offloading of the backup you are looking for, which is identified by `<backup_ID>`, to a defined Tivoli Storage Manager was successful at *timestamp*. Here is an example of the message to look for:

FMM9096I Offloading of backup with ID `<backup_ID>` to Tivoli Storage Manager server(s) `<server_list>` ended successfully on `<timestamp>`.

The *timestamp* shows the client date. The Tivoli Storage Manager server date can differ according to the clock difference between the client and the server. Calculate the Tivoli Storage Manager server time stamp from the *timestamp* in the log file. Use this time stamp to specify `pitdate` and `pittime` options to restore a specific GPFS snapshot from Tivoli Storage Manager.

Restoring data with remote mirroring

Tivoli Storage FlashCopy Manager software can be used to complete a remote FlashCopy restore of database or custom application data. Note however, that SAN Volume Controller and Storwize family with dynamic target allocation does not support remote mirroring.

About this task

The instructions that are provided assume the following environment:

- Data is successfully backed up and the backup copy of data is accessible.
- A take over host is running with the same operating system level as the production host. In addition, the take over host is configured on the remote side.
- (Databases only) The database instance is created on the take over host.
- Tivoli Storage FlashCopy Manager software is installed on the take over host. The software level on the production host and take over host match.

Restoring custom application agent data

About this task

The Tivoli Storage FlashCopy Manager snapshot local repository is restored to the take over host at a point in time after the remote backup. When you are recovering data for maintenance, not disaster recovery, the Tivoli Storage FlashCopy Manager repository can be shared by NFS. Complete the following steps:

Procedure

1. Update the Tivoli Storage FlashCopy Manager configuration parameters with the setup script wizard. Specifically, in the GLOBAL section, set the **ACSD** parameter to use the host name on the take over host. Do not use the acsd of the production host.
2. Stop the Tivoli Storage FlashCopy Manager acsd daemon on the primary production host. Transfer all the repository files from the primary production host to the take over host. The repository files are in the directory that is defined by the parameter **ACS_REPOSITORY** in the ACSD section of the profile.
3. Start the Tivoli Storage FlashCopy Manager acsd daemon on the take over host.
4. From the backups that are displayed, select the remote backup to use for the restore. The backups are displayed when you enter the query command on the take over host. For example, **fcmlcli -f inquire_detail**
5. Start the restore by entering the following command:
`fcmlcli -f restore -b <backup_id>`

Note: Using some storage systems, the snapshot restore requires a certain amount of available space on the target storage pool, so that it can restore the necessary volume. If there is not enough storage space available, you can increase the capacity on the requested storage pool, or free up some items that are using existing capacity. Check the message for the exact amount of storage space that is required.

Results

The remote mirroring relationships are stopped. The volume groups with the file systems that contain the table spaces are restored from the FlashCopy targets to the remote mirroring targets. The file systems that contain the table spaces are mounted.

For IBM System Storage SAN Volume Controller all versions, starting with version 6.2, the remote relationships are stopped. You must restart the remote relationships before another snapshot of targets of remote mirroring can be run. For IBM XIV Storage System and IBM System Storage SAN Volume Controller before version 6.2, the remote relationships are removed. You must re-create the remote

relationships before another snapshot of targets of remote mirroring can be run.

Chapter 9. Troubleshooting

There are multiple resources for support.

The following list identifies the various ways that you can find information online:

- Tivoli Storage FlashCopy Manager wiki on the developerWorks® site at [https://www.ibm.com/developerworks/community/wikis/home?lang=en#/wiki/Tivoli Storage FlashCopy Manager](https://www.ibm.com/developerworks/community/wikis/home?lang=en#/wiki/Tivoli%20Storage%20FlashCopy%20Manager).
- Service Management Connect site at <https://www.ibm.com/developerworks/servicemanagement/sm/index.html>.
- Tivoli Storage FlashCopy Manager product support at <http://www.ibm.com/software/tivoli/products/storage-flashcopy-mgr/>. Enter the search term, such as an authorized program analysis report (APAR) number, release level, or operating system to narrow the search criteria for your support need.

General troubleshooting procedure

This procedure is valid for all Tivoli Storage FlashCopy Manager applications.

The starting point for problem determination is the summary log file located in the <ACS_DIR>/logs directory. The summary log file name is summary.<timestamp>.log where <timestamp> is an entry that represents the four-digit year, month, and day (for example, summary.20090817.log). A new log file is created each day. This file contains a list of all operations and the most important messages. Each line begins with one of these prefixes to indicate the type of operation:

Table 7. Message prefixes used in the summary log file

Prefix	Operation
GEN	Generic message
DB	Database backup or restore; inquire or delete of FlashCopy backups
MON	Monitoring of the background copy that is performed by the storage device
TSM	Off-loaded backup to Tivoli Storage Manager
MNT	Mount and unmount services
CLO	FlashCopy cloning operations

The summary log file only contains the information about operations that were performed and whether they completed successfully. Error messages are also logged when they occur. A dedicated log file is created for each operation in the <ACS_DIR>/logs/details. These files should be checked for detailed information when an error occurs.

This summary log file example shows a FlashCopy backup of a database. Messages with the DB prefix are issued by the database client. This is the application that requests the backup operation.

GEN 00:10:00 (70a)

=====

New backup operation started for database instance db2h51, database H51.

```

=====
DB 00:10:00 (70a) FMM1510I New connection received.
DB 00:10:00 (70a) FMM1513I ***** Database client connected: db2s95, database S95,
partition NODE0000
DB 00:10:00 (70a) FMM1574I Backup for db2s95.S95.DEVICE_CLASS:STANDARD.NODE0000 is
created using DEVICE_CLASS
DEVICE_CLASS:STANDARD.
DB 00:10:01 (80c) FMM1510I New connection received.
DB 00:10:01 (80c) FMM1514I ***** Device client connected.
DB 00:10:01 (80c) FMM6219I Backup to TSM: NO
DB 00:10:01 (80c) FMM1582I The target set 1 will be used for the current backup.
DB 00:10:44 (70a) FMM1014I Operation backup completed successful.
GEN 00:12:28 (70e)
=====

```

Logging and tracing files

Log and trace files are updated during Tivoli Storage FlashCopy Manager operations.

Log and trace files are written to during backup and restore processing by these products:

- DB2
- Oracle
- Tivoli Storage FlashCopy Manager
- Storage system
- CIM
- General Parallel File System (GPFS) for Tivoli Storage FlashCopy Manager for Custom Applications.
- General Parallel File System (GPFS) for DB2 pureScale.
- Tivoli Storage Manager for ERP
- Operating system

The following figure illustrates a sample sequence for examining log and trace files when troubleshooting SAP with Oracle Tivoli Storage FlashCopy Manager.

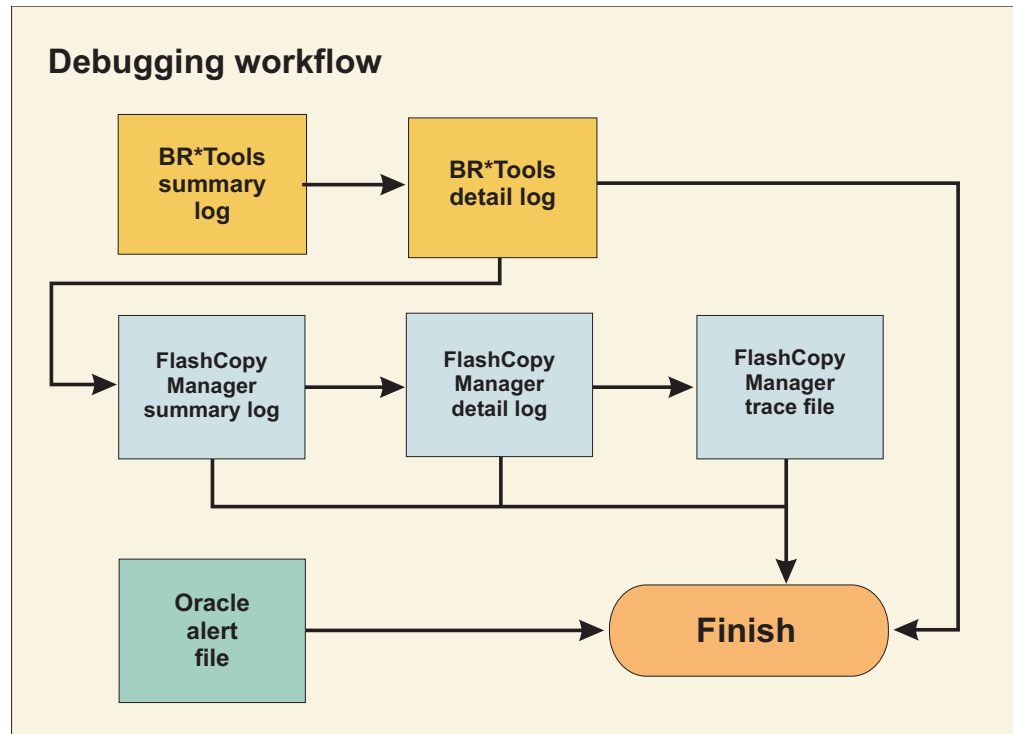


Figure 13. Debugging workflow for SAP with Oracle Tivoli Storage FlashCopy Manager

The following figure illustrates a sample sequence for examining log and trace files when troubleshooting SAP with Oracle Tivoli Storage FlashCopy Manager with Tivoli Storage Manager.

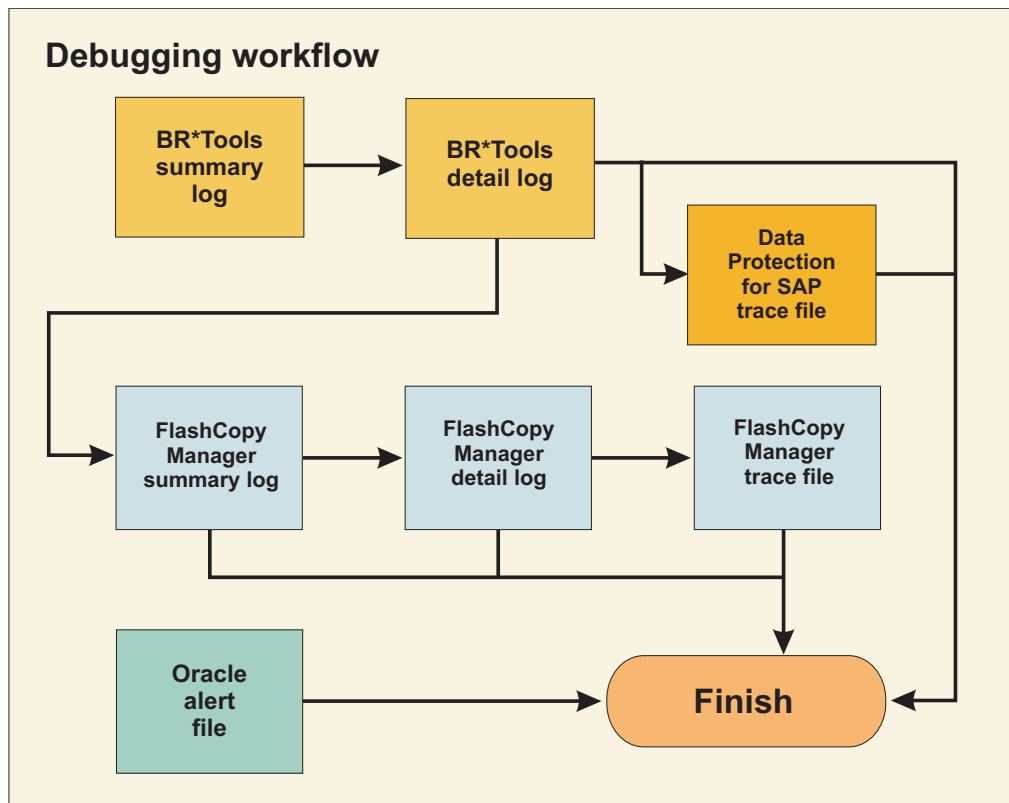


Figure 14. Debugging workflow for SAP with Oracle Tivoli Storage FlashCopy Manager with Tivoli Storage Manager

Log files and trace files

Refer to these examples of the log and trace files that are maintained by Tivoli Storage FlashCopy Manager.

Tivoli Storage FlashCopy Manager document each operation in log files. In addition, trace files can be requested with the TRACE parameter in the profile. Do not activate tracing unless requested by IBM Support. If TRACE is set to YES, each Tivoli Storage FlashCopy Manager component creates an extra trace file in the log directory.

Tip: Ensure to look for, and manage the amount of free space of the file system that contains the ACS_DIR/logs directory.

The following tables list the log and trace files that are maintained by Tivoli Storage FlashCopy Manager. These files are in ACS_DIR/logs.

Table 8. Tivoli Storage FlashCopy Manager log files

Purpose	File
Overview of operations and their result.	summary.timestamp.log
Overview about the monitoring of the background copy that is done by the storage device.	monitor.timestamp.log
Detailed log of a particular operation.	details/function.longtimestamp

Table 8. Tivoli Storage FlashCopy Manager log files (continued)

Purpose	File
Note: <ul style="list-style-type: none"> <i>timestamp</i> is the date (yyyymmdd) <i>longtimestamp</i> is the date and time (yyyymmddHHMMSS) <i>function</i> is a value of backup, restore, inquire, delete, mount, unmount, tsm, or clone <p>The summary log file is always used as an entry point. All major events, such as the start of a new operation or errors, are recorded in this file. A new summary log file is created for every day and records all operations of one day within a single file.</p>	

Table 9. Tivoli Storage FlashCopy Manager trace files.

Component	File
Management Agent (acsd)	acsd.id.trace
Application client (for DB2, the Snapshot Backup Library)	client.instance.db name.node.id.trace
Generic Device Agent (acsgen)	acsgen.hostname.device class.node num.id.trace acsgen.hostname.function.id.trace acsgend.hostname.id.trace
Device Agent for IBM XIV® Storage System Devices	xivadapter_id_function.trace
Device Agent for IBM System Storage N series and NetApp storage solutions	fmna.hostname.function.id.trace fmna.hostname.device class.node num.id.trace
Device Agent for CIM Devices (DS8000, SAN Volume Controller, Storwize family)	fmcima.hostname.function.id.trace fmcima.hostname.device class.node num.id.trace
Offload Agent (tsm4acs)	tsm4acs. host.id.trace
fcmcli	fcmcli.host.id.trace
RMAN (when started by Tivoli Storage FlashCopy Manager)	rman.SID.id.log
Notes: <ul style="list-style-type: none"> Names ending in -d are daemon processes (started with -D option). <i>id</i> is the date (yyyymmdd) for log files written by daemon processes, date, and process ID (yyyymmdd.xxxxxx) for trace files written by daemon processes or a timestamp (yyyymmddHHMMSS) for log and trace files for other processes. <i>device class</i> can be a device class specified in the profile or all if no command-line parameter -s device class was specified for the device agent. It can also be omitted for traces of the device agent. <i>instance</i> and <i>db hostname</i> can be <i>undef</i> for query and delete requests that are started with db2acsutil. <i>node num</i> is the DB2 partition number in the case of DB2 and SAP with DB2. It is 0 for Oracle and SAP with Oracle or it can also be omitted for Oracle and SAP with Oracle. <i>function</i> is backup, delete, restore, mount, unmount, or reconcile. 	

Table 10. Tivoli Storage FlashCopy Manager return codes.

Reason code	Explanation	User response
0	Operation is successful	None
1	Operation terminated successfully with warnings	The Tivoli Storage FlashCopy Manager operation was successful but warning messages were reported. Check the Tivoli Storage FlashCopy Manager summary log file and the therein referenced detail log files for more information.
2	Operation terminated with error	The Tivoli Storage FlashCopy Manager operation failed. Check the Tivoli Storage FlashCopy Manager summary log file and the therein referenced detail log files for more information.

Table 11. Tivoli Storage FlashCopy Manager installer exit codes.

Exit Code	Explanation	User Response
0	The operation completed successfully	The installation completed successfully without any warnings or errors.
1	The operation completed successfully with warnings.	The installation completed successfully, but one or more of the actions from the installation sequence caused a warning or a non-fatal error. See the Tivoli Storage FlashCopy Manager installer log file installation.log in the installation directory for details.
-1	The operation terminated with error	One or more of the actions from the installation sequence caused a unrecoverable error. See the Tivoli Storage FlashCopy Manager installer log file installation.log in the installation directory for details.
>=1000	The operation terminated with error Note: There more error codes with numbers greater than or equal to 1000 which all mean that some kind of error occurred.	One or more of the actions from the installation sequence caused a unrecoverable error. See the Tivoli Storage FlashCopy Manager installer log file installation.log in the installation directory for details.

Table 12. DB2 vendor reason codes.

Reason Code	Explanation	User Response
0	The operation is successful.	None
2	Communication error with device	TheTivoli Storage FlashCopy Manager operation failed. Check the db2diag.log and the Tivoli Storage FlashCopy Manager summary log file for details.

Table 12. DB2 vendor reason codes (continued).

Reason Code	Explanation	User Response
3	The DB2 and vendor products are incompatible	The Tivoli Storage FlashCopy Manager operation failed during initialization of the Tivoli Storage FlashCopy Manager vendor library. The DB2 API version does not match the Tivoli Storage FlashCopy Manager vendor library version. Check the db2diag.log for details.
6	Object specified cannot be found	The Tivoli Storage FlashCopy Manager operation failed because the requested object cannot be found in the Tivoli Storage FlashCopy Manager repository. Check the db2diag.log and the Tivoli Storage FlashCopy Manager summary log file for details.
8	Invalid user ID specified	The Tivoli Storage FlashCopy Manager operation failed because an invalid user ID was specified on the db2 command line. Check the db2diag.log.
9	Invalid password provided	The Tivoli Storage FlashCopy Manager operation failed because an invalid password was specified on the db2 command line. Check the db2diag.log.
10	Invalid options specified	The Tivoli Storage FlashCopy Manager operation failed because an invalid db2 command-line option was specified. Check the db2diag.log.
11	Initialization failed	The Tivoli Storage FlashCopy Manager operation failed because the Tivoli Storage FlashCopy Manager vendor library cannot be initialized. Check the db2diag.log and the Tivoli Storage FlashCopy Manager summary log file for details.
14	End of data reached	Not an error condition.
18	Device error	The Tivoli Storage FlashCopy Manager operation failed. Check the Tivoli Storage FlashCopy Manager summary log file for details.
19	Warning	The Tivoli Storage FlashCopy Manager operation is successful with warning messages. Check the Tivoli Storage FlashCopy Manager summary log file for details.
21	More data to come	Not an error condition.
26	Delete object fails	The Tivoli Storage FlashCopy Manager delete operation failed. Check the Tivoli Storage FlashCopy Manager summary log file for details.

Table 12. DB2 vendor reason codes (continued).

Reason Code	Explanation	User Response
29	Abort request failed	The Tivoli Storage FlashCopy Manager abort request failed. Check the Tivoli Storage FlashCopy Manager summary log file for details.
30	Unexpected Error	The Tivoli Storage FlashCopy Manager operation failed. Check the Tivoli Storage FlashCopy Manager summary log file for details.
31	No data has been returned	Not an error condition.
32	Object not under Backup Adapter control	The Tivoli Storage FlashCopy Manager operation failed because the object specified for a restore or query is not under the control of Tivoli Storage FlashCopy Manager. It might be under control of Tivoli Storage Manager for ERP, for example. Check the db2diag.log and the Tivoli Storage FlashCopy Manager summary log file for details.
34	Another database or application is using the same storage groups	The Tivoli Storage FlashCopy Manager snapshot backup operation failed because another database or application is using the same storage group. Check the db2diag.log and the Tivoli Storage FlashCopy Manager summary log file for details.

Storage system log and trace files

Storage system log and trace files are updated during Tivoli Storage FlashCopy Manager operations.

Consult the documentation for the configured storage system.

CIM log and trace files

CIM log and trace files are updated during Tivoli Storage FlashCopy Manager operations.

For more information about log and trace files for CIM, see the CIM documentation. The DS8000 Open API, SAN Volume Controller, and Storwize family master console produce log and trace output.

GPFS log files

IBM General Parallel File System (GPFS) log files are updated during Tivoli Storage FlashCopy ManagerDB2 pureScale, or Tivoli Storage FlashCopy Manager Custom Applications operations.

The GPFS log files are in /var/adm/ras directory on each GPFS node, and start with the prefix mmfs.log. The most current GPFS log file can be found by using the symbolic link /var/adm/ras/mmfs.log.latest. See the information about GPFS log files and troubleshooting procedures in the *IBM General Parallel File System (GPFS) for Clusters: Problem Determination Guide (GA76-0415-08)*.

Tivoli Storage Manager for ERP log and trace files

Tivoli Storage Manager for ERP log and trace files are updated during backup and restore operations.

See the section *How to find files containing message output (log files)* in the Tivoli Storage Manager for ERP *Installation and User's Guide* for details concerning logs and traces within Tivoli Storage Manager for ERP.

Important: A trace file can be requested by specifying the TRACEFILE parameter in the Tivoli Storage Manager for ERP profile. However, do not place this file on NFS, because this might cause network problems due to the high volume of trace entries being written.

Troubleshooting mirroring relationships

There are some questions that might arise when implementing Tivoli Storage FlashCopy Manager and storage systems with mirroring technologies. The following information is provided to help you answer questions unique to your environment.

Question

Why are some remote mirroring relationships missing?

Answer

The target volumes that are referenced in this solution are part of the remote mirror relationship. The target volumes are used as the source for the snapshot operation.

Before you start the snapshot backup that uses the target volumes, verify that the remote mirroring relationships are established. You can verify the relationships by using either the graphical user interface or the command-line interface. For example, if using SAN Volume Controller global mirror, you can enter the following command to verify the mirroring relationship:

```
ssh -i/<dir>/ssh-identity <username>@<hostname>
svctask mkrcrelationship -master <vdiskname local> -aux <vdiskname remote>
-cluster <clusterid> -name <relation name> -consistgrp <consgrp name>
-global
```

Question

The remote mirroring relationships are not in the state consistent_synchronized. How does the state for remote mirroring relationship get updated?

Answer

Go to the storage solution. Synchronize the consistency groups. For more

information about synchronizing consistency groups, see the documentation that is provided with the storage hardware.

Question

(SAN Volume Controller only) One or more of the FlashCopy target volumes for the remote site are missing. Where is the FlashCopy target volume?

Answer

Use either the graphical user interface or command-line interface to start the Metro Mirror or Global Mirror consistency group. For example, you can enter the following command from the command-line interface:

```
ssh -i/<di>ssh-identity <username>@<hostname of the cluster> svctask  
starttrconsistgrp consist group id>
```

Question

(XIV only) One of the following issues exists.

- The remote mirroring is not operational.
- For XIV system synchronous mirroring, the state of the consistency group is not consistent synchronized.
- For XIV system asynchronous mirroring, the state of the consistency group is not RPO_OK.

How are these issues resolved?

Answer

Verify that the consistency groups meet the following requirements:

- Consistency groups need to be enabled and synchronized.
- The volumes that are assigned to the consistency groups need to be correctly identified and enabled.

One consistency group per database partition is needed.

Troubleshooting storage solutions

There are some common problems that might occur when using Tivoli Storage FlashCopy Manager and storage solutions. These problems and the solutions are provided to help you complete problem determination activities.

Question

During the backup or cloning on a storage solution running a supported AIX operating system, the mount of one or more file systems fails on the auxiliary host with the following message:

```
FMM0644E Error on running command: mount: 0506-334  
/oracle/C21/mirrlog2 is not a known file system.
```

How can this error be resolved?

Answer

When the storage solution running a supported AIX operating system imports a volume group, use the label of the logical volume for the new mount point. Check the production system to determine the labels of the logical volumes that support backup and clone operations. The fields **mount point** and **label** should have identical values. For example:

```
# ls1v 1vDS1data1  
LOGICAL VOLUME: 1vDS1data1 VOLUME GROUP: DS1data1vg  
...  
MOUNT POINT: /db2/DS1/db2ds1/NODE0001 LABEL: /db2/DS1/db2ds1/NODE0001
```

Problem

In an environment with an IBM System Storage N series and NetApp storage system and Tivoli Storage FlashCopy Manager, the performance seems to lag. What could be the problem?

Solution

The primary variable that affects the performance of the Tivoli Storage FlashCopy Manager is the number of volumes and LUNs that are backed up with a FlashCopy.

Problem

As an administrator using Tivoli Storage FlashCopy Manager, how do I mount a backup that resides on a SAN-attached IBM System Storage N series or NetApp storage system?

Answer

After the backup is created, run the following commands:

```
fcmlcli -f mount
```

Verify that the snapshot is mounted on the backup system.

Problem

As an administrator using Tivoli Storage FlashCopy Manager, how do I complete an offloaded backup of a database that resides on a SAN-attached IBM System Storage N series or NetApp storage system? This backup copy is used to recover from disasters.

Answer

After the backup is created, run the following commands:

```
fcmlcli -f tape_backup
```

Verify that the snapshot is mounted on the backup system.

Problem

As an administrator using Tivoli Storage FlashCopy Manager, how do I restore disk backups that reside on a SAN-attached IBM System Storage N series or NetApp storage system? The goal is to integrate recovery into established workflows.

Answer

For the configured application, run one of the following commands to restore:

- db2 restore db <id> use snapshot
- acsora -f restore
- brrestore
- tsm4acs -f restore

Verify that the data can be used by the respective application.

Troubleshooting connectivity problems

This information covers a problem that can occur with connectivity. The problem and the solution are provided to help you complete problem determination activities.

When the production server and backup server are separated by a firewall, socket connections might time out

Question

After a successful snapshot backup operation, why is it not possible to mount or unmount this snapshot backup on a backup or clone server?

Answer

The socket connection failure can result from a mismatch between the firewalls connection timeout setting and the operating systems frequency of sending keep alive network packets. When a firewall or other network devices such as a router or switch exists between the production and backup server, the daemon connection can time out. A similar situation can exist between a production and clone server. To prevent connections from timing out, the management agent acsd on the production server, requests that the operating system sends out network packets. These packets keep the connection between the servers alive.

The **tcp_keepidle** operating system parameter specifies the interval of inactivity. Depending on the operating system, this parameter might vary. After this interval of inactivity, the TCP generates a keep alive transmission for the application that requests it. This interval is measured in half seconds. For AIX operating systems, the keep alive default value for this parameter is 14400 (2 hours). This frequency is sufficient for many environments. Decrease this value when the following conditions exist:

- A firewall or other network device exists between the production and backup or clone server.
- If the device connection timeout is less than 2 hours.

For AIX operating systems, issue the following network command to reduce the **tcp_keepidle** parameter value and send a keep alive transmission every 5 minutes:

```
no -o tcp_keepidle=600
```

This change remains in effect until you restart the production server. To permanently modify this parameter, add the command to the `/etc/rc.net` file.

Internet Protocol Version 6 (IPv6) support

The Tivoli Storage FlashCopy Manager for UNIX and Linux software operates in IPv4, IPv6, and mixed environments.

The network configuration determines which protocol is used by the Tivoli Storage FlashCopy Manager software. The acsd service listens for IPv4 and IPv6 connection requests. Connection requests to the acsd service are made for the addresses that are returned by the system for the respective port on the local host. Connection requests to other systems are made for the addresses that are specified by the user. When TCP/IP addresses are set from a command-line interface, or when you are setting configuration parameters with the setup script, IPv6 addresses are supported. When an IP address and a port are specified in the following format:

<IPv4 address>:<service or port>

the format needs to be changed for IPv environments only:

<service or port>@<IP address>

In pure IPv4 environments, the traditional format can be used.

Appendix A. Configuration files

When you complete the setup script, the information you enter is used to configure Tivoli Storage FlashCopy Manager.

Tivoli Storage FlashCopy Manager uses the following configuration files:

- Profile
- Target volumes
- Password

The parameter and option information provided for the Tivoli Storage FlashCopy Manager configuration files is for reference only. Do not edit these configuration files. The configuration files are updated when you use the setup script.

Profile configuration file

When you complete the setup script, the information you enter is used to create the profile configuration file. Each section of the profile includes parameters and options that determine how the Tivoli Storage FlashCopy Manager backs up and restores data in your environment. For references, the following information explains the various parameters and options.

In the Tivoli Storage FlashCopy Manager executable files, the profile is identified by the value specified for option `-p`.

The profile is divided into the following sections:

- GLOBAL
- ACSD
- CLIENT
- DEVICE_CLASS *device*
- OFFLOAD

There can be multiple DEVICE_CLASS sections. Each DEVICE_CLASS section must have a unique *device* instance name.

The profile must be available on all database nodes and on the system where the management agent, `acsd`, is running. In addition, the GLOBAL section of the profile is required on the host where the clone databases reside.

GLOBAL The GLOBAL section contains information that is required and used by all Tivoli Storage FlashCopy Manager components. The section is used by all database nodes, and the management, device, and offload agents. The components reference the information in the GLOBAL section during the start up process. Changes to this section require a restart of Tivoli Storage FlashCopy Manager.

Tivoli Storage FlashCopy Manager can be installed on multiple systems within an environment. For example, when a database is distributed among multiple application hosts or when a backup server is used to transfer snapshot backups to Tivoli Storage Manager. When Tivoli Storage FlashCopy Manager is installed on multiple systems within an

environment, there is only one active management agent. The location of this management agent is specified in GLOBAL section using the **ACSD** parameter.

Other parameters in the GLOBAL section specify the location for logging, tracing, and password files. On the backup server, the only section of profile that is referenced is GLOBAL.

ACSD The ACSD section contains information that is used exclusively by the management agent, acsd. This section includes the **ACS_REPOSITORY** parameter. The **ACS_REPOSITORY** parameter specifies the directory where the management agent stores its backup repository. This repository is the most important collection of Tivoli Storage FlashCopy Manager data. If the repository is lost, any previously created backup cannot be restored.

CLIENT The CLIENT section contains all parameters relating to backup operations, including parameters for database applications, the number of backup versions, whether a Tivoli Storage Manager backup is to be created from the snapshot, how many snapshot backup generations to retain, and which **DEVICE_CLASS** section is used during snapshot creation. The CLIENT section is used by the snapshot backup library that is loaded to start backup or restore processing.

DEVICE_CLASS *device*

The **DEVICE_CLASS** section contains parameters that are related to the storage solution or file system (file system snapshots). At least one **DEVICE_CLASS** section is required for the configuration of the management agent. A **DEVICE_CLASS** section describes the characteristics of a storage device or file system that can be used to create a snapshot backup. The parameters and options that are used in the **DEVICE_CLASS** section depend on the storage solution.

Each storage solution that is used in the environment must have a **DEVICE_CLASS** section and must have a unique *device* instance name.

The **DEVICE_CLASS** section that is used is determined by the value of the **DEVICE_CLASS** parameter in the CLIENT section of the profile for backup operation. For cloning operations, this value is determined by the **DEVICE_CLASS** parameter in the CLONING section of the profile. If the same value is specified for the **DEVICE_CLASS** parameter in both the CLIENT and CLONING sections, an error is reported.

The value of **DEVICE_CLASS device** is recorded in the Tivoli Storage FlashCopy Manager repository to identify the appropriate **DEVICE_CLASS** section during the restore process. Therefore, use caution when you delete or rename **DEVICE_CLASS** sections. If the appropriate section cannot be found, then the data that is backed up cannot be restored.

For each **DEVICE_CLASS** section, a password is required and can be set by running the setup script without the **-a** action option. For example:

```
setup_type.sh -d <Instance owner $HOME directory>
```

The password can be set in a batch processing mode using the following **fcmccli** command: **fcmccli -f password**

These passwords are used by Tivoli Storage FlashCopy Manager to authenticate to the storage solution represented by the **DEVICE_CLASS** section.

OFFLOAD

The parameters and options in the OFFLOAD section determine how a snapshot is transferred to Tivoli Storage Manager. The information is sent to the offload agent, tsm4acs.

When the offload agent is started, it connects to the management agent and queries for snapshot backups that have been backed up with the **TSM_BACKUP** parameter that is set to YES. If this parameter and option is found, the offload agent mounts the snapshot and initiates a Tivoli Storage Manager backup using Tivoli Storage Manager backup-archive client.

Examples

All parameters in a section are indicated by a section start notation, >>> *section_name*, and a section end notation, <<< *section_name*. The name is optional on the section end notation. Comments can be used at any place within the profile. Comments start with a # character and extend to the end of the line. Tab characters are permitted. The following example provides an example of the profile configuration file:

```
# Global section
>>> GLOBAL
parametername1 value1
parametername2 value1 value2
....
<<<
# ACSD section
>>> ACSD
parametername1 value1
parametername2 value1 value2
....
<<<
# CLIENT section
>>> CLIENT
parametername1 value1
parametername2 value1 value2
....
<<<
# DEVICE_CLASS device section
>>> DEVICE_CLASS device
parametername1 value1
parametername2 value1 value2
....
<<<
# DEVICE_CLASS device2 section
>>> DEVICE_CLASS device2device2
parametername1 value1
parametername2 value1 value2
....
<<<
# OFFLOAD section
>>> OFFLOAD
parametername1 value1
parametername2 value1 value2
....
<<<
```

GLOBAL

The profile parameters in the GLOBAL section contain basic configuration information. Examples of the type of information that is specified by the parameters are the port that is used by Tivoli Storage FlashCopy Manager and the location of log files. The parameters are independent of the storage solution, database application, and custom application.

The following list provides the parameters, a description of each parameter, and default values for the GLOBAL section of the profile configuration file.

ACS_DIR

Path to the IBM Tivoli Storage FlashCopy Manager configuration directory. This parameter is required. The following subdirectories are included in this directory:

logs The subdirectory contains all log and trace information for Tivoli Storage FlashCopy Manager.

shared The subdirectory contains information that is shared among all Tivoli Storage FlashCopy Manager components.

When the subdirectory is initially created, the only file that is stored in the directory is the password file: `pwd.acsd`. This file contains the passwords for all devices that are specified within the profile. The file also contains a master password that is used from all components for authentication when they are connecting to the management agent. When you run remote configuration tasks from the production system with SSH, the information in these directories is promoted to all systems that belong to the instance where Tivoli Storage FlashCopy Manager is configured. When you run configuration tasks separately, you must promote the information manually.

Default

user_home/acs

Advanced mode only

Yes

ACSD

The host name and port of the system where the management agent is running. The following format is used for **ACSD**: *hostname port*

This parameter must be identical on all systems where Tivoli Storage FlashCopy Manager is installed for a database instance. While the parameter must be identical, each database instance can be managed by an individual management agent.

Default

hostname 57328

Advanced mode only

Yes

ENFORCE_TLS12

Tivoli Storage FlashCopy Manager uses the security suite, IBM Global Security Kit (GSKit) for Secure Socket Layer / Transport Layer Security (SSL/TLS) TCP/IP connections. GSKit is able to provide SP800-131 compliant encryption by using the TLS protocol V1.2. To enforce the use of this protocol, select the option YES, otherwise the TLS version 1.0 and 1.1 is enabled by default.

Default

NO

Advanced mode only

Yes

TRACE

There are two options for **TRACE**: YES and NO. YES means that tracing is enabled. NO means that tracing is not enabled.

This parameter can also be set in the .utl file.

Default

NO

Advanced mode only

Yes

ACSD

Except where noted, the profile parameters in the ACSD section are independent of the storage device or application.

ACS_REPOSITORY

This parameter sets the path to the IBM Tivoli Storage FlashCopy Manager repository. This directory is used during restore operations and must be in a secure location. If the repository is lost, all backups are not available.

The directory that is referenced by the **ACS_REPOSITORY** parameter cannot be in a file system that participates in snapshot backup operations. If the directory is part of a file system that is used for snapshot backup operations, Tivoli Storage FlashCopy Manager reports a failure. The Tivoli Storage FlashCopy Manager repository cannot be in the main Tivoli Storage FlashCopy Manager directory that is specified by the **ACS_DIR** parameter. Ideally, the **ACS_REPOSITORY** directory is a subdirectory of the **ACS_DIR** directory. For example:

```
<ACS_DIR>/acsrepository
```

Before you configure Tivoli Storage FlashCopy Manager, the path to the **ACS_REPOSITORY** is set, but the directory does not exist. The **ACS_REPOSITORY** directory is created during the configuration process. If the directory specified for the **ACS_REPOSITORY** parameter exists, the setup script, used to configure Tivoli Storage FlashCopy Manager, reports an error.

Default

user_home/acs/acsrepository.

Advanced mode only

Yes.

ADMIN_ASSISTANT

In non-SAP environments, this parameter is ignored. If Tivoli Storage Manager for ERP and the Administration Assistant component are installed, when this parameter is set, Tivoli Storage FlashCopy Manager sends backup and restore information to the Administration Assistant.

<server> <port>

Server and port where the Tivoli Storage Manager for ERP Administration Assistant server component is listening.

NO Do not send data to the Administration Assistant.

Default

NO

Advanced mode only

Yes.

REPOSITORY_LABEL

When this parameter is set, a prefix is added to each volume name on the IBM XIV Storage System, IBM System Storage N series, and NetApp Storage System. The prefix contains 3 characters in one of the following ranges:

[a-z]

[A-Z]

[0-9]

Note: If the repository label changes, backups that are created with the prior repository label are excluded from reconciliation.

Default

TSM

Advanced mode only

Yes.

SYNCHRONOUS_RECONCILE

This parameter is used to configure Tivoli Storage FlashCopy Manager to synchronously reconcile and delete snapshot backups. If the RESTORE_AND_DELETE option is specified for this parameter, a delete and restore operation also starts a synchronous delete and reconcile operation. This process can be useful for storage systems that can delete snapshot backups during a Tivoli Storage FlashCopy Manager snapshot restore process. Deletion can occur on N series, NetApp, Storwize family, or SAN Volume Controller storage systems. Also, this process is useful if you manually delete snapshot backups and use the force option (-f) on DS8000, SAN Volume Controller, or Storwize family storage systems.

If the YES option is specified in addition to the delete and restore operation, a backup operation also starts a synchronous delete and reconcile process. This process can be useful for storage systems that delete snapshot backups during a Tivoli Storage FlashCopy Manager backup or cloning operation. Deletion can occur on SAN Volume Controller or Storwize family storage systems. The following list identifies the possible options:

NO Use this option not to start a synchronous delete and reconcile operation.

YES

Use this option to start a synchronous delete and reconcile process as part of a backup, restore, and delete operation.

RESTORE_AND_DELETE

Use this option to start a synchronous delete and reconcile process as part of a restore and delete operation.

Default

RESTORE_AND_DELETE

Advanced mode only

YES

CLIENT

The CLIENT section of the Tivoli Storage FlashCopy Manager profile file contains parameters that relate to database and custom applications. The parameters do not depend on the storage solution. The client section is required for all database and custom applications except for Oracle in an SAP environment. When you use Oracle in an SAP environment databases and Tivoli Storage FlashCopy Manager with IBM Tivoli Storage Manager for Enterprise Resource Planning, the Tivoli Storage FlashCopy Manager profile does not contain a CLIENT section.

CLIENT parameters for custom applications

Tivoli Storage FlashCopy Manager uses specific custom application parameters to configure custom application backup and restore operations. These parameters are defined in the client section of the Tivoli Storage FlashCopy Manager profile configuration file.

Custom applications

APPLICATION_TYPE

For this parameter, specify the environment. The following list identifies the possible options:

GENERIC

This parameter specifies that the Tivoli Storage FlashCopy Manager backup is a custom application backup.

Default

None. When you use the setup script, the option for this parameter is entered.

Advanced mode only

No

BACKUPIDPREFIX

This parameter specifies a string that is added before the backup ID that is generated by Tivoli Storage FlashCopy Manager. This parameter is used to separate the backups within the same repository. When you use this parameter, other clients are not able to query, restore, or delete these backups.

The string can contain letters, digits, or the underscore character (_).

Default

None

Advanced mode only

Yes

DEVICE_CLASS

This parameter specifies the device classes to use. The following sample identifies the syntax that can be used with the **DEVICE_CLASS** parameter:

`DEVICE_CLASS list_of_device_classes [conditions]`

When a list of device classes is specified, the software determines which device class matches the device class in the environment. When multiple device classes are specified, separate the device classes names with a space. The condition statement is optional. When you use the condition statement, use the following syntax:

`[USE_AT days of week] [FROM time TO time]`

Note: The time period that is specified cannot span midnight for a device class. If a device class time period is required to span midnight, you must specify two time periods for the device class. The first time period must end with a value 1 minute before midnight and the second time period must start at midnight. The following example shows how to specify a time period that spans midnight for a device class:

```
DEVICE_CLASS myClass FROM 20:00 TO 23:59  
DEVICE_CLASS myClass FROM 00:00 TO 06:00
```

When there are different devices, multiple sections can be used. Each section provides information about a particular device. To select a particular section, use the **DEVICE_CLASS** parameter. When the software restores data, the software uses the **DEVICE_CLASS** value that is specified when the data was backed up.

The configuration wizard (the setup script) automatically adds **DEVICE_CLASS** sections to the Tivoli Storage FlashCopy Manager profile when you add more instances of the **DEVICE_CLASS** parameter to the **CLIENT** section of the profile.

Default

STANDARD

Advanced mode only

No

ENHANCED_PARTITIONING

The **ENHANCED_PARTITIONING** parameter is used to control processing of the application file systems during the backup or restore operation. Tivoli Storage FlashCopy Manager fails, when a file system contains symbolic links that point to a file system on a different volume group that is not part of the FlashCopy operation. Set the **ENHANCED_PARTITIONING** parameter to **NO** to ensure that symbolic links if present are not processed. With this setting, there is no check for additional files that are not associated with the application. If you use this setting, the run time of the backup operation is likely to decrease depending on the file system structure. The following list identifies the possible options:

YES

Use this option to ensure that Tivoli Storage FlashCopy Manager processes all symbolic links of files or directories.

NO Use this option to ensure that Tivoli Storage FlashCopy Manager does not process symbolic links of files or directories.

Default

YES

Advanced mode only

Yes.

INFILE

This parameter is used when the **APPLICATION_TYPE** parameter is set to **GENERIC**. This parameter identifies the file that contains a list of all objects to be processed. The file must meet the following requirements:

- Each line specifies only one file or directory to be backed up.
- A directory, including all subdirectories, is recursively processed. When the directory is expanded, links are followed.

- When a link to a file is specified, Tivoli Storage FlashCopy Manager protects the file system where the file is located. However, the file system where the link is located is disregarded.

The **INFILE** parameter can be overridden by an entry from the command-line interface. If the **INFILE** parameter is not specified in the profile configuration file, the parameter must be specified from the command-line interface.

Default

There is no default for this required parameter.

Advanced mode only

Yes.

LVM_FREEZE_THAW

This parameter specifies when to enable file system freeze and thaw actions. The following list identifies the possible options:

YES

Enable file system freeze before the snapshot operation and the thaw after the snapshot operation. For AIX, the YES value can be used only when all file systems included in the backup are JFS2 file systems.

- NO** Do not freeze the file system. To set this parameter to NO, a licensed version of Tivoli Storage FlashCopy Manager is needed and a backup server is required for mounting the snapshot to ensure file system consistency.

The value NO is required if at least one file system that does not support freeze or thaw actions, such as JFS, is involved.

AUTO

If the **TARGET_DATABASE_SUSPEND** parameter is YES, then this parameter is set with the following option: **LVM_FREEZE_THAW YES**. If the file system does not support freeze actions, the AUTO value is NO.

For more information, see “Interdependency of **LVM_FREEZE_THAW** and **TARGET_DATABASE_SUSPEND**” on page 133.

Default

AUTO

Advanced mode only

Yes

MAX_VERSIONS

This parameter specifies the number of snapshot versions to store. The following list identifies the possible options:

ADAPTIVE

The maximum number varies depending on the available space. Tivoli Storage FlashCopy Manager reuses the oldest target set as the target for the current backup.

- n** Where *n* is the maximum number of snapshot versions to be stored. The amount of space that is required depends on the following factors:
- The number of snapshots.
 - For each snapshot, the number of changes to the file system content since the snapshot was taken.

When this limit is reached, the oldest version is deleted.

Default

ADAPTIVE

Advanced mode only

No

NEGATIVE_LIST

This parameter is used to control file processing. This processing occurs when files not associated with the database are stored within the same file system that is used for the backup and restore operations. This parameter is required. The following list identifies the possible options:

NO_CHECK

Use this option to not check for extra files. The operation ignores any additional files that are identified. When you use this option and data is restored, all files on the file system or volume group are overwritten.

WARN

Use this option to receive a warning message for each file that is identified on the volume, but not part of the FlashCopy operation. The processing continues. When you use this option and data is restored, all files on the file system or volume group are overwritten.

ERROR

Use this option to receive an error message for each file that is discovered on the volume, but not part of the FlashCopy operation. The processing ends.

filename

Where *filename* is a name of a file that contains a list of fully qualified names of files and directories, each name requires a new line. Only files or directories that are not associated with the database but are stored within the file system that is used for backup operations are listed. Any file that is identified by Tivoli Storage FlashCopy Manager that is not part of the database files or is not in the **NEGATIVE_LIST** file, causes processing to end. Any directory that is listed in the **NEGATIVE_LIST** file is processed recursively. For example, all files within the directory, including subdirectories, are processed during a backup or restore request.

Default

None

Advanced mode only

No

POST_FLASH_CMD

This parameter identifies the command script or executable file that is used to resume the application after the snapshot operation. Arguments can be specified and are separated by blanks. This parameter is used when the **APPLICATION_TYPE** parameter is set to GENERIC.

This parameter can be set in the profile configuration file, or the parameter can be set from the command-line interface. If set from the command-line interface, the parameter setting overrides the corresponding parameter in the profile configuration file.

Default

There is no default for this required parameter.

Advanced mode only

Yes.

PRE_FLASH_CMD

This parameter identifies the command script or executable file that is used to immediately quiesce the application before the snapshot operation begins. Arguments can be specified and are separated by blanks. This parameter is used when the **APPLICATION_TYPE** parameter is set to GENERIC.

This parameter can be set in the profile configuration file, or the parameter can be set from the command-line interface. If set from the command-line interface, the parameter setting overrides the corresponding parameter in the profile configuration file.

Default

There is no default for this required parameter.

Advanced mode only

Yes.

TSM_BACKUP

This parameter specifies whether to create a Tivoli Storage Manager backup from a snapshot. Tivoli Storage FlashCopy Manager must be installed on a backup server. When the **TSM_BACKUP** parameter is set to YES, MANDATE, or LATEST, and after the offload agent runs, a Tivoli Storage Manager backup is created from the snapshot. The following list identifies the possible options:

YES

This option creates a Tivoli Storage Manager backup from a snapshot. If the Tivoli Storage Manager backup operation does not successfully complete, the target set can be reused.

MANDATE

This option creates a Tivoli Storage Manager backup from a snapshot. However, the target set cannot be reused until the Tivoli Storage Manager backup successfully completes.

LATEST

This option removes a backup request to Tivoli Storage Manager from a previous backup. When a new snapshot with **TSM_BACKUP** set to LATEST, YES, or MANDATE is created, Tivoli Storage FlashCopy Manager removes any unsuccessful backup request that were previously created with the **TSM_BACKUP** option set to LATEST. This option prevents backup requests to Tivoli Storage Manager from queuing if they are not completed in time.

NO Keeps the snapshot backup but the snapshot is not used as a source for a subsequent tape backup operation.

TSM_ONLY

After the Tivoli Storage Manager backup is completed, during the unmount operation, the backup is automatically marked for deletion. This action occurs regardless of whether the backup is successful or not.

USE_FOR list of device classes

To create a Tivoli Storage Manager backup from snapshots that are run with particular device classes, as specified in the profile, combine this attribute with other options. When you list device classes, separate device classes with the space character. There is no limit of the number of device classes.

Default

None

Advanced mode only

No

TIMEOUT_FLASH

This parameter specifies the maximum time, in seconds, that the database agent waits for a response to the management agent call during the *flash* phase. If the database agent does not receive a response within the specified time, an error message is displayed. This parameter allows the maximum time to be specified for a database to be suspended. This parameter also implies the maximum time when JFS2 file systems can be frozen. When the timeout is reached, the file systems thaw, the database is resumed, and the backup operation ends with an error. If the **LVM_FREEZE_THAW** parameter is set to either AUTO or YES, the minimal value for **TIMEOUT_FLASH** is 5 seconds. In other scenarios, the minimal value is 1 second.

Default

The default value is 120 seconds.

Advanced mode only

Yes

TIMEOUT_PHASE

This parameter specifies the maximum time, in seconds, that the database agent waits for a response to the management agent call during a specific operation phase. If the database agent does not receive a response within the specified time, either the backup or restore operation ends and an error message is shown.

Specify one of the following phase values for a FlashCopy backup:

- **PARTITION**
- **PREPARE**
- **FLASH** (this parameter has a separate description)
- **VERIFY**
- **CLOSE**

For example, **TIMEOUT_PREPARE**.

Specify one of the following phase values for a FlashCopy restore:

- **PREPARESTORE**
- **FLASHRESTORE**
- **COMPLETERESTORE**
- **CLOSE**

For example, **TIMEOUT_FLASHRESTORE**.

Default

The default value is 3600 seconds.

Advanced mode only

Yes

DEVICE_CLASS *device*

The Tivoli Storage FlashCopy Manager profile configuration file can contain one or more **DEVICE_CLASS** sections. The device class section configures Tivoli Storage FlashCopy Manager for use with a particular storage or file system solution. The parameters do not depend on the database or custom application that is protected.

Use care when you rename or delete a **DEVICE_CLASS** section from the profile, as you cannot access backups that were taken with the original **DEVICE_CLASS** section. Therefore, first remove backups and clones that are associated with the **DEVICE_CLASS** before you rename or delete the **DEVICE_CLASS** section.

A *device* refers to supported IBM XIV Storage System , IBM Storwize family, IBM System Storage SAN Volume Controller, IBM System Storage DS8000 series, IBM System Storage N series, and NetApp storage systems. In addition to these storage systems, a device can also be a General Parallel File System (GPFS) file system.

Updating DEVICE_CLASS device for mirroring

To use the mirroring technologies, a **DEVICE_CLASS** section specific to the storage solution used for mirroring needs to be added to the profile configuration file. There is one exception to this statement: If remote backups are run, the existing **DEVICE_CLASS** section for the device is sufficient. No additional **DEVICE_CLASS** section is needed.

About this task

When creating a **DEVICE_CLASS** section for the storage solution used for mirroring, the section includes the same parameters as the device class for the local site, specific vales for the remote site, and the parameters that are required to connect and send requests to the remote cluster. The parameters required to connect and send requests to the remote cluster are identified in the following list:

COPYSERVICES_REMOTE

The option set for this parameter determines if the backup is taken at the remote site. The options are YES and NO. The default option is set to NO.

COPYSERVICES_REMOTE_SERVERNAME

This parameter specifies the IP address or hostname for the secondary cluster. If the **COPYSERVICES_REMOTE** parameter is set to YES, the parameter is required. If the **COPYSERVICES_REMOTE** parameter is set to NO, the **COPYSERVICES_REMOTE_SERVERNAME** parameter cannot be used. If the parameter is used, an error occurs.

COPYSERVICES_REMOTE_USERNAME

This parameter specifies the user name used to connect to the secondary cluster. The default option is superuser. If the **COPYSERVICES_REMOTE** parameter is set to NO, the **COPYSERVICES_REMOTE_SERVERNAME** parameter cannot be used. If the parameter is used, an error occurs.

TAKEOVER_HOST_NAME

This parameter is required when restoring a remote mirroring backup after a takeover procedure on the remote side. The value for this parameter is the host name of the takeover host and is only used in combination with the secondary cluster defined by the **COPYSERVICES_REMOTE_SERVERNAME** parameter. The value specified for this parameter needs to match the value defined in the storage system. If the values do not match, an error occurs.

The following **DEVICE_CLASS** parameters need to be common to both clusters:

- **COPYSERVICES_COMMPROTOCOL**
- **COPYSERVICES_CERTIFICATEFILE**
- **COPYSERVICES_SERVERPORT**

DEVICE_CLASS XIV system Storage System parameters

The parameters that are defined in the device class section of the Tivoli Storage FlashCopy Manager profile file, configure Tivoli Storage FlashCopy Manager for use with the IBM XIV Storage System.

BACKUP_HOST_NAME

This parameter specifies the name of the backup host that is used during offloaded tape backups only. The following list identifies the possible options:

backup_server_hostname

Enter the host name or cluster name of the backup server as configured on the XIV system Storage System.

None

This option is used if you do not have a backup server.

Default

None

Advanced mode only

No.

CLONE_DATABASE

This parameter is preset by the setup script. If you use the setup script for configuration, it is not necessary to manually update any parameters. The following list identifies the possible options:

YES

Use the device class for cloning. When the parameter is set to YES, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning. When the parameter is set to NO, any cloning request fails with an error message and return code 2.

The following example shows the **CLONE_DATABASE** parameter that is specified in the **DEVICE_CLASS device** section of the profile:

```
>>> DEVICE_CLASS STANDARD
CLONE_DATABASE YES
COPYSERVICES_HARDWARE_TYPE XIV
# STORAGE_SYSTEM_ID
PATH_TO_XCLI /home/xivtest/XCLI
COPYSERVICES_SERVERNAME nextra
COPYSERVICES_USERNAME admin
# RECON_INTERVAL 12
# USE_WRITABLE_SNAPSHOTS AUTO
BACKUP_HOST_NAME acsback5
<<<
```

Default

This parameter is not explicitly set. The setup script sets the value, depending on if the device class is specified in the **CLIENT** or **CLONING** section.

Advanced mode only

No.

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

XIV

Specify the XIV option, when the database is stored on the XIV system Storage System.

On the console, any notifications that refer to IBM XIV Storage System operations and **COPYSERVICES_HARDWARE_TYPE** are displayed as **COPYSERVICES_HARDWARE_TYPE=GENERIC**. Similarly, when you view the log or trace files in the ACS_DIR/logs directory, any references that are related to the **COPYSERVICES_HARDWARE_TYPE** for the XIV system Storage System are displayed as **COPYSERVICES_HARDWARE_TYPE=GENERIC**.

Default

Not available.

Advanced mode only

No.

COPYSERVICES_SERVERNAME

This parameter identifies the TCP/IP host name of the storage system where the data to protect is located.

Default

None

Advanced mode only

No.

COPYSERVICES_USERNAME

This parameter identifies the user name. Use the *XIV user* name that you use log on to the XIV system Storage System.

Default

superuser

Advanced mode only

No.

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default

12

Advanced mode only

Yes.

STORAGE_SYSTEM_ID

This parameter specifies the storage system ID of the cluster where the storage system is used in the AIX Logical Volume Manager mirrored environment. This parameter must not be specified in non-mirrored environments.

The **STORAGE_SYSTEM_ID** parameter refers to the four-digit hexadecimal XIV system ID.

Default

None.

Advanced mode only

Yes.

PATH_TO_XCLI

This parameter specifies the path where the XIV command-line interface, XCLI, is installed. There is no default value. This parameter is only valid when **COPYSERVICES_HARDWARE_TYPE** specifies XIV.

Default

None.

Advanced mode only

No.

USE_WRITABLE_SNAPSHOTS

This parameter determines whether writable snapshots are used. Writable snapshots are required in LVM mirrored environments. The following list identifies the options:

YES Writable snapshots are used.

NO Writable snapshots are not used.

AUTO Based on the environment, the value is automatically selected.

Default

AUTO

Advanced mode only

Yes

DEVICE_CLASS Storwize family and SAN Volume Controller Storage System parameters

The parameters that are defined in the device class section of the profile file, configure IBM Tivoli Storage FlashCopy Manager for UNIX and Linux for use with the IBM Storwize family or IBM System Storage SAN Volume Controller storage systems.

When you configure, you have a choice of Storwize family and SAN Volume Controller device types. Depending on which device type you select, the parameter values that are required vary.

Specify SVCDDTA or SVC when prompted by the setup script with a choice of storage system types (**COPYSERVICES_HARDWARE_TYPE**). You can select one of the following device types:

Storwize family and SAN Volume Controller dynamic target allocation (SVCDDTA)

Tivoli Storage FlashCopy Manager for UNIX and Linux dynamically allocates target volumes on the storage system during the backup process.

Storwize family and SAN Volume Controller static target allocation (SVC)

Before you start the backup process, you must manually create target volumes on the storage system. Also, predefined volumes must be defined in a Tivoli Storage FlashCopy Manager configuration file or must match a specific naming pattern.

DEVICE_CLASS parameters for static target allocation:

The parameters that are defined in the device class section of the Tivoli Storage FlashCopy Manager profile file, configure Tivoli Storage FlashCopy Manager for use with the IBM Storwize family or IBM System Storage SAN Volume Controller storage systems.

CLONE_DATABASE

This parameter is preset by the setup script. If you use the setup script for configuration, it is not necessary to manually update any parameters. The following list identifies the possible options:

YES Use the device class for cloning. When the parameter is set to YES, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning. When the parameter is set to NO, any cloning request fails with an error message and return code 2.

Default

This parameter is not explicitly set. The setup script sets the value, depending on if the device class is specified in the CLIENT or CLONING section.

Advanced mode only

No

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

SVC

Specify the SVC option, when the database is stored on either the SAN Volume Controller or the Storwize family storage system.

Tip: You must manually create backup target volumes in advance on the storage system.

Default

Not available

Advanced mode only

No

COPYSERVICES_USERNAME

This parameter identifies the user name. Use the *SVC user* name that you use to log on to the SAN Volume Controller master console or cluster. For Storwize family, use the *Storwize V7000 user* name that you use to log on to the Storwize family.

Default

superuser

Advanced mode only

No

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default

12

Advanced mode only

Yes

STORAGE_SYSTEM_ID

Specify the storage system ID of the cluster where the storage system is used in an AIX Logical Volume Manager mirrored environment. This parameter must not be specified in non-mirrored environments.

The **STORAGE_SYSTEM_ID** parameter refers to the storage system Cluster ID.

Default

None

Advanced mode only

Yes

COPYSERVICES_COMMPROTOCOL

This parameter identifies the protocol to be used for communication with the CIM Agent. The options are HTTP, for communication in a non-secure mode, and HTTPS, for communication in a secure mode.

Default

HTTPS

Advanced mode only

Yes

COPYSERVICES_CERTIFICATEFILE

When **COPYSERVICES_COMMPROTOCOL** is set to HTTPS, there are two options:

certificate_filename

Name of a certificate file that is created for secure communication between the CIM Client and the CIM Agent.

NO_CERTIFICATE

Select for null trust provider mode.

By default, the CIM Agent for DS8000, which is preinstalled on the HMC, requires communication in secure mode. For this scenario, clients such as Tivoli Storage FlashCopy Manager must connect by using HTTPS instead of HTTP. This connection requires that the CIM Client obtain the public key that is used for encryption from the *truststore* certificate in the CIM Agent. After the client obtains the public key, the CIM Client is authenticated by using the user name and password.

To enable the HTTPS protocol, the Tivoli Storage FlashCopy Manager profile parameter **COPYSERVICES_COMMPROTOCOL** must specify HTTPS. For this scenario, the **COPYSERVICES_CERTIFICATEFILE** parameter can define a certificate file name, and Tivoli Storage FlashCopy Manager exports the certificate by using this file.

The CIM Agent also provides another communication mode that is known as *null trust provider*. In this scenario, the CIM Agent does not verify that the certificate passed by the client matches a known certificate. Rather, it accepts any certificate from the client, including a null string for the file name. To enable this mode, the value of **COPYSERVICES_CERTIFICATEFILE** must be **NO_CERTIFICATE**. This mode is used only if the production and backup systems, and the storage system, are protected by a firewall. If **NO_CERTIFICATE** is used, the `cimom.properties` parameter **DigestAuthentication** must be set to false.

Default
NO_CERTIFICATE

Advanced mode only
Yes

COPYSERVICES_PRIMARY_SERVERNAME

This parameter identifies the server name or address that defines the TCP/IP address of the host that is running the CIM Agent for DS Open API. This host manages the SAN Volume Controller master console and the embedded CIM Agent in the Storwize family storage system. For SAN Volume Controller, the **COPYSERVICES_PRIMARY_SERVERNAME** parameter, if specified, must point directly to the SAN Volume Controller cluster with the embedded CIM server. For Storwize family, the **COPYSERVICES_PRIMARY_SERVERNAME** parameter must point to the Storwize family cluster.

Default
localhost

Advanced mode only
No

COPYSERVICES_SERVERPORT

This parameter identifies the server port number on the CIM Agent for DS Open API. This information is used to manage the primary and secondary Copy Services servers of the SAN Volume Controller master console or the embedded CIM Agent on the Storwize family storage system.

Default
The default port number depends on the settings of **COPYSERVICES_HARDWARE_TYPE** and **COPYSERVICES_COMMPROTOCOL**:

COPYSERVICES_HARDWARE_TYPE	COPYSERVICES_COMMPROTOCOL	Default Port
SVC	HTTPS	5989
	HTTP	5988

Advanced mode only
Yes

COPYSERVICES_TIMEOUT

This parameter identifies the maximum length of time, in minutes, that the CIM Client waits for a response to a call put to the CIMOM (CIM Agent). If the CIM Client does not receive a response within this time, an error message is displayed.

Default
6

Advanced mode only
Yes

FLASHCOPY_TYPE

This parameter specifies whether the storage solution does a bit-level copy of data from one logical volume to another. This parameter applies to any FlashCopy storage system. The following options are available:

COPY Directs the storage system to run a bit-level copy of the data from one physical volume to another. Specify this value when the following conditions are true:

- A fast snapshot restore of a backed-up database is required.
- A complete copy of the database data on the target volume is required.

NOCOPY Directs the storage system to run a bit-level copy of a track if the data is modified after the initial FlashCopy request. This technique is typically referred as copy-on-write. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:

- A complete copy of the source volumes that contain the database files is not required on the target volumes.
- Backup time constraints are a concern.

INCR This option is similar to the COPY option but the INCR option copies only those tracks that were modified since the previous incremental FlashCopy was created. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:

- Tivoli Storage Manager backups are taken from disk copies. This type of backup creates less burden on the storage system than for the COPY option.
- A snapshot restore operation of the backed up database is to be completed.
- More frequent backups for the database are scheduled.

The **SVC_COPY_RATE** parameter is forced to 0 when the **FLASHCOPY_TYPE** parameter is specified as NOCOPY.

Default

COPY

Advanced mode only

No

RESTORE_FORCE

This parameter specifies whether to force a restore. During a rerun of a snapshot restore, the message FMM0200E can be generated. This problem occurs if the background copy process of the previous snapshot restore is still running and the **RESTORE_FORCE** parameter is set to NO. There are two ways to resolve the issue that is identified by the message:

- Wait until the background copy process ends.
- Set the **RESTORE_FORCE** parameter to YES in the profile configuration file and try the snapshot restore again. This option withdraws all existing source and target relationships, and creates new source and target relationships. A full copy is completed. If you want to set **RESTORE_FORCE** to YES for a specific restore, you can create a temporary profile configuration file.

Default

NO

Advanced mode only

Yes

TARGET_SETS

This parameter specifies the target volumes to be used in the FlashCopy operation. The following list identifies the possible options:

VOLUMES_FILE

The name of the target volumes file (.fct).

list_of target_set_names

A list of target set names. For example: TARGET_SETS 1 2 3

To define the naming convention for the target volumes, specify the **TARGET_NAMING** parameter. For example: **TARGET_NAMING** *string_with_wildcards_%SOURCE_and_%TARGETSET*

This parameter and option define the naming convention for target volumes. When a backup volume is required, Tivoli Storage FlashCopy Manager determines the name of the target set for the operation and the name of the source volume to be backed up. The name of the target volume that stores the backup is the name that is specified after the following strings are replaced with the respective values in the operation: *%SOURCE_and_%TARGETSET*.

Default

None

Advanced mode only

No

VOLUMES_FILE

This parameter specifies the name of the target volumes file (.fct).

Default

None

Advanced mode only

No

ALLOW_NOCOPY_FLASHCOPY

Use this parameter with the **CLONE_DATABASE** parameter. The following list identifies the possible options:

YES Create a Tivoli Storage FlashCopy Manager clone on space-efficient targets. For this device class, use space-efficient targets and set **FLASHCOPY_TYPE** to **NOCOPY**. FlashCopy backups cannot be stored on the same source volumes.

NO Do not create a Tivoli Storage FlashCopy Manager clone on space-efficient targets. If both backup and cloning must be completed on the same source volumes, cloning is completed to full targets and the **ALLOW_NOCOPY_FLASHCOPY** parameter is set to **NO**.

Default

NO

Advanced mode only

Yes

ALLOW_ALL_FLASHCOPY_TYPES

Use this parameter when Tivoli Storage FlashCopy Manager is configured with **FLASHCOPY_TYPE FULL**, or **FLASHCOPY_TYPE INCR**. Use the parameter when the source volumes are fully allocated and the target volumes are space efficient. The following list identifies the available options:

YES Allows Tivoli Storage FlashCopy Manager to be configured to use **FLASHCOPY_TYPE FULL**, or **FLASHCOPY_TYPE INCR** when the source volumes are fully allocated and the target volumes are space efficient.

NO If the source volumes are fully allocated and the target volumes are space efficient, you can set the parameter **FLASHCOPY_TYPE** to **NOCOPY** only.

Default

NO

Advanced mode only

Yes

SVC_CLEAN_RATE

This parameter specifies the cleaning rate for the FlashCopy mapping. A value from 1 to 100 can be entered.

Default

None

Advanced mode only

Yes

SVC_COPY_RATE

This parameter specifies the priority that the SAN Volume Controller or Storwize family gives to the FlashCopy background process for the current backup or restore. A value from 0 to 100 can be entered.

A value of 100 indicates the highest priority, but places the greatest burden on the responsiveness of the storage system. A value of 0 indicates the lowest priority, but suppresses the background copy process and forces the **FLASHCOPY_TYPE** parameter to have the NOCOPY option.

Default

50

Advanced mode only

No

SVC_GRAIN_SIZE

This parameter specifies the grain size, in KB, for FlashCopy mapping for space-efficient virtual disks on SAN Volume Controller or Storwize family. The grain size of the space-efficient virtual disk must match the grain size of the FlashCopy. The options for this parameter are 64, and 256.

After the parameter is set, the value cannot be changed until the backup is deleted with the option -F to remove the mappings.

Default

256

Advanced mode only

Yes

DEVICE_CLASS parameters for dynamic target allocation:

The parameters that are defined in the device class section of the Tivoli Storage FlashCopy Manager profile file, configure Tivoli Storage FlashCopy Manager for use with IBM Storwize family or IBM System Storage SAN Volume Controller storage systems.

CLONE_DATABASE

This parameter is preset by the setup script. If you use the setup script for configuration, it is not necessary to manually update any parameters. The following list identifies the possible options:

YES Use the device class for cloning. When the parameter is set to YES, the

device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning. When the parameter is set to NO, any cloning request fails with an error message and return code 2.

Default

This parameter is not explicitly set. The setup script sets the value, depending on if the device class is specified in the CLIENT or CLONING section.

Advanced mode only

No

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

SVCDTA

Specify the SVCDTA option when the storage system is SAN Volume Controller or Storwize family and you require the target volumes to be dynamically allocated during the backup process.

Default

None

Advanced mode only

No

COPYSERVICES_SERVERNAME

Defines the TCP/IP host name of the storage system where the application data to protect is allocated.

Default

None

Advanced mode only

No

COPYSERVICES_USERNAME

Identifies the user name. Specify the user name that is used to log on to the SAN Volume Controller cluster. For Storwize family, specify the Storwize family user name.

Default

superuser

Advanced mode only

No

SVC_SSHKEY_FULLPATH

Specifies the path and the file name to the private SSH key file. The key file is used to authenticate to the storage system with the user name specified for the COPYSERVICES_USERNAME parameter.

Default

\$HOME/.ssh/svc_sshkey

Advanced mode only

Yes

SSH_DIR

Specifies the path to the Secure Shell protocols and executable files.

Default

/usr/bin

Advanced mode only

Yes

SVC_COPY_RATE

Specifies the priority that the storage system gives to the FlashCopy background process for the current backup or restore operation. Enter a value from the range 1 - 100.

The **SVC_COPY_RATE** parameter only applies for full copy backups (FLASHCOPY_TYPE COPY). For space-efficient backups (FLASHCOPY_TYPE NOCOPY), the copy rate is implicitly set to 0.

Default

0

Advanced mode only

Yes

STORAGE_SYSTEM_ID

The **STORAGE_SYSTEM_ID** parameter refers to the storage system Cluster ID.

Default

None

Advanced mode only

Yes

FLASHCOPY_TYPE

Specifies whether the storage solution does a bit-level copy of data from one logical volume to another. This parameter applies to any FlashCopy storage system. The following options are available:

COPY Directs the storage system to run a bit-level copy of the data from one physical volume to another. Specify this value when the following conditions are true:

- A fast snapshot restore of a backed-up database is required.
- A complete copy of the database data on the target volume is required.

NOCOPY Directs the storage system to run a bit-level copy of a track if the data is modified after the initial FlashCopy request. This technique is typically referred as copy-on-write. Specify this value when the following conditions are true:

- A complete copy of the source volumes that contain the database files is not required on the target volumes.
- A fast snapshot restore of a backed-up database is required.
- Backup time constraints are a concern.

Default

NOCOPY

Advanced mode only

No

ALLOW_NOCOPY_FLASHCOPY

Use this parameter with the **CLONE_DATABASE** parameter. The following list identifies the possible options:

YES Create a Tivoli Storage FlashCopy Manager clone on space-efficient targets. For this device class, use space-efficient targets and set **FLASHCOPY_TYPE** to NOCOPY. FlashCopy backups cannot be stored on the same source volumes.

NO Do not create a Tivoli Storage FlashCopy Manager clone on space-efficient targets. If both backup and cloning must be completed on the same source volumes, cloning is completed to full targets and the **ALLOW_NOCOPY_FLASHCOPY** parameter is set to NO.

Default

NO

Advanced mode only

Yes

SVC_GRAIN_SIZE

Specifies the grain size, in KB, for FlashCopy mapping for space-efficient virtual disks on SAN Volume Controller or Storwize family. The grain size of the space-efficient virtual disk must match the grain size of the FlashCopy. The options for this parameter are 64, and 256.

After the parameter is set, the value cannot be changed until the backup is deleted with the option -F to remove the mappings.

Note: When you are migrating from the SVC adapter with static target allocation, you must ensure that the grain size for the new SVCDTA device classes is set to the same value as it was for the device classes for SVC.

Default

256

Advanced mode only

Yes

SVC_POOLNAME

This parameter specifies the name of the storage pool that is used to create target volumes for the FlashCopy backups, and creates consistency groups and the FlashCopy map for restore operations.

Default

Name of the storage pool on the source volume where the FlashCopy relationship is established.

Advanced mode only

Yes

SVC_IOGROUP

Specifies the name of the input and output (IO) group, which is used to create target volumes for the FlashCopy backups.

Default

Name of the IO group on the source volume where the FlashCopy relationship is established.

Advanced mode only

Yes

SVC_MOUNT_POOLNAME

Specifies the name of the storage pool that is used to create temporary duplicates of the target volumes of a FlashCopy backup, which then mounts to a host.

Default

Name of the storage pool on the target volume that is used to create duplicate volumes for the mount operation.

Advanced mode only

Yes

SVC_MOUNT_IOGROUP

Specifies the name of the IO group, which is used to create duplicate volumes for the mount operation.

Default

Name of the IO group on the target volume that is used to create duplicate volume for the mount operation.

Advanced mode only

Yes

SVC_TARGET_VOLUME_REAL_SIZE

Specify the percentage of the source volume size to allocate, which is used to create the actual target volumes during the backup operation.

The **SVC_TARGET_VOLUME_REAL_SIZE** parameter only applies to FLASHCOPY_TYPE NOCOPY

Default

10

Advanced mode only

Yes

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default

12

Advanced mode only

Yes

DEVICE_CLASS System Storage N series and NetApp parameters

The parameters that are defined in the device class section of the Tivoli Storage FlashCopy Manager profile file, configure Tivoli Storage FlashCopy Manager for use with the IBM System Storage N series and NetApp storage systems.

BACKUP_HOST_NAME

This parameter is dependent on if the N series or NetApp storage systems are in a storage area network (SAN) or network-attached storage (NAS) based infrastructure. The following list identifies the possible options:

backup_server_hostname

For SAN-attached storage, enter the name of the initiator group for the SAN adapter of the backup host as configured on the N series or NetApp storage system. This parameter is used to map the LUNs to the backup host.

For NAS-attached storage, specify the IP address of the backup server.

None

This option is used if you do not have a backup server.

Default

None

Advanced mode only

No

CLONE_DATABASE

This parameter is preset by the setup script. If you use the setup script for configuration, it is not necessary to manually update any parameters. The following list identifies the possible options:

YES Use the device class for cloning. When the parameter is set to YES, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning. When the parameter is set to NO, any cloning request fails with an error message and return code 2.

Default

This parameter is not explicitly set. The setup script sets the value, depending on if the device class is specified in the CLIENT or CLONING section.

Advanced mode only

No

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified. The following list identifies the possible options:

NAS_NSERIES

Specify the NAS_NSERIES option, when the database is stored on NAS-attached storage systems.

SAN_NSERIES

Specify the SAN_NSERIES option, when the database is stored on SAN-attached storage systems.

Default

Not available.

Advanced mode only

No

COPYSERVICES_SERVERNAME

This parameter identifies the TCP/IP host name of the storage system where the data to protect is located.

Default

None

Advanced mode only

No

COPYSERVICES_USERNAME

This parameter identifies the user name to log on to the N series or NetApp storage system.

Default

superuser

Advanced mode only

No

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default

12

Advanced mode only

Yes

STORAGE_SYSTEM_ID

This parameter specifies the storage system ID of the cluster where the storage system is used in an AIX Logical Volume Manager mirrored environment. This parameter must not be specified in non-mirrored environments.

The storage system ID as displayed for example in the system status pane of the storage interface.

Default

None.

Advanced mode only

Yes.

DEVICE_CLASS GPFS parameters

The parameters that are defined in the device class section of the Tivoli Storage FlashCopy Manager profile file, configure Tivoli Storage FlashCopy Manager for use with a General Parallel File System (GPFS). In addition to device classes for storage systems, a device can also be a General Parallel File System.

COPYSERVICES_HARDWARE_TYPE

This parameter is required.

GPFS

Specify the GPFS option, when the database is in a DB2 pureScale environment, or a Custom Application database and is on a GPFS file system.

Default

Not available.

Advanced mode only

No

NUMBER_GPFS_CONCURRENT_TASKS

This parameter specifies the number of concurrent threads to use during a GPFS operation, for example during a tape backup operation. Use this parameter only when the **COPYSERVICES_HARDWARE_TYPE** has GPFS as the assigned device value.

The following example shows a typical GPFS device class section from a profile file where the number of GPFS concurrent tasks is set to 10.

```
>>> DEVICE_CLASS STANDARD
COPY_SERVICES_HARDWARE_TYPE GPFS
NUMBER_OF_GPFS_CONCURRENT_TASKS 10
```

```
<<<
```

Default

3

Advanced mode only

No

DEVICE_CLASS DS8000 Storage System parameters

The parameters that are defined in the device class section of the Tivoli Storage FlashCopy Manager profile file, configure Tivoli Storage FlashCopy Manager for use with the IBM System Storage DS8000.

BACKUP_HOST_NAME

This parameter specifies the name of the backup host that is used during offloaded tape backups only. The following list identifies the possible options:

PREASSIGNED_VOLUMES

Specify this option when the target volumes are preassigned to a specific backup server.

None

This option is used if you do not have a backup server.

Default

None.

Advanced mode only

No.

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

DS8000

Specify the DS8000 option, when the database is stored on one of the following storage systems:

- IBM DS8100
- IBM DS8300
- IBM DS8700
- IBM DS8800
- IBM DS8870

Default

None.

Advanced mode only

No.

COPYSERVICES_USERNAME

This parameter identifies the user name, use the *cim user* of the CIM Agent for DS Open API. The CIM Agent for DS Open API manages the primary and secondary copy services servers of the DS8000 cluster.

Default

superuser

Advanced mode only

No.

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default

12

Advanced mode only

Yes

STORAGE_SYSTEM_ID

Specify the storage system ID of the cluster where the storage system is used in the following mirrored environments:

- AIX Logical Volume Manager mirrored environment.
- Oracle ASM mirrored environment where the failure groups are distributed across multiple storage systems.

This parameter must not be specified in non-mirrored environments.

Note: For information about ASM failure group environments, see “LVM mirroring environments” on page 60.

Default

None.

Advanced mode only

Yes.

COPYSERVICES_COMMPROTOCOL

This parameter identifies the protocol to be used for communication with the CIM Agent. The options are HTTP, for communication in a non-secure mode, and HTTPS, for communication in a secure mode.

Default

HTTPS

Advanced mode only

Yes.

COPYSERVICES_CERTIFICATEFILE

When **COPYSERVICES_COMMPROTOCOL** is set to HTTPS, there are two options:

certificate_filename

Name of a certificate file that is created for secure communication between the CIM Client and the CIM Agent.

NO_CERTIFICATE

Select for null trust provider mode.

By default, the CIM Agent for DS8000, which is preinstalled on the HMC, requires communication in secure mode. For this scenario, clients such as Tivoli Storage FlashCopy Manager must connect by using HTTPS instead of HTTP. This connection requires that the CIM Client obtain the public key that is used for encryption from the *truststore* certificate in the CIM Agent. After the client obtains the public key, the CIM Client is authenticated by using the user name and password.

To enable the HTTPS protocol, the Tivoli Storage FlashCopy Manager profile parameter **COPYSERVICES_COMMPROTOCOL** must specify HTTPS. For this scenario, the **COPYSERVICES_CERTIFICATEFILE** parameter can define a certificate file name, and Tivoli Storage FlashCopy Manager exports the certificate by using this file.

The CIM Agent also provides another communication mode that is known as *null trust provider*. In this scenario, the CIM Agent does not verify that the certificate passed by the client matches a known certificate. Rather, it accepts any certificate from the client, including a null string for the file name. To

enable this mode, the value of **COPYSERVICES_CERTIFICATEFILE** must be **NO_CERTIFICATE**. This mode is used only if the production and backup systems, and the storage system, are protected by a firewall. If **NO_CERTIFICATE** is used, the **cimom.properties** parameter **DigestAuthentication** must be set to false.

Default

NO_CERTIFICATE

Advanced mode only

Yes.

COPYSERVICES_PRIMARY_SERVERNAME

This parameter identifies the server name or address that defines the TCP/IP address of the host that is running the CIM Agent for DS Open API. This host manages the primary and secondary copy services servers of the DS8000 cluster.

Default

localhost

Advanced mode only

No.

COPYSERVICES_SECONDARY_SERVERNAME

This parameter identifies the name of the backup Copy Services server that is located within a snapshot devices cluster. Specify either the IP address or the server DNS name. This parameter can be used only in environments with DS8000 in combination with the proxy CIM Agent.

Default

None

Advanced mode only

Yes.

COPYSERVICES_SERVERPORT

This parameter identifies the server port number of the host that is running the CIM Agent for DS Open API.

Default

The default port number depends on the settings of

COPYSERVICES_HARDWARE_TYPE and **COPYSERVICES_COMMPROTOCOL**:

COPYSERVICES_HARDWARE_TYPE	COPYSERVICES_COMMPROTOCOL	Default Port
DS8000	HTTPS	6989
	HTTP	6988

Advanced mode only

Yes.

COPYSERVICES_TIMEOUT

This parameter identifies the maximum length of time, in minutes, that the CIM Client waits for a response to a call sent to the CIMOM (CIM Agent). If the CIM Client does not receive a response within this time, an error message is sent.

Default

6

Advanced mode only

Yes.

FLASHCOPY_TYPE

This parameter specifies whether the storage solution does a bit-level copy of

data from one logical volume to another. This parameter applies to any FlashCopy storage system. The following options are available:

COPY Directs the storage system to run a bit-level copy of the data from one physical volume to another. Specify this value when the following conditions are true:

- A fast snapshot restore of a backed-up database is required.
- A complete copy of the database data on the target volume is required.

NOCOPY Directs the storage system to run a bit-level copy of a track if the data is modified after the initial FlashCopy request. This technique is typically referred as copy-on-write. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:

- A complete copy of the source volumes that contain the database files is not required on the target volumes.
- Backup time constraints are a concern.

INCR This option is similar to the COPY option but the INCR option copies only those tracks that were modified since the previous incremental FlashCopy was created. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:

- Tivoli Storage Manager backups are taken from disk copies. This type of backup creates less burden on the storage system than for the COPY option.
- A snapshot restore operation of the backed up database is to be completed.
- More frequent backups for the database are scheduled.

There must be only one target set specified in the target volumes file (.fct) for incremental snapshots. CIM errors might occur when more than one target set is specified. A successful backup of the database to the Tivoli Storage Manager server is possible even if the parameter is set to NOCOPY.

Default

COPY

Advanced mode only

No.

RESTORE_FORCE

This parameter specifies whether to force a restore. During a rerun of a snapshot restore, the message FMM0200E can be generated. This problem occurs if the background copy process of the previous snapshot restore is still running and the **RESTORE_FORCE** parameter is set to NO. There are two ways to resolve the issue that is identified by the message:

- Wait until the background copy process ends.
- Set the **RESTORE_FORCE** parameter to YES in the profile configuration file and try the snapshot restore again. This option withdraws all existing source and target relationships, and creates new source and target relationships. A full copy is completed. If you want to set **RESTORE_FORCE** to YES for a specific restore, you can create a temporary profile configuration file.

Default

NO

Advanced mode only

Yes

TARGET_SETS

This parameter specifies the target volumes to be used in the FlashCopy operation. The following list identifies the possible options:

VOLUMES_FILE

The name of the target volumes file (.fct).

Default

None.

Advanced mode only

No.

VOLUMES_FILE

This parameter specifies the name of the target volumes file (.fct).

Default

None.

Advanced mode only

No.

OFFLOAD

The OFFLOAD section of the configuration contains information that is related to Tivoli Storage Manager backups from a snapshot.

File names that are specified in the offload section, typically point to files that are on a backup server. There is an exception in the case of GPFS, the file names point to files in the cluster node where the offload agent is running. The parameters do not depend on the storage device. There are different parameter sets for environments in GPFS clusters and other environments.

The following list provides the parameters, a description of each parameter, and default values applicable for Custom Applications.

BACKUP_METHOD

This parameter is preset by the setup script (the profile configuration wizard). The setup script value depends on the environment where the setup script is running.

If the **BACKUP_METHOD** is TSM_CLIENT for custom applications, as set in the CLIENT section, the **APPLICATION_TYPE** is set to GENERIC.

The **BACKUP_METHOD** is automatically set to MMBACKUP for custom applications in a GPFS environment.

Default

Preset by the setup script, according to the environment.

Advanced mode only

Yes.

Parameters for offload for custom applications on supported storage hardware

The following list provides the parameters, a description of each parameter, and default values applicable in custom application environments:

MODE

This parameter determines which of the following Tivoli Storage Manager Backup Archive client backup functions to use when a Tivoli Storage Manager offloaded backup is created:

ARCHIVE

Creates an archive backup of all files and directories that are specified in the backup request. Directories are processed recursively.

The ARCHIVE mode is similar to the FULL mode, except that the archive management class is used instead of a backup management class. One of the advantages of the archive management class is that Tivoli Storage FlashCopy Manager does not need to resend all data after a failure during an archive operation. The remainder of the data is sent after the failure occurs.

FULL

Creates a full backup of all files and directories that are specified in the backup request. Directories are processed recursively.

DIFF

Creates a differential backup of all files and directories that are specified in the backup request. Directories are processed recursively. This operation backs up changes since the most recent full backup.

USE_FOR device class

Allows the backup mode to be changed based on the device class that is used to create the snapshot. Use this option to define rules that create a weekly full backup and daily incremental backups.

Tip: You can use the USE_FOR option to define multiple **MODE** statements within the OFFLOAD section.

Default

FULL

Advanced mode only

No.

ASNODENAME nodename

This required parameter identifies the name of the node where data is stored during a Tivoli Storage Manager offloaded backup.

ASNODENAME is the same option that can be set in the dsm.sys file.

Default

None. This parameter is required.

Advanced mode only

No.

VIRTUALFSNAME name

This parameter identifies the virtual file space name of a backup group. The parameter is available when the **MODE** parameter specifies a value of FULL or DIFF. VIRTUALFSNAME is optional.

Default

fcm

Advanced mode only

Yes.

DSM_DIR

This optional parameter identifies the path that is used for the *DSM_DIR* environment variable. For UNIX and Linux operating systems, this value specifies the path where the executable file *dsmc*, the resource files, and the *dsm.sys* file are stored.

Default

The default value is an empty string.

Advanced mode only

Yes.

DSM_OPT

This optional parameter identifies the path and file name of the Tivoli Storage Manager client options file: *dsm.opt*

Default

The default value is the path of the Tivoli Storage Manager client installation directory.

Advanced mode only

Yes.

DSM_LOG

This optional parameter identifies the path that is used for the Tivoli Storage Manager client error log file: *dsmerror.log*

Default

The default value is an empty string.

Advanced mode only

Yes.

Parameters for offload for custom applications in a GPFS cluster

The following offload parameters apply to GPFS environments:

MMBACKUP_SERVER

MMBACKUP_SERVER is a required parameter that identifies a Tivoli Storage Manager server where backup data is sent during an offloaded backup. Server names must be listed in the appropriate *dsm.sys* file. If data is to be sent to multiple Tivoli Storage Manager servers, multiple instances of this parameter can be specified. Snapshots are sent to each of the specified servers when a backup to the Tivoli Storage Manager is requested.

Default

There is no default value.

Advanced mode only

No.

Tivoli Storage FlashCopy Manager tries to create incremental backups that use the GPFS **mmbackup** command. In the case where a full backup was not completed to a particular Tivoli Storage Manager, a full backup is created.

A Tivoli Storage FlashCopy Manager offload operation fails when data is offloaded to two or more Tivoli Storage Manager servers when one server has data while another does not. If you want to add a Tivoli Storage Manager server to the list, create an offloaded backup to the new Tivoli Storage Manager server first. Afterward, offloaded backups can be done to all servers.

MMBACKUP_OPTIONS

Use this optional parameter to add options to the **mmbackup** command, which is

run by the Tivoli Storage FlashCopy Manager. For a list of **mmbackup** options, see http://www-01.ibm.com/support/knowledgecenter/STXKQY_4.1.1/com.ibm.spectrum.scale.v4r11.adm.doc/bl1adm_mmbackup.htm.

The following options are used by Tivoli Storage Manager, so cannot be set with this parameter: **-t**, **-S**, **-v**, **-L**, **--scope**, **--tsm-servers**, **--rebuild**. The **-q** option is used by Tivoli Storage FlashCopy Manager in certain circumstances, but can also be specified with **MMBACKUP_OPTIONS**. A Tivoli Storage FlashCopy Manager offload operation fails if the backup contains a root file set and option **-q** is specified.

If the options string contains a blank character, it must be in quotation marks.

Default

No options are specified.

Advanced mode only

Yes.

MMBACKUP_MAX_RETRIES

In a GPFS environment, the value for **MMBACKUP_MAX_RETRIES** indicates the maximum number of times the **mmbackup** command is retried after it returned an exit code 1.

Default

2

Advanced mode only

Yes.

DSM_DIR

This optional parameter applies for GPFS environments also. It identifies the path for the **DSM_DIR** environment variable. The **DSM_DIR** value shows the path where the executable file **dsmc**, resource files, and the **dsm.sys** file are stored.

Default

The default value is an empty string.

Advanced mode only

Yes.

Changing profile parameters

Except for the **GLOBAL** and **ACSD** sections, changes to the profile take effect immediately and do not require restarting Tivoli Storage FlashCopy Manager. Updates to the **GLOBAL** and **ACSD** sections require a restart of Tivoli Storage FlashCopy Manager.

About this task

To change the **GLOBAL** and **ACSD** sections, complete the following steps:

Procedure

1. For each system where Tivoli Storage FlashCopy Manager is installed, enter the following command to stop Tivoli Storage FlashCopy Manager:
`setup_type.sh -a stop`
2. Start the setup script by entering the appropriate command for your database environment: `./setup_gen.sh`
To use the advanced mode, use the **-advanced** option with the appropriate setup script command. In the advanced mode, you can specify more parameters.

3. Follow the setup script instructions that are displayed.
4. For each system where Tivoli Storage FlashCopy Manager is installed, enter the following command to start Tivoli Storage FlashCopy Manager:

```
setup_type.sh -a start -d Instance_owner_$HOME directory
```

Interdependency of LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND

The **LVM_FREEZE_THAW** and **TARGET_DATABASE_SUSPEND** parameters are interdependent.

These two Tivoli Storage FlashCopy Manager profile parameters are interdependent in the following manner:

- If **LVM_FREEZE_THAW** is set to YES, the database must be suspended. Otherwise, write operations to the database might time out and leave the database in an inconsistent state. A specified value of YES for **TARGET_DATABASE_SUSPEND** prevents this situation.
- If **LVM_FREEZE_THAW** is set to NO, the user might want to suspend the database without freezing the file system. Also, if JFS is used, freeze and thaw are not supported.
- If **LVM_FREEZE_THAW** is set to AUTO, and the file systems support the freeze function, the effect of AUTO is described in the following table. If the file systems do not support the freeze function, the AUTO value resolves to NO.

For Oracle ASM environments, **TARGET_DATABASE_SUSPEND** is independent of **LVM_FREEZE_THAW**, and **LVM_FREEZE_THAW** is not allowed for ASM.

The following table summarizes the actions taken depending on the values of the two parameters:

Table 13. Actions taken depending on values of LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND

Value of LVM_FREEZE_THAW	Value of TARGET_DATABASE_SUSPEND		
	YES	NO	OFFLINE
YES	Suspend and freeze	Terminate with an appropriate error message. Conflicting parameters.	Offline with freeze
NO	Suspend, no freeze	No suspend, no freeze	Offline without freeze
AUTO	Treat as LVM_FREEZE_THAW YES	Treat as LVM_FREEZE_THAW NO	Offline with freeze

Target set and target volumes

FlashCopy backups on DS8000, SAN Volume Controller, and Storwize family, require a target set for each set of source volumes to be backed up. The target set is a set of target volumes, and several target sets can be defined for use in different FlashCopy backups. The target volumes file, with extension .fct, identifies the target volumes to be used for a Tivoli Storage FlashCopy Manager backup.

The volumes in each target set that are used in a backup, must be specified in a separate target set. These target sets are specified in a target volumes file, the .fct file. The target set section name begins with the prefix **TARGET_SET** and is appended with a target set name. The target set name differentiates different target set sections. The target set name can be any alphanumeric value.

In the **TARGET_SET**, use the **TARGET_VOLUME** parameter for every target volume in the target set as shown in the following example:

```
>>> TARGET_SET 1
TARGET_VOLUME ...
.
.
.
TARGET_VOLUME ...
<<<
```

To specify multiple target sets in the target volumes file, add the next target set section with a unique target set ID as shown in this example:

```
>>> TARGET_SET 2
TARGET_VOLUME ...
.
.
.
TARGET_VOLUME ...
<<<
```

Comments can be entered before the first target set section only, and are indicated by a “#” character in the first column of each line. Tab characters can be entered.

When **VOLUMES_FILE** is specified in the profile, the target volumes file can have any file name and does not conform to any naming convention.

Target set definitions are not required on XIV system, IBM System Storage N series, and NetApp.

Related concepts:

Appendix C, “Examples,” on page 167

Manage target volumes files for your storage system

Different storage systems require different methods of target volume mapping. Use the **VOLUMES_FILE** parameter to share a target volume file between multiple device classes.

DS8000 and SAN Volume Controller, and Storwize family storage systems, need the **TARGET_SETS** parameter to specify the target volumes file, **VOLUMES_FILE**. For XIV system, N series, and NetApp target LUNs are created automatically without the target volumes files, as shown in the following table:

Table 14. Managing target volume LUNs by storage system

DS8000	SAN Volume Controller and Storwize family	XIV system	IBM System Storage N series and NetApp
Manual target LUN creation with the target volumes file (.fct) that defines the VOLUMES_FILE parameter.	Manual target LUN creation with the target volumes file (.fct) that defines the VOLUMES_FILE parameter. Or, Naming convention that defines the TARGET_NAMING parameter.	Automatic target LUN creation without using target volumes file (.fct).	Automatic target LUN creation without using target volumes file (.fct).

For Tivoli Storage FlashCopy Manager to associate a target volume to a source volume, the following criteria must be met:

The source volume and target volume must be in the same storage system.

The source volume and target volume must be the same size.

A target volume is selected for validation as a suitable target volume for the source volume depending on the value of the parameter **TARGET_SETS**.

If you moved data from Tivoli Storage Manager for Advanced Copy Services 5.5 or later to Tivoli Storage FlashCopy Manager, the **VOLUMES_DIR** parameter is deprecated. Use **TARGET_SETS VOLUMES_FILE** to specify the target volumes file.

VOLUMES_FILE

The **VOLUMES_FILE** parameter is used to share a target volume file between multiple device classes by restricting a target set to a specific **DEVICE_CLASS**. The target volume is validated as suitable for the source volume based on the value of the **TARGET_SETS** parameter. The following criteria must be in place for a valid target volume:

- A target volumes file, .fct, must be specified.
- A list of target volumes must be specified in the target volumes file. The source volumes and the size are optional.

This example shows the syntax of target volumes files that are specified by the **VOLUMES_FILE** parameter:

```
>>> TARGET_SET <target set name>
```

```
DEVICE_CLASS <device class name> # this parameter is optional and allows to
                                # restrict the use of this target set to a
                                # specific device class
```

```
>>> PARTITION <name of partition> # e.g. NODE0000 for partition 0 or NODE0001 for
#partition 1, ...
```

```
TARGET_VOLUME <target> [<source>] [<size>]
```

```
[...]
```

```
<<<
```

```
[...]
```

<<<

[...]

If no source is specified in the **TARGET_SETS** parameter and a FlashCopy relation exists between target volumes and a source volume, Tivoli Storage Manager for Advanced Copy Services checks for each of the specified target volumes. If a FlashCopy relation exists, it is reused for the next FlashCopy backup. However, if no FlashCopy relation exists to a source volume, a new relation between one source volume and the target is created with the next FlashCopy backup. In this case, the created source-target pairs are unpredictable because they depend on the order of the target volumes as listed in the target volumes file. There is also a dependency on the order of the source volumes as they occur in the operating system. If you want predefined source-target pairs, you must specify the dedicated source volume for each of the target volumes in the target volumes file. Alternatively you can ensure that all FlashCopy relations exist in the storage system before the start of the FlashCopy backup.

Related reference:

“DS8000 target volume parameter settings”

“SAN Volume Controller and Storwize family target volume parameter settings”
on page 137

DS8000 target volume parameter settings

Each target volume that is planned for use must be specified by its serial number for a DS8000 configuration.

A snapshot backup operation looks for either a source volume and target volume correlation, or a target-volume-only specification. A target set definition file contains a list of target volumes that are organized into target sets. Tivoli Storage FlashCopy Manager attempts to match source volumes to suitable targets within a target set during backup.

Table 15. Parameters of the 'VOLUMES_SET_X' Topic (DS8000)

Parameter Name	Value
TARGET_VOLUME <target volume serial number> <source volume serial number> <source volume size>	<p>Specify a source serial number with a target serial number in the target set definition file. This action determines source target relations. The relation between the source and target is required. Backup processing fails if one of the targets is unavailable for the specified source.</p> <p>This example shows a configuration where the DS8000 source volume with serial 75924811011 must be used in a FlashCopy with the target volume with serial number 75924811001.</p> <pre>TARGET_VOLUME 75924811001 75924811011 Size=2.0_GB</pre> <p>The source serial number and the size can be omitted or dashes can be entered in both fields as placeholders, as shown in the following example:</p> <pre>TARGET_VOLUME 75924811001 - -</pre> <p>Target volumes must meet the following requirements:</p> <ul style="list-style-type: none"> • The size of the target volume must be the same as the size of the source volume • The source and target volumes that are listed in one TARGET_SET must be in the same storage system • The order of the parameters, target volume serial number, source volume serial number, and size of source volume must not be changed.

Use the **FLASHCOPY_TYPE** parameter for DS8000 and SAN Volume Controller, and Storwize family. The following actions are possible:

- Change the **FLASHCOPY_TYPE** value of an existing target set
- Remove a target volume from an existing target set
- Remove a complete target set.

You must use the sequence of commands that are described in “Deleting snapshot backups” on page 146 with the force option.

SAN Volume Controller and Storwize family target volume parameter settings

Each target volume that is used, must be specified by the corresponding virtual disk name. A snapshot backup operation looks for either a source volume and target volume correlation, or a target-volume-only specification.

A target set definition file contains a list of target volumes that are organized into target sets. During the backup process, the Tivoli Storage FlashCopy Manager software attempts to match source volumes to suitable targets within a target set.

Table 16. Parameters of the 'VOLUMES_SET_X' topic (SAN Volume Controller and Storwize family)

Parameter Name	Value
TARGET_VOLUME <target volume virtual disk name> <source volume virtual disk name> <source volume size>	<p>Specify a source virtual disk name with a target virtual disk name in the target set definition file. This action determines source target relations. The relation between the source and target is required, backup processing fails if one of the targets is unavailable for the specified source.</p> <p>This example shows a configuration where the SAN Volume Controller source volume with virtual disk name <i>svdfsrc4</i> must be used in a FlashCopy with the target volume with virtual disk name <i>svdftgt4</i>. TARGET_VOLUME svdftgt4 svdfsrc4 Size=2.0_GB</p> <p>The source virtual disk name and the size can be omitted or dashes can be entered in both fields as placeholders, as shown in the following example: TARGET_VOLUME svdftgt4 - -</p> <p>Target volumes must meet the following requirements:</p> <ul style="list-style-type: none"> • The size of the target volume must be the same or greater than the size of the source volume. • The source and target volumes listed in one TARGET_SET must be in the same SAN Volume Controller cluster. • The order of the parameters must not be changed.

For more information about the criteria that are used to associate a target volume to a source volume, see “Target set and target volumes” on page 133.

Use the **FLASHCOPY_TYPE** parameter for DS8000, SAN Volume Controller, and Storwize family. The following actions are possible:

- Change the **FLASHCOPY_TYPE** value of an existing target set
- Remove a target volume from an existing target set
- Remove a complete target set.

To complete these types of changes, use the sequence of commands that are described in “Deleting snapshot backups” on page 146 with the force option.

For SAN Volume Controller 6.1 or later and Storwize family, with Tivoli Storage FlashCopy Manager software you can delete FlashCopy mappings that are not dependent on other FlashCopy mappings. Only the source and target FlashCopy mappings of the oldest backup can be deleted. If multiple backup generations are used and you want to delete a backup that is not the oldest backed up version, the background operation that deletes the mappings is delayed until all older backups are deleted or are reused by a new backup request.

The following example presents a typical Multiple Target FlashCopy (MTFC) cascade:

S->T4->T3->T2->T1

S = Source volume

T1-T4 = Snapshots taken at t1, t2, t3, t4 where T1 is the oldest,
T4 the most recent snapshot

T1 depends on T2,T3,T4,S
T2 depends on T3,T4,S
and so on...

Following the path from S to T4 is called *downstream*. The opposite direction is called *upstream*.

Example 1: T2 is restored

All upstream snapshot mappings are stopped: T3,T4

Example 2: T2 is overwritten by a new backup

All downstream snapshot mappings are stopped: T1

Related reference:

“SAN Volume Controller and Storwize family target volumes file example” on page 169

Tivoli Storage FlashCopy Manager password file

To access the storage system where the database volumes are stored, Tivoli Storage FlashCopy Manager requires a password file.

The password file contains a *master password* that is required by the agents such as application agents or offload agents, when they are authenticating or connecting to the Management Agent. When Tivoli Storage FlashCopy Manager agents are running in a distributed environment across multiple servers, separate password file instances can be used for different nodes. In a distributed environment, you must ensure that each local password file instance contains all the passwords that are needed by the agents that are running on the node. The master password must be included in all instances. Use the SSH for the setup to ensure that the password files are replicated to all nodes automatically.

The master password is only prompted for in advanced mode, and is only needed when you are installing Tivoli Storage FlashCopy Manager separately on the backup servers or cloning servers without using SSH. In this case, you must know the password. The password is defined when you configure the production server; for backup and cloning servers this password must be used so that the servers can connect to the management agent on the production server. When you use SSH for remote deployment to the backup and cloning servers, the password file is copied to the servers automatically.

A password file is created during the Tivoli Storage FlashCopy Manager configuration process. The setup script that is used for the configuration also updates information that is stored in the /etc/inittab directory. An example of the path to the password file follows:

```
<ACS_DIR>/shared/pwd.acsd
```

where <ACS_DIR> is the value of the **ACS_DIR** parameter in the profile. In basic mode, the password is not prompted as it is generated automatically if it is not set earlier. A generated password is available as the default password in advanced mode.

The minimum length of the master password is 8 characters. The password must contain at least one number and one letter. The use of special symbols increases the strength of the password.

IBM Global Security Kit configuration

IBM Tivoli Storage FlashCopy Manager uses the security suite IBM Global Security Kit (GSKit), for Secure Socket Layer (SSL) and Transport Layer Security (TLS) TCP/IP connections. GSKit supports Federal Information Processing Standards (FIPS140-2) and also incorporates the new security standards as defined in the Special Publications 800131 (SP 800-131). GSKit is automatically installed by Tivoli Storage FlashCopy Manager.

This security standard requires longer key lengths, stronger cryptographic algorithms, and incorporates TLS Protocol version 1.2.

During the installation, Tivoli Storage FlashCopy Manager automatically creates a new key pair and a self-signed certificate if no default certificate exists. The key pair is stored in the local key database file. The self-signed certificate is created from the key pair and automatically distributed to all backup and cloning servers through the existing SSH remote deployment mechanisms.

If you do not use the SSH remote deployment capabilities of Tivoli Storage FlashCopy Manager, you must complete the following steps:

1. Manually copy the self-signed certificate `fcmselcert.arm` file to the Tivoli Storage FlashCopy Manager `INSTANCE_DIR` directory on the backup and cloning servers. The manually copied self-signed certificate is imported automatically when the setup routine is rerun on the backup or cloning servers.
2. Globally install GSKit on each server by running the setup script as root user on the backup or cloning server. The required installation files are available in the `gskit_install` subdirectory of the Tivoli Storage FlashCopy Manager `INSTANCE_DIR` directory. The files are visible to the backup and cloning servers. To install GSKit, enter the command, `./setup_gen.sh -a install_gskit -d instance_directory`

If manually copying the self-signed certificate file to the backup and cloning servers is not feasible, as an alternative, use a signed certificate. The signed certificate can be from an internal or external certificate authority (CA). When SP800-131 encryption is enforced, the signed certificate must comply with the standard as defined by the National Institute of Standards and Technology (NIST) SP800-131 standard encryption. This standard requires a minimum key size = 2048 bits and a signature algorithm = RSA with SHA-224 or higher. Import the CA signed certificate to the key database on the production server.

If you use a standard CA-signed certificate, you do not need to handle `fcmselcert.arm` files. You must import the CA-signed certificate manually into the production server key ring. Use the GSKit command-line utilities to import the certificate to the production server. If the CA-signed certificate is not a standard certificate that GSKit has a root certificate for, you must import the certificate to all sites. No further action is necessary on the auxiliary server.

The following GSKit files are installed by Tivoli Storage FlashCopy Manager:

- A key database file, `fcmcert.kdb`, is in the **INSTANCE_DIR** directory.
The KDB file on the production server contains a new key pair and a self-signed certificate. On the backup and cloning servers, the KDB file contains the public part of the self-signed certificate.
- A request database file, `fcmcert.rdb`, is in the **INSTANCE_DIR** directory.

The request database file is used to store certificate requests that are associated with the key database. This file is automatically created when Tivoli Storage FlashCopy Manager creates a key database file. This file is created with the same name as the key database file, but with a `.rdb` extension.

- An encrypted stash file, `fcmcert.sth`.

The password that is protecting the key database file is generated automatically and is stored in the encrypted stash file.

- An ASCII encoded binary file, `fcmselfcert.arm`.

This file is used to export the public part of the self-signed certificate. It is also used to import the public part of the self-sign certificate to the backup and cloning servers.

When you install backup and clone servers separately without the use of SSH, the installation process installs and sets up IBM GSKit. In this scenario, after IBM GSKit installation, manually copy the self-signed certificate to the backup and cloning servers.

- A certificate revocation list file, `fcmcert.crl`.

This file contains a list of revoked certificates.

The `.kdb`, `.rdb`, `.crl`, and the `.sth` files contain critical security parameters and these parameters must be protected against unauthorized access by the operating system. It is advisable to back up the key database files regularly, especially if you are using a CA signed certificate.

If you are working with the self-signed certificates that are created by the setup script, you need to ensure that the `.arm` file is integrated on the auxiliary server. To do this, run the setup script on the production server through OpenSSL, or manually copy it to the auxiliary server and run the setup script there.

If you are using a CA signed certificate, you must use the GSKit command-line utilities to import the certificate to the production server. If the CA signed certificate is not a standard certificate that GSKit has a root certificate for, you must import the certificate to all sites.

Enforcing SP800-131 compliant encryption

The files that are needed for IBM GSKit are automatically installed during the installation. To enforce SP800-131 compliant encryption, during the configuration of Tivoli Storage FlashCopy Manager, you must set the **ENFORCE_TLS12** parameter to YES in the Tivoli Storage FlashCopy Manager profile file. You must use the advanced mode during the configuration to specify this parameter. Otherwise, TLS Protocol version 1.0 and 1.1 is enabled as the default value for the **ENFORCE_TLS12** parameter is NO.

Any existing self-signed certificates that were created by a previous version of Tivoli Storage FlashCopy Manager must be deleted to allow Tivoli Storage FlashCopy Manager to create new self-signed certificates. To remove any existing self-signed certificates, go to the Tivoli Storage FlashCopy Manager installation (*INSTANCE_DIR*) directory and enter the following command:

```
rm fmcert.*
```

Note: It is not required to delete existing external certificate authority (CA) signed certificates. However, if the CA signed certificate does not meet the minimum SP800-131 criteria, you must manually replace it with a new one.

Uninstall GSKit

GSKit must not be uninstalled unless you are sure that no product on the system is using it. By uninstalling GSKit you are removing the global GSKit installation from the system entirely.

If required, you can globally uninstall GSKit on each server by running the setup script on the backup or cloning server.

```
./setup_gen.sh -a uninstall_gskit -d instance_directory
```

Appendix B. Commands and scripts

A list of various commands and scripts that are used with Tivoli Storage FlashCopy Manager operations is provided.

About this task

You can issue various commands for example to trigger a snapshot backup or snapshot restore. In addition, administrative tasks such as to start or stop Tivoli Storage FlashCopy Manager can be issued from the command line.

Backup, restore, cloning commands, and utilities

You can issue commands to trigger a snapshot backup or snapshot restore, and to inquire and delete snapshot backups within the Tivoli Storage FlashCopy Manager repository. In addition, you can create and manage database clones from the command-line interface.

Backup and restore commands for custom applications

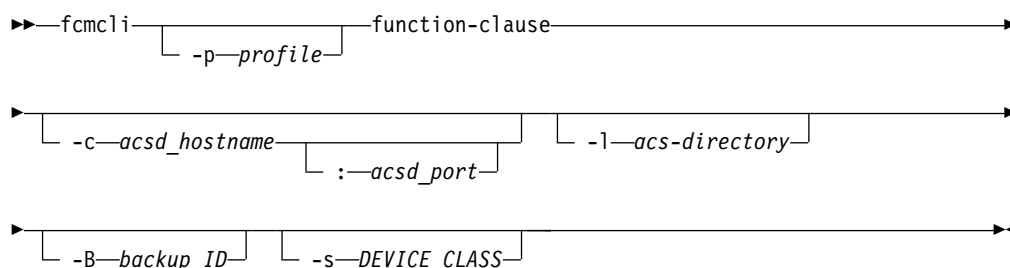
The Tivoli Storage FlashCopy Manager command line interface, `fccli`, is used to create snapshot backups, snapshot restores, inquire, and delete operations for applications when a native backup adapter does not exist.

When you run the `fccli` command, provide a list of files for which a snapshot backup is created. You can specify the list of files either through the configuration file or through the command line interface. Optionally, you can provide `fccli` with the following scripts:

- A script to prepare your environment before the snapshot is created. For instance, provide a script to quiesce or shutdown the applications that are backed up.
- A script to resume your environment after the snapshot is complete.

If specified, the scripts are started immediately before and after the snapshot is created to minimize application downtime.

`fccli` command

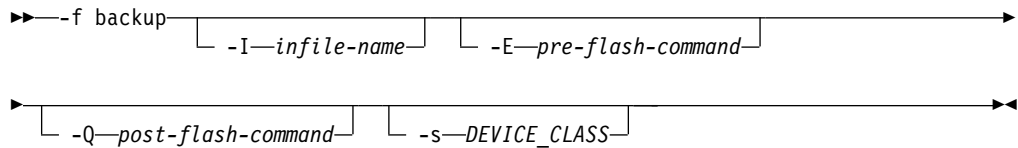


The values for the `function-clause` parameter are described in the following sections.

FlashCopy operations of custom applications: `function-clause`:

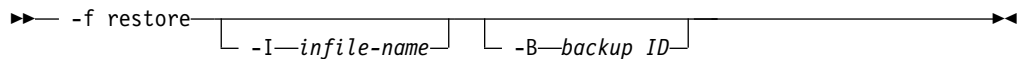
The following functions are supported by the **fcmccli** command option **-f** 'function' for FlashCopy Manager for Custom Applications backups of custom applications:

fcmccli command functions



The following functions are supported by the **fcmccli** command option **-f** function for FlashCopy restores, inquire, and delete of custom applications:

fcmccli command functions



fcmccli command functions

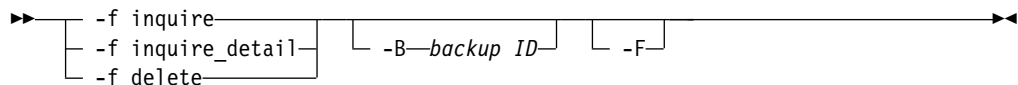


Table 17. Options for the Tivoli Storage FlashCopy Manager **fcmccli** command for custom applications

Option	Description	Default
-p profile	Full profile name.	INSTANCE_DIR/profile
-c acsd-hostname	Name of the server where the management agent, acsd, is running.	localhost
acsd-port	TCP/IP port number or service name on which the management agent, acsd, is listening.	57328
-l acs-directory	Directory where the logs and shared directories can be found.	ACS_DIR
-f backup	Back up a custom application.	
-f restore	Restore a regular DB2 snapshot backup (with advanced restore options) or restore a custom application backup.	

Table 17. Options for the Tivoli Storage FlashCopy Manager **fmccli** command for custom applications (continued)

Option	Description	Default
-E preflash command	<p>Overrides the value of the PRE_FLASH_CMD parameter as specified in the CLIENT section of the profile. The preflash command is run on the production server and can be a script. The return code of the preflash command is evaluated as follows:</p> <p>0 Successful. The Tivoli Storage FlashCopy Manager backup operation continues.</p> <p>Any value other than 0 Unsuccessful. The Tivoli Storage FlashCopy Manager backup operation stops.</p>	
-Q postflash command	<p>Overrides the value of the POST_FLASH_CMD parameter as specified in the CLIENT section of the profile. The postflash command is run on the production server and can be a script. The return code of the postflash command is evaluated as follows:</p> <p>0 Successful. The Tivoli Storage FlashCopy Manager backup operation continues.</p> <p>Any value other than 0 Unsuccessful. The Tivoli Storage FlashCopy Manager backup operation stops.</p>	
-I infile	<p>Overrides the value of the INFILE parameter as specified in the CLIENT section of the profile. The fmccli functions inquire, inquireDetails, and delete do not recognize the infile parameter. The function restore accepts infile as an optional parameter.</p>	

Table 17. Options for the Tivoli Storage FlashCopy Manager **fcmlcli** command for custom applications (continued)

Option	Description	Default
-F	Use the force option with the inquire , inquire_detail , or delete functions. When used with inquire or inquire_detail , all available backups and all backups marked for deletion are displayed. When used with the delete function, the force option withdraws the source target FlashCopy relations on DS8000 or SAN Volume Controller.	None.
-v	Display version.	
-h	Display help text.	
-B	The Backup ID as displayed by fcmlcli -f inquire [_detail] or db2acsutil .	None.
-s <i>DEVICE_CLASS</i>	The name of the DEVICE_CLASS section in the profile that is used for the backup operation.	As specified in the profile.

- The return code of the **fcmlcli** command is 0 if it finishes the request without an error or if there were no candidates for the request.
- The return code is 1 if one or more minor issues occur that are not critical but must be checked to prevent major issues later.
- The return code is 2 indicating that an error occurred during the command execution.

The following sections describe the details of the various functions that are specified with the **-f** option of the Tivoli Storage FlashCopy Manager command, **fcmlcli**.

Deleting snapshot backups

Tivoli Storage FlashCopy Manager snapshot backups can be deleted from the snapshot repository.

Before you begin

Optionally, you can delete snapshot backups on DS8000 and SAN Volume Controller storage subsystems that contain a dedicated set of target volumes in one or more target sets. With IBM XIV Storage System, IBM System Storage N series, and NetApp storage solutions you can create as many snapshot backups as needed, and old backups are manually deleted. Old backups can also be deleted automatically by using the **MAX_VERSIONS** (**MAX_SNAPSHOT_VERSIONS**) parameter.

About this task

Manually delete a Tivoli Storage FlashCopy Manager snapshot backup by following the procedure.

Procedure

1. Run the following command to unmount the file systems and export the volume groups on a backup system. This method is used when the backup that is using this target set is currently mounted. This step can be omitted if the backup is not currently mounted.

```
fccli -f unmount [-B <backupID>]
```

2. Based on the use of this target set, any existing source, and target FlashCopy relationships (such as INCR or NOCOPY) must be withdrawn. Run the following command:

(Custom applications) `fccli -f delete -B <backupID>`

Results

Note: (IBM XIV Storage System, IBM System Storage N series, and NetApp): These commands delete the snapshot backup in the Tivoli Storage FlashCopy Manager snapshot repository, and the snapshot on the storage system is also deleted.

Note: (DS8000 or SAN Volume Controller): These commands delete the snapshot backup in the Tivoli Storage FlashCopy Manager snapshot repository only. The source and target relations on DS8000 or SAN Volume Controller are not withdrawn.

Deleting a target volume or target set

To remove a target volume from a target set or to remove a complete target set, run the following steps to free up the target volumes:

Procedure

1. Run the following command to unmount the file systems and export the volume groups on a backup system. If the backup is not mounted, do not run this step.

```
fccli -f unmount [-B <backupID>]
```

This method is used when the backup that is using this target set is mounted

2. Based on the use of this target set, any existing source, and target FlashCopy relationships (such as INCR or NOCOPY) must be withdrawn. Run the following command:

For custom applications, `fccli -f delete -B <backupID> -F`

Results

The withdrawal of the source and target FlashCopy relationship is done by the Tivoli Storage FlashCopy Manager generic device agent, `acsngen`, as a background operation. This process can take up to 10 minutes. Do not try to reuse the target volumes before the actual process completes successfully.

Snapshot backup status in the repository

Ensure that you routinely check the status of the Tivoli Storage FlashCopy Manager repository.

To check the status of snapshot backups in the Tivoli Storage FlashCopy Manager repository, use one of the following commands:

For custom applications, `fccli -f inquire[_detail]`

When using the `inquire_detail` command with the appropriate tool, output similar to the following displays:

```
Type Partition Backup-ID TSM Backup-ID State
DevClass TargetSet Background Copy ByteStobeFlashcopied
#BACKUP NODE0000 C01__A0FY303K6B IN-PROGRESS MIRROR1 1 3.000GB of 3.000GB
3.000GB
UsabilityStates :
REMOTELY_MOUNTABLE,REPETITIVELY_RESTOREABLE,SWAP-RESTORABLE,PHYSICAL_PROTECTION,
FULL_COPY,TAPE_BACKUP_PENDING
```

Administrative commands

You can use commands to administer Tivoli Storage FlashCopy Manager.

Administrative commands are available for you to do the following tasks:

- Start, stop, or configure Tivoli Storage FlashCopy Manager.
- Mount or unmount a snapshot backup on a secondary system.
- Create a backup to Tivoli Storage Manager from a snapshot if you have Tivoli Storage Manager configured in your environment

To use the commands to automate operations for Tivoli Storage FlashCopy Manager, add entries to the cron table (crontab) file. Because there are so many ways to implement Tivoli Storage FlashCopy Manager software, there are no templates. To automate operations, either specify the commands in the crontab file, or create scripts and add the scripts to the crontab file.

Configuration commands

Use configuration commands to run the setup script, maintain Tivoli Storage FlashCopy Manager passwords, and query the amount of storage space that is used for backups.

Installation setup script

The setup script provides instructions for configuration. The setup script is used by the Tivoli Storage FlashCopy Manager installation program. The setup script can also be used to manually set up Tivoli Storage FlashCopy Manager, and to complete a basic configuration.

The setup script uses the following command syntax:

```
setup_type.sh -a action -d Instance_owner_$HOME directory
```

For the *type* parameter, in the setup script name, the following values can be specified:

- `setup_gen.sh`

You can use the setup script for the following purposes:

- Activation or upgrade of Tivoli Storage FlashCopy Manager for one instance-specific installation, as root user:

```
setup_type.sh -a install -d Instance_owner_$HOME_directory
```

The setup script is run from the *FCM_INSTALL_DIR* directory.

- Initial configuration and reconfiguration:

```
setup_type.sh
```

The setup script must be run as the database instance owner.

For custom applications, run the script as the application backup user. Run the script from the *INSTANCE_DIR* directory.

- Initial configuration and reconfiguration in advanced mode:

```
setup_type.sh -advanced
```

- Stopping an activated instance:

```
setup_type.sh -a stop -d Instance_owner_$HOME_directory
```

The command must run as the database instance owner.

For custom applications, run the command as the application backup user. The command must be run from the *INSTANCE_DIR* directory.

- Starting an activated instance:

```
setup_type.sh -a start -d Instance_owner_$HOME_directory
```

The command must be run as the database instance owner.

For custom applications, run the command as application backup user. The command must be run from the *INSTANCE_DIR* directory.

- Disabling a stopped instance:

```
setup_type.sh -a disable -d Instance_owner_$HOME_directory
```

The command must be run as the database instance owner.

For custom applications, run the command as the application backup user. The command must be run from the *INSTANCE_DIR* directory. This command completely removes the entries from the */etc/inittab*.

For a typical configuration, these commands are run on a production system. There are some scenarios where these commands need to be run on a backup system. If you are running the commands on both systems, when you stop or disable Tivoli Storage FlashCopy Manager, run the command on the production system before the backup system.

The setup script can be used to install Tivoli Storage FlashCopy Manager on multiple backup nodes from the production server. As a prerequisite, Open Secure Shell (OpenSSH) must be installed on all of the nodes in the backup server. NFS shares between the production server and backup server nodes are not required for this type of remote installation. OpenSSH is the preferred method for Tivoli Storage FlashCopy Manager.

The default action, setup, is performed and the instance is configured.

For FlashCopy Manager for Custom Applications, there is no database instance-specific directory. The script must be run from the *\$HOME* directory of the backup user. The backup user needs to be able to access all file systems that are going to be protected.

If the script is called without parameters, it can be issued as the instance owner. The script creates a profile or changes an existing profile, and updates `/etc/inittab` according to the current profile (production system) or user preference (backup system). Updates to `inittab` require starting and stopping Tivoli Storage FlashCopy Manager as intermediate steps. This call cannot stop the Tivoli Storage FlashCopy Manager on the backup system if the following conditions are present:

- Tivoli Storage FlashCopy Manager is running on the production system
- The binary files in the instance-specific installation directory are NFS-shared between the production and backup systems.

If Tivoli Storage FlashCopy Manager cannot be stopped, stop Tivoli Storage FlashCopy Manager on the production system before you run the script with the `-a install -d Instance_owner_$HOME_directory` options.

Setup script values

The following values are available for `setup_type.sh`.

The following values are available for action: The instance directory name (`-d` option) is required for all explicit actions.

Use `setup_gen.sh` to configure FlashCopy Manager for Custom Applications.

disable

This call can be issued as the root or instance owner. It stops Tivoli Storage FlashCopy Manager and removes all entries from `/etc/inittab`. To reactivate Tivoli Storage FlashCopy Manager, call the script without parameters.

This call cannot stop Tivoli Storage FlashCopy Manager on the backup system if the following conditions are present:

- Tivoli Storage FlashCopy Manager is running on the production system
- The binary files in the instance-specific installation directory are NFS-shared between the production and backup systems.

If Tivoli Storage FlashCopy Manager cannot be stopped, stop Tivoli Storage FlashCopy Manager on the production system before running `setup_type.sh -a install -d <Instance owner $HOME directory>`.

install

This call needs to be issued with the root user ID. When issued, the following actions are completed:

1. Stops Tivoli Storage FlashCopy Manager (`setup_type.sh -a stop -d <Instance owner $HOME directory>`) For DB2 databases, change `<INSTANCE owner $HOME directory>` to `<INSTANCE owner $HOME directory>/sqlib`.
2. Copies all binary files from the Tivoli Storage FlashCopy Manager installation directory to the instance-specific installation directory (`INSTANCE_DIR`)
3. Sets the appropriate access rights for the binary files.
4. Restarts Tivoli Storage FlashCopy Manager (`setup_type.sh -a start -d <Instance owner $HOME directory>`).

The steps to start and stop Tivoli Storage FlashCopy Manager are skipped if it is not configured.

This call cannot stop Tivoli Storage FlashCopy Manager on the backup system if the following conditions are present:

- Tivoli Storage FlashCopy Manager is running on the production system

- The binary files in the instance-specific installation directory are NFS-shared between the production and backup systems.

If Tivoli Storage FlashCopy Manager cannot be stopped, stop Tivoli Storage FlashCopy Manager on the production system before running `setup_type.sh -a install -d <Instance owner $HOME directory>`.

start

This call can be issued as the root or instance owner. The call starts a previously installed and configured version of Tivoli Storage FlashCopy Manager. This call starts different entries in `/etc/inittab`, by changing the action for the existing entries to *respawn*, depending on whether the call is issued on the backup or production system.

stop

This call can be issued as the root or instance owner. It stops the version of Tivoli Storage FlashCopy Manager that is currently running. This call updates `/etc/inittab` and checks that Tivoli Storage FlashCopy Manager is stopped successfully (a write lock can be acquired for the `.lock` file that is located in the instance-specific installation directory).

This call fails on the backup system in environments where the instance-specific installation directory is shared between the production and backup systems, if Tivoli Storage FlashCopy Manager is running on the production system. To successfully stop Tivoli Storage FlashCopy Manager in those environments, stop Tivoli Storage FlashCopy Manager on the production system.

This option is not required for the default setup function.

Setting or changing passwords with the setup script

You can set or change passwords by issuing the setup script without the `-a` action option.

Use the command in this example:

```
setup_type.sh
```

Running the setup script without the `-a` action option proceeds through several tasks that are similar to the tasks described in Chapter 5, “Installing and upgrading,” on page 35.

When this command is issued, the profile wizard starts. You can use the profile wizard to edit the profile, and to set or change passwords. Using this wizard to administer passwords is preferred because the wizard updates changed passwords on the backup systems. To update passwords on the backup system, specify *YES* at the following prompt:

Select the backup system to update or delete:

- 1) acsback5
- n) configure a new backup system
- b) return to previous menu
- q) quit configuration

Select one of the options.

1

The selected backup system is acsback5

The backup system on acsback5 is configured with the device class(es) `DISK_ONLY`.

Select the action you want to take on the backup system acsback5:

- 1) update IBM Tivoli Storage FlashCopy Manager installation
- 2) start IBM Tivoli Storage FlashCopy Manager services
- 3) stop IBM Tivoli Storage FlashCopy Manager

```

4) uninstall IBM Tivoli Storage FlashCopy Manager
5) setup the SSH key authentication
b) return to backup system selection
q) quit the configuration
Select one of the options.
1

```

Do you want to update the Backup System installation on acsback5? [y|n] [y]

Password administration

You can use the `setup.sh` script or the `fcmcli -f password` command to change the Tivoli Storage FlashCopy Manager passwords.

The `fcmcli -f password` command supports an interactive and a non-interactive mode. To use the interactive mode, do not enter a password when you issue the command and you are prompted to enter the following passwords:

- The master password, which is the password of the acsd management agent. By default, a 32 character password is automatically generated. However, you can enter an alternative password.
- The password for the ORACLE section if defined in the specified profile.
- The password for the DB2STANDBY section if defined in the specified profile.
- The passwords for the disk storage subsystems that are referenced by the `DEVICE_CLASS` sections in the specified profile.

If the specified profile contains multiple `DEVICE_CLASS` sections that reference the same physical disk storage subsystem, the password is queried one time by combining these `DEVICE_CLASS` sections.

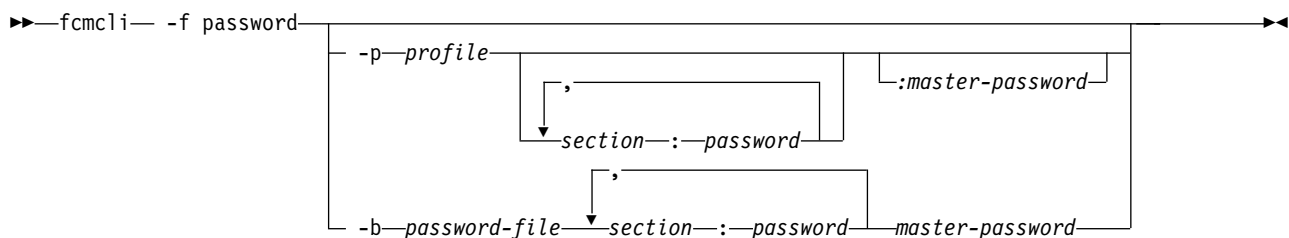
The interactive mode is the preferred method for setting passwords. Using this method, the passwords are verified by testing the connections to the corresponding storage devices, management agent, or database. For the non-interactive mode, the command syntax is verified but no additional validations are performed.

Note: The minimum length of the master password is 8 characters. The password must contain at least one number and one letter. The use of special symbols increases the strength of the password.

Tip: To ensure that backup servers are also updated by SSH if applicable, use the setup scripts to modify any passwords.

Use the following syntax to change the passwords for intercommunication between Tivoli Storage FlashCopy Manager components, and communication to Oracle and DB2 databases and to storage devices.

fcmcli command: -f password



Parameters

-p *profile*

Specify the full path and name of the profile that is used. If the path is not specified, the profile file in the current working path is used.

In interactive mode, the command searches the profile for the ORACLE, DB2STANDBY, and DEVICE_CLASS sections and then requests you to enter the relevant passwords.

-b *password-file*

Specify the password file to be created or updated. By default, the shared/acsd.pwd password file is in the directory that is specified by the **ACS_DIR** parameter. This parameter is included in the GLOBAL section of the profile file. This information is read from one of the following profiles:

- When the -p option is not specified, the profile file in the current working directory is used.
- When the -p option is specified, the profile file that is specified by this option is used.

sectionname:password

Specify the password for the user account that is referenced by the ORACLE, DB2STANDBY, and DEVICE_CLASS sections of the profile. To specify the password for the DEVICE_CLASS section, replace the *sectionname* variable with the *DEVICE_CLASS:device class name* variable for example, *DEVICE_CLASS:STANDARD*. Use this syntax when you specify the password: *DEVICE_CLASS:device class name:password*.

No spaces are allowed between the *sectionname:password* syntax.

:masterpassword

Specify the master password that is used to authenticate a library or agent to the acsd management agent. Alternatively, enter the value *auto* to enable Tivoli Storage FlashCopy Manager to auto-generate a password. For example, issue the following command to auto-generate the master password:

```
./fcmcli -f password :auto
```

GSKit commands

If you are not using SSH for remote installation and configuration of Tivoli Storage FlashCopy Manager on backup and cloning systems, use GSKit commands to manually import a self-signed certificate. If you decide to use a CA signed certificate, use GSKit commands to complete a manual setup.

Manually importing the self-signed certificate

The self-signed certificate is automatically created by Tivoli Storage FlashCopy Manager. When the Tivoli Storage FlashCopy Manager setup script is run on the production server, it automatically creates the *fcmselfcert.arm* file. It is stored on the production server in the default installation path. The *fcmselfcert.arm* file is automatically imported on the backup and cloning servers from the production server with the SSH remote deployment mechanisms of the setup script. When remote deployment is not used and you separately run the setup script on the backup or cloning server, the *fcmselfcert.arm* file if present is automatically imported to the local key database and then deleted. To use this automation, copy the *fcmselfcert.arm* file from the production server to either the backup or cloning server before you start the setup routines on the backup or cloning server.

Alternatively, you can import the self-signed certificate by using the following GSKit command. However, in most scenarios this step is not necessary as the file is automatically imported as part of the Tivoli Storage FlashCopy Manager setup process.

```
gsk8capicmd_64 -cert -add -db fmcert.kdb -stashed -label "FCM server  
certificate" -file <path to fcmselfcert.arm> -format ascii
```

This command fails if the key database already contains a certificate with the label FCM server certificate. To remove the certificate with the label FCM server certificate, you can use the following command:

```
gsk8capicmd_64 -cert -delete -db fmcert.kdb -stashed -label "FCM server  
certificate"
```

CA Certificate

You can use a CA signed certificate for Tivoli Storage FlashCopy Manager. If the certificate that is assigned by a CA has no built-in GSKit support, import the CA root certificate into the key database file (fmcert.kdb). Use the GSKit command-line utilities to update the file on the production system, the backup system, and the cloning system. The root certificate of a trusted CA certificate is in the key database. GSKit has the following trusted root certificates:

- Entrust.net Global Secure Server Certification Authority
- Entrust.net Global Client Certification Authority
- Entrust.net Client Certification Authority
- Entrust.net Certification Authority (2048)
- Entrust.net Secure Server Certification Authority
- VeriSign Class 3 Public Primary Certification Authority
- VeriSign Class 2 Public Primary Certification Authority
- VeriSign Class 1 Public Primary Certification Authority
- VeriSign Class 4 Public Primary Certification Authority - G2
- VeriSign Class 3 Public Primary Certification Authority - G2
- VeriSign Class 2 Public Primary Certification Authority - G2
- VeriSign Class 1 Public Primary Certification Authority - G2
- VeriSign Class 4 Public Primary Certification Authority - G3
- VeriSign Class 3 Public Primary Certification Authority - G3
- VeriSign Class 2 Public Primary Certification Authority - G3
- VeriSign Class 1 Public Primary Certification Authority - G3
- Thawte Personal Premium CA
- Thawte Personal Freemail CA
- Thawte Personal Basic CA
- Thawte Premium Server CA
- Thawte Server CA
- RSA Secure Server Certification Authority
- Secure Server Certification Authority

The following example shows the command to request that a CA signed certificate is included:

```
gsk8capicmd_64 -certreq -create -db fmcert.kdb -stashed -label "FCM server  
certificate request" -dn dist_name -target fcmservercertreq.arm
```


For SP800-131 compliance, when the **ENFORCE_TLS12** parameter is set to YES in the Tivoli Storage FlashCopy Manager profile, ensure that the certificate meets the minimum requirement by adding the following two options:

- `-size 2048` (or higher)
- `-sigalg sha224` (or higher)

Note: Tivoli Storage FlashCopy Manager creates a self-signed certificate that is signed with SHA512, and the size is 4086 bits.

The **label** parameter can have any value except FCM server certificate. This value is already used by the self-signed certificate in the key database.

When you use a certificate that is signed by a CA that has no built-in GSKit support, you must import the CA root certificate. This task must be completed before the certificate is received or imported. The CA root certificate must be imported into the key database (KDB) files on the production system. The CA root certificate must also be imported into the KDB files on the backup and cloning servers. Issue the following command to import the root certificate:

```
gsk8capicmd_64 -cert -add -db fmcert.kdb -stashed -label "FCM server certificate request" -file path to CARootCertificate.arm
```

Issue the following command to import a signed certificate when it is received from a CA:

```
gsk8capicmd_64 -cert -receive -file fcmservecertsigned.arm -db fmcert.kdb -stashed
```

Rename the CA signed certificate label to FCM server certificate. Usually, the key database still contains the self-signed certificate, it must be deleted before the CA signed certificate can be renamed. To remove the self-signed certificate from the key database, issue the following command:

```
gsk8capicmd_64 -cert -delete -db fmcert.kdb -stashed -label "FCM server certificate"
```

To rename the CA signed certificate issue the following command:

```
gsk8capicmd_64 -cert -rename -db fmcert.kdb -stashed -label "FCM server certificate request" -new_label "FCM server certificate"
```

The file `fcmselfcert.arm` is used to export the self-signed certificate. When you use a CA certificate, the `.arm` file is obsolete and must be deleted on the production system. The self-signed certificate is automatically removed from the key database on the backup or cloning system during the next remote update with the setup script. If remote deployment is not used, you can manually remove the self-signed certificate from the key database on the backup and cloning servers. To remove the self-signed certificate, issue the following command:


```
gsk8capicmd_64 -cert -delete -db fmcert.kdb -stashed -label "FCM server certificate"
```

Monitoring the expiry date of certificates

When a self-signed certificate is created, an expiry date can be specified. The expiration time of the certificate is specified in days. The default is 365 days. The duration is 1-7300 days (20 years). The Tivoli Storage FlashCopy Manager setup script creates the self-signed certificate for the production, backup, and cloning servers. The expiration time of all self-signed certificates that is generated by the setup script is 20 years. If you are using CA signed certificates, the expiration date is set by the certificate authority. You must monitor certificates for expiry and

remove any expired certificates. If the key database does not contain a valid certificate with the label FCM server certificate and the setup script is rerun, a new self-signed certificate is generated. The.kdb, .rdb, .arm and .sth files are rewritten.

Related information:

 ftp://ftp.software.ibm.com/software/webserver/appserv/library/v80/GSK_CapiCmd_UserGuide.pdf

Query managed capacity

Use the **managed_capacity** command to display information about Tivoli Storage FlashCopy Manager managed capacity and licensing.

Enter the following command to generate an XML managed capacity and licensing report to a specified directory:

```
fcmlcli -f managed_capacity [-p profile] [-o <output_directory>]
```

The report that is generated lists the capacity value that is calculated from source disks that are protected by Tivoli Storage FlashCopy Manager for which a FlashCopy or snapshot backup was created. If a volume contains multiple backups, that volume is counted once during the query. Identify the repository from which to list backups by specifying the profile that is associated with the source volume. The output displays the total managed capacity for all source volumes.

Tip: Ensure to regularly delete old copies of managed capacity reports from the output directory.

The **fcmlcli -f managed_capacity** syntax is as follows:

```
fcmlcli -f managed_capacity [-p profile] [-c] [-o<output_directory>]
```

- p** Specify the name of the Tivoli Storage FlashCopy Manager profile that is associated with the backups on the volume.
- c** Specify this option to display the output as comma-separated values.
- o** Specify this option to print the report to a specified directory as an XML report to view in your browser. When you do not specify a **-o** directory, the report is printed to *ACS_DIR/capacity_reports*.

Example output

This command displays capacity for the profile in /ca/S01/acs:

```
fcmlcli -f managed_capacity -p /ca/S01/acs/profile
```

Output:

```
FMM0461I Created tracefile '/ca/S01/acs/logs/fmquery.trace' for process ID '31634'.
FMM1498I Front-End Capacity Report: Total protected size: 108.723 MB
FMM1497I Front-End Capacity Report: Number of managed objects: 1
FMM1496I Back-End Capacity Report: Total protected size: 217.445 MB
FMM1493I Back-End Capacity Report: Number of managed objects: 2
FMM1495I Logical Unit (LUN) Capacity Report: Total protected size: 768.000 MB
FMM1494I Logical Unit (LUN) Capacity Report: Number of managed objects: 2
```

This command displays all volumes for the profile that is in /ca/S01/acs as comma-separated values:

```
fcmccli -f managed_capacity -p /ca/S01/acs/profile -c
```

Output:

```
...
tsm_sur_capacity,0
tsm_sur_objects,0
fcm_be_capacity,0
fcm_be_objects,0
fcm_lun_capacity,8589934592
fcm_lun_objects,4
tsm,no
```

For more information about front-end and back-end capacity and how to measure them, see the latest User's Guide at this site ftp://public.dhe.ibm.com/storage/tivoli-storage-management/front_end_capacity_measurement_tools/

Background daemons

For Tivoli Storage FlashCopy Manager to work, some background daemon processes are required. Background daemon processes are not started directly. Instead, they are usually added to the `/etc/inittab` through the `setup_*.sh` commands.

To support high availability environments where the `/etc/inittab` cannot be used, you can instruct the `setup_*.sh` scripts to provide you with the exact commands that must be added to your high availability scripts instead of adding entries to `/etc/inittab`.

Management agent: acsd

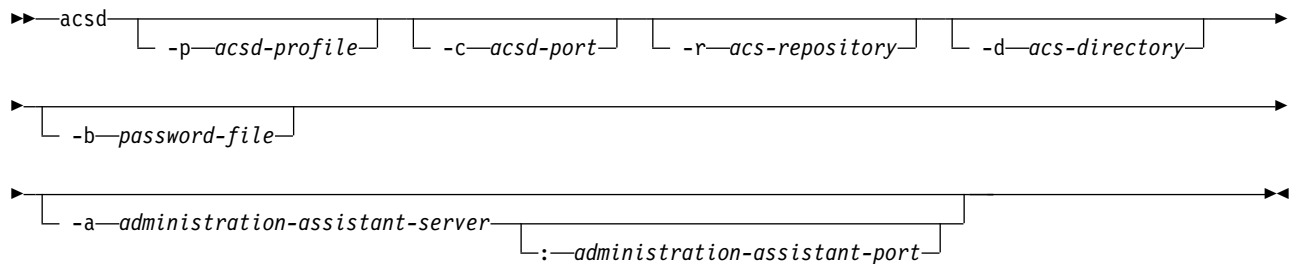
The management agent, `acsd`, coordinates the snapshot backup operation. It is a background daemon process that starts automatically.

The management agent, `acsd`, controls the backup flow and mediates between the other agents. The `acsd` agent provides access to the snapshot backup repository, which contains information about the valid snapshot backups and their relationships to snapshot capable storage devices.

(DB2) `acsd` must be started as the DB2 instance owner.

If you must deviate from the standard installation, the management agent offers the following command options for customization:

acsd management agent



Syntax for obtaining version or help information:

acsd management agent help



Table 18. Options for starting the management agent, *acsd*, as a daemon process

Option	Description	Default	Overrides profile parameter
-p acsd-profile	Full path and name of the profile that is used by the management agent. The management agent uses the GLOBAL and acsd sections of the configuration profile.	INSTANCE_DIR/profile	
-c acsd-port	TCP/IP port number or service name on which the management agent is listening	57328	ACSD (port number or service name)
-r acs-repository	Directory name where the snapshot backup repository is located	None	ACS_REPOSITORY
-d acs-directory	Name of Tivoli Storage FlashCopy Manager directory	ACS_DIR	
-b password-file	File in which the Tivoli Storage FlashCopy Manager management agent password is stored (in encrypted form). See notes.	ACS_DIR/shared/pwd.acsd	No corresponding profile parameter.
-a administration-assistant-server	(SAP) Host name of the server on which the Administration Assistant is running	None	ADMIN_ASSISTANT (hostname)
administration-assistant-port	(SAP) TCP/IP port on which the Administration Assistant is listening	None	ADMIN_ASSISTANT (port number)
-v	Display version and help information	None	N/A
-h	Display help information only	None	N/A

All parameters override the values that are specified in the *acsd* profile or the corresponding default values. The *shared* and *logs* directories are automatically created in *ACS_DIR*. If no parameters are entered, *acsd* starts with the default profile and uses the default parameter values where applicable, or an error message is shown if this profile does not exist.

(DB2) When a user installs DB2 and creates a DB2 instance, the *acsd* management agent, is copied to the *DB2 instance directory/acs* directory. To activate Tivoli Storage FlashCopy Manager, the user must start the setup script as the DB2 instance owner from this same directory. This script creates two entries in the

/etc/inittab directory. The management agent, acsd, starts automatically from the /etc/inittab directory without any command-line arguments. The default values are used for configuring the management agent, acsd. The default values can be overridden by providing a profile. By default, this profile is in the directory *DB2 instance directory/acs*.

When acsd is started for the first time, or with a new **ACS_DIR** parameter, the following actions occur:

- Create the subdirectories shared and logs
- Create a password file pwd.acsd in the shared subdirectory
- Generate a master password

When the snapshot backup library uses the same ACS_DIR, it can authenticate itself to acsd with the password provided in the pwd.acsd file. If the snapshot backup library uses a different ACS_DIR, the default password file pwd.acsd must be copied to that directory so that they can read the master password from that directory.

Note: The minimum length of the master password is 8 characters. It must contain at least one number and one letter. The use of special symbols increases the strength of the password.

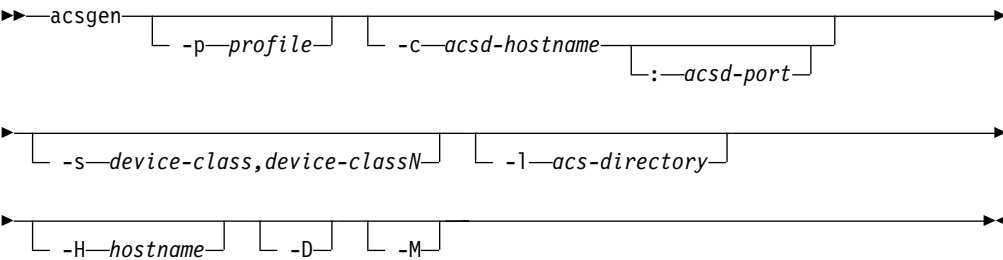
Generic device agent: acsgen

The generic device agent, acsgen, is the component that uses adapters to start snapshot commands on snapshot-compatible devices.

The generic device agent, acsgen, is started as a background daemon so you are not required to manually start it.

If you must deviate from the standard installation, the generic device agent, acsgen, offers the following command options for customization:

acsgen generic device agent



Syntax for obtaining version or help information:

acsgen generic device agent help

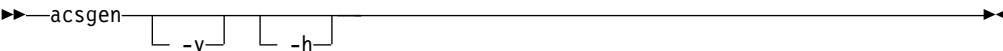


Table 19. Options for starting the generic device agent, acsgen. Description of acsgen options with default values if applicable.

Option	Description	Default
-p profile	Full profile name.	<INSTANCE_DIR>/profile

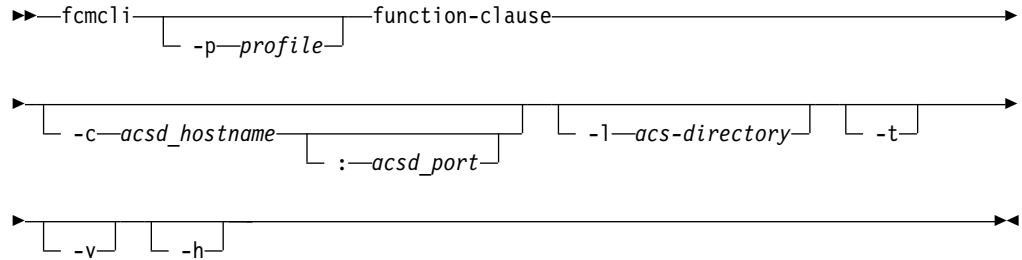
Table 19. Options for starting the generic device agent, *acsngen* (continued). Description of *acsngen* options with default values if applicable.

Option	Description	Default
-c acsd-hostname	Name of the server where the management agent, <i>acsd</i> , is running.	<i>localhost</i>
acsd-port	TCP/IP port number or service name on which the management agent, <i>acsd</i> , is listening.	57328
-s device-class	Section in the profile that pertains to the device class. Specify multiple device classes by separating each device class by a space.	STANDARD
-l acs-directory	Directory where the logs and shared directories can be found.	<ACS_DIR>
-D	Start as daemon. The -a option defines the usability states that the device agent responds to. Valid only when started from the following path: /etc/inittab	Run and end.
-H hostname	The host name where the process is running. The primary use is by the launchpad component to check its partitions in a DB2 multi-partition environment.	The system host name that is displayed by the hostname command.
-M	Start the device agent as a mount agent. This agent is called for mounting or unmounting the target volumes on the backup system when any of the following situations exist: <ul style="list-style-type: none"> • An offloaded backup to Tivoli Storage Manager is requested • Database files on JFS file systems • Database files on AIX LVM mirrored volumes • The database is not suspended A mount verifies the consistency of the associated file systems.	Start as the monitoring agent.
-v	Display version and help information.	None
-h	Display help information only.	None

Mounting and unmounting snapshots on a secondary system

Tivoli Storage FlashCopy Manager commands are available to mount or unmount a snapshot backup on a secondary system.

fcmcli command



Where:

-p profile

Full profile name. Default value: *INSTANCE_DIR/profile*

-c acsd-hostname

Name of the server where the management agent (acsd) is running. Default value: *localhost*

acsd-port

TCP/IP port number or service name on which the management agent (acsd) is listening. Default value: *57328*

-l acs-directory

Directory where the logs and shared directories are located. Default value: *ACS_DIR*

-t Start with trace on. Default value: off.

-v Show version.

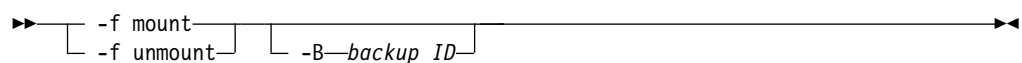
-h Show help text.

The return code of the **fcmcli** command is *0* if it finishes the request without an error or if there were no candidates for the request. Return code *1* indicates one or more minor issues occurred that are not critical but can be checked to prevent major issues later. Return code *2* indicates that an error occurred during the command execution.

FlashCopy administrative operations

The following functions are supported by the **fcmcli** command option **-f 'function'** for mount and unmount:

-f mount and -f unmount function-clauses



Where:

-f mount

Mount snapshot target set.

-f unmount

Unmount snapshot target set.

-B backup ID

The Backup ID as displayed by `fccli -f inquire [_detail]` command.

The following functions are supported by the **fccli** command option **-f 'function'** for forced unmount:

-f unmount function-clause with force option

➡ — `-f unmount` — `-F` — `-B backup ID` ————— ➡

Where:

-f unmount

Unmount snapshot target set.

-F Force a reset of **TAPE_BACKUP_IN_PROGRESS** usability states for the specified snapshot backup during the unmount force function. This parameter also requires the following **-B backup-id** argument.

-B backup ID

The Backup ID as displayed by `fccli -f inquire [_detail]` command.

The functions **mount**, **unmount**, or **tape_backup** cannot run in parallel on the same backup server.

-f mount

This command mounts a snapshot backup on a backup system.

Mounting a backup means the following occurs:

1. Configure the target volumes, which might need to be assigned to the offload system (see the profile parameter **BACKUP_HOST_NAME** in “*DEVICE_CLASS device*” on page 109 for details).
2. Import the volume groups from the target volumes.
3. Mount all file systems within the volume groups.

The mount is done by one mount agent for each backup server. As a result, a mount agent is started by the launchpad daemon that runs on the respective backup server. By specifying **-B backup-id**, a specific snapshot backup can be selected for mounting on the offload system.

If no backup with the usability state **TAPE_BACKUP_PENDING** exists, the parameter **-B** is mandatory.

Note: If the option **-B** is omitted, the oldest backup still in state *tape_backup_pending* is selected implicitly.

To reflect whether a snapshot backup is being mounted or is mounted, the usability states **MOUNTING** and **MOUNTED**, are set for those backups in the snapshot backup repository. These two state values prevent a duplicate mount request for a backup that is being mounted, or is already mounted, on the backup system. If multiple snapshot backups of a database are candidates to be mounted, Tivoli Storage FlashCopy Manager picks the one with the most recent snapshot backup ID.

-f unmount

This command releases all resources on the offload server that were used by the mount command.

For *normal mode*, the unmount is completed by one mount agent for each backup server. A mount agent is started by the launchpad daemon that runs on the respective backup server. The following steps are completed by the software:

1. Unmount the file system that belongs to the target volumes.
2. Export the assigned volume group.
3. Remove the devices, vpath/hdisk, from the offload system.

Use filter argument **-B *backup-id*** to specify a particular snapshot backup for unmounting from the offload system.

If the unmount does not succeed because of problems that are related to the device agent, the usability state of the backup remains **MOUNTED** in the snapshot backup repository. After resolving the problems on the backup system, the **fcmdi unmount** command must be issued again. The command is issued again to finalize the unmount of the file systems and update the usability state of the backup in the snapshot backup repository. If an off-loaded tape backup is running, the usability state **TAPE_BACKUP_IN_PROGRESS** is set and those backups are not be picked by Tivoli Storage FlashCopy Manager for unmounting.

For *force mode*, unexpected system failures with offloaded tape backups can lead to an incorrect state of the backup reflected in the snapshot backup repository. The state **TAPE_BACKUP_IN_PROGRESS** is set. A built-in force option, **-F**, for the **fcmdi unmount** function is provided to return the system to a usable state. Besides the normal unmount function, the unmount force option picks backups in the **TAPE_BACKUP_IN_PROGRESS** state as candidates to be unmounted and to reset the **TAPE_BACKUP_IN_PROGRESS** usability state for those backups. The **-B** option is specified to uniquely identify the backup that is involved.

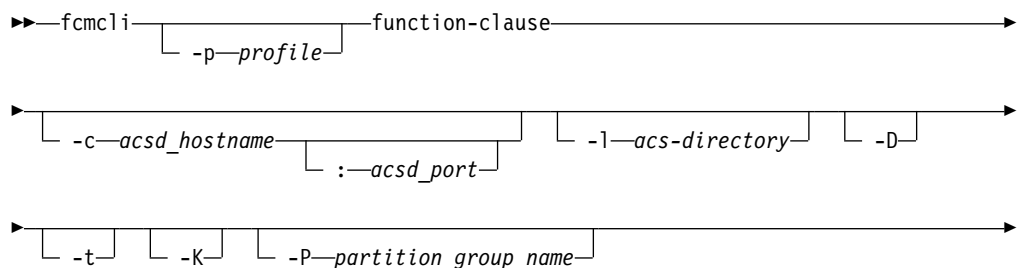
Integration with Tivoli Storage Manager

If Tivoli Storage Manager is set up and configured in your environment, you can create a backup to Tivoli Storage Manager from a snapshot.

The fcmcli offload agent

The offload agent is a daemon process that manages offloaded backups to Tivoli Storage Manager. The agent also provides a command line interface offering functions for managing Tivoli Storage Manager backups.

fcmdi command



└─*-N partition_number_list*─┐

Where:

-p *profile*

Full profile name. Default value: *INSTANCE_DIR/profile*

-c *acsd_hostname*

Name of the server where the management agent (acsd) is running. Default value: *localhost*.

acsd-port

TCP/IP port number or service name on which the management agent (acsd) is listening. Default value: *57328*.

-l *acs-directory*

Directory where the logs and shared directories are located. Default value: *ACS_DIR*.

-D Run as daemon process. Valid only when started from */etc/inittab*. Default value: Run and end.

-t Start trace on. Default value: Trace off.

-K In a multi-partition environment, the partitions remain mounted when all participating partitions are successfully offloaded to Tivoli Storage Manager. The offload agent unmounts all partitions after the last partition is successfully offloaded. Default value: Off. The unmount operation is part of every Tivoli Storage Manager backup operation.

-P *partition_group_name*

The name of a partition group as specified in the profile with the **PARTITION_GROUP** parameter.

-N *partition_number_list*

A single number or list of numbers that are separated by a comma that specifies the partitions to apply the action against. When not specified, the action is applied to all partitions.

The values for the function-clause parameter are described in the following sections.

-f *tape_backup*

This offload agent command backs up data to tape storage.

Note: IBM Tivoli Storage Manager for Enterprise Resource Planning must be installed on the production and backup server if you use IBM Tivoli Storage FlashCopy Manager in an SAP environment with Oracle or DB2. Tivoli Storage Manager for Databases: Data Protection for Oracle as well as Oracle must be installed on the production and backup server if you use Tivoli Storage FlashCopy Manager to protect an Oracle non-SAP environment. If FlashCopy Manager for Custom Applications is used, the Tivoli Storage Manager backup-archive client must be installed on the backup server

To create a snapshot backup with a subsequent tape backup, **TSM_BACKUP** or **TAPE_BACKUP_FROM_SNAPSHOT** must be specified either as part of the backup command or as a profile parameter, thus applying to all backups. The management agent updates the usability state with **TAPE_BACKUP_PENDING**. The Tivoli Storage

FlashCopy Manager offload agent then picks up all snapshot backups in the state **TAPE_BACKUP_PENDING** and backs them up to tape.

To start the offload backup to tape, enter the command:

```
fccli -f tape_backup
```

By specifying additional options or filter arguments such as

```
-i instance-name  
-d database-name
```

the appropriate backup for the given instance and or database can be selected for offloading to tape. The **-B backup-id** option cannot be specified in conjunction with **-f tape_backup**. The backups should be processed in chronological order. The tsm4acs backs up the oldest snapshot eligible for transfer to Tivoli Storage Manager.

By specifying the **-D** option for the offload agent, it acts as a daemon process that periodically checks for outstanding tape backup requests. Furthermore, the offload agent, running as a daemon, tries to offload a snapshot backup to tape only one time. If the first attempt fails for some reason, the snapshot backup is marked accordingly and is not be picked a second time by the tsm4acs daemon for offloading to tape. This type of backup must be offloaded to tape manually by issuing the following command:

```
fccli -f tape_backup filter_arguments
```

If multiple snapshot backups of a database are candidates for offloading to tape, the Tivoli Storage FlashCopy Manager offload agent (whether as a daemon or with the **-f tape_backup** function) always selects the one with the oldest snapshot backup ID. This selection ensures that the Tivoli Storage Manager backups are created in the appropriate sequential order.

Tip: Whenever a new snapshot backup with **TSM_BACKUP** set to YES, MANDATE, or LATEST is created, Tivoli Storage FlashCopy Manager sets the **TAPE_BACKUP_PENDING** status to NO for all snapshot backups that were previously created with **TSM_BACKUP** set to LATEST. This prevents backup requests to Tivoli Storage Manager from queuing if they cannot be completed in time.

The tsm4acs **tape_backup** function internally does the following steps:

1. Mount the file systems on the offload system if they were not previously mounted using fccli with the 'mount' function or by a forced mount request. If all necessary file systems were mounted, this step is skipped.
2. Update the usability state to **TAPE_BACKUP_IN_PROGRESS** for all partitions that have the usability state **TAPE_BACKUP_PENDING** set.
3. Back up these partitions to tape.
4. Update usability states: For those partitions for which the backup succeeded, reset the usability state **TAPE_BACKUP_PENDING** and set **TAPE_BACKUP_COMPLETE**. For those partitions where the backup failed, set the usability state **TAPE_BACKUP_FAILED**. For all participating partitions, reset the usability state **TAPE_BACKUP_IN_PROGRESS**.
5. Unmount the file systems from the offload system.

When the usability state for a partition is **TAPE_BACKUP_IN_PROGRESS**, any request to restart the offload of that partition to tape is refused.

If a backup to Tivoli Storage Manager fails, the Tivoli Storage FlashCopy Manager software can try the backup operation again.

-f update_status:

This offload agent command updates the usability state of a specified snapshot backup.

The usability state of a specified snapshot backup can be updated to either offload a snapshot backup to Tivoli Storage Manager (TSM_BACKUP=yes) or to not offload a snapshot backup to Tivoli Storage Manager (TSM_BACKUP=no). This provides opportunity to offload a snapshot backup to Tivoli Storage Manager although the TSM_BACKUP or TSM_BACKUP_FROM_SNAPSHOT profile parameter was deactivated during the snapshot backup operation. In this situation, if there is no longer a need to offload the snapshot backup to Tivoli Storage Manager (which was performed with the parameter TSM_BACKUP or TSM_BACKUP_FROM_SNAPSHOT activated), the usability state can be reset accordingly.

To identify the backup whose state is to be modified, these parameters must also be specified when using -f update_status:

- d database-name
- i instance-name
- B backup-id

Appendix C. Examples

Refer to these Tivoli Storage FlashCopy Manager examples when you are configuring, updating, or following product tasks.

DS8000 target volumes file example

Refer to this example when you are editing the target volumes file for a DS8000 storage subsystem configuration.

The following file is an example of a VOLUMES_FILE .fct file that includes the target set configuration that is used for cloning:

```
#
#***** First sample *****#
#

#=====#

>>> TARGET_SET 1
>>> PARTITION NODE0000
TARGET_VOLUME 13ABCTA0111 - -
TARGET_VOLUME 13ABCTA0112 - -
TARGET_VOLUME 13ABCTA0113 - -
<<<
<<<

>>> TARGET_SET 3

DEVICE_CLASS CLONE USE_FOR_CLONING D98
>>> PARTITION NODE0000
TARGET_VOLUME 13ABCTA011D - -
TARGET_VOLUME 13ABCTA011E - -
TARGET_VOLUME 13ABCTA011F - -
<<<
<<<

#=====#
```

The following file shows a VOLUMES_FILE .fct file for DB2 EEE configurations:

```
#
#***** Second sample *****#
#

#=====#

>>> TARGET_SET 1

DEVICE_CLASS CLONE USE_FOR_CLONING S98
>>> PARTITION NODE0000
    TARGET_VOLUME S97p5d1_t1 - -
    TARGET_VOLUME S97p5d2_t1 - -
    <<<
>>> PARTITION NODE0001
    TARGET_VOLUME S97p5d3_t1 - -
    TARGET_VOLUME S97p5d4_t1 - -
    <<<
>>> PARTITION NODE0002
    TARGET_VOLUME S97p5i1_t1 - -
    TARGET_VOLUME S97p5i2_t1 - -
    <<<
>>> PARTITION NODE0003
```

```

TARGET_VOLUME S97p513_t1 - -
TARGET_VOLUME S97p514_t1 - -
<<<
<<<

#=====#

```

DS8000 target volume Logical Volume Mirror setup

Refer to this example when you are editing the target volumes file for Logical Volume Mirror (LVM) setup with a DS8000 configuration.

The example shows the required setup of a target volumes file for running the FlashCopy backup when the AIX LVM mirrors are set up in DS8000. Two copy sets of LVs are set up according to the requirements for setting up a copy set. This set up means that 2 DS8000 units are needed.

In the following example, volume set 1 uses serial number 7513158, and volume set 2 uses 7512067.

```

#-----Start of sample target volumes file -----
#===
#=== This file contains setup information about source/target volumes
#=== as they will be used in the FlashCopy function.
#===
#=== The target volumes file identifies the target volumes to be used
#=== for a FlashCopy backup.
#=== The file conforms to the following naming convention:
#=== For DB2 environments:
#=== <Db2 inst name>.<DB2 db name>.<dev class>.<DB2 par num>.fct
#=== For native Oracle environments:
#=== <Oracle SID>.<ORCL_>.<device class>.<ORACLE>.fct
#=== For SAP for Oracle environments:
#=== <DBSID>.<backup ID prefix>.<device class>.<SAP_ORACLE>.fct
#===
#=== and resides in the directory specified by the VOLUMES_DIR parameter
#=== profile
#===
#=== It is required to embed the TARGET_VOLUME parameters
#=== between the topic start parameter (>>>VOLUMES_SET_x)
#=== and topic end parameter (<<<) #===
#===
#=== Note: On the parameter statement TARGET_VOLUME, the
#=== 1st value is target_volume_serial_number
#=== 2nd value is source_volume_serial_number or -
#=== 3rd value is Size=2.0_GB or -
#===
#=== If you specify source volume serial number and size,
#=== you must ensure the target volume size is the same.
#===
#=== A target volume must be available in the same hardware unit in
#=== which the source volume is accessed.
#-----#

>>> VOLUMES_SET_1
#-----#
# STORAGE_SYSTEM_ID# Defines in an AIX LVM Mirror environment the storage
#subsystem which contains a complete set of at least 1 copy of all DB LVs
#which are to be the object of the backup process. Only the source volumes
#of the specified storage subsystem will be used on the production system
#by Tivoli Storage FlashCopy(R) Manager for the FlashCopy process. Possible
#parameter values : XXXXXXX where XXXXXXX is the 7 digit storage system serial
#number. Parameter definition can only be used if an appropriate setup
#has been done as defined in the Tivoli Storage FlashCopy(R) Manager manual.
# DEFAULT : NOT DEFINED #

```

```

#-----#
STORAGE_SYSTEM_ID 7513158
#-----#
#
# For e a c h target volume which is planned to be used in the
# FlashCopy operation the volume serial number must be specified as
# the 1st parameter followed by - -
# The characters '-' will be replaced by a (source) volume serial
# number and the Size found for that source volume (if the size matches
# that of the target volume) by Tivoli Storage FlashCopy® Manager
# once the FlashCopy function has been started on the production system
# and identified all (source) volumes.
#
#
# Replace all statements below with your installation values.
#
#-----#

TARGET_VOLUME 75131581200 - -
TARGET_VOLUME 75131581201 - -
TARGET_VOLUME 75131581202 - -
TARGET_VOLUME 75131581203 - -
TARGET_VOLUME 75131581204 - -
TARGET_VOLUME 75131581205 - -
TARGET_VOLUME 75131581206 - -
TARGET_VOLUME 75131581207 - -
TARGET_VOLUME 75131581208 - -
TARGET_VOLUME 75131581209 - -
<<<

>>> VOLUMES_SET_2
STORAGE_SYSTEM_ID 7512067
TARGET_VOLUME 75120671300 - -
TARGET_VOLUME 75120671301 - -
TARGET_VOLUME 75120671302 - -
TARGET_VOLUME 75120671303 - -
TARGET_VOLUME 75120671304 - -
TARGET_VOLUME 75120671305 - -
TARGET_VOLUME 75120671306 - -
TARGET_VOLUME 75120671307 - -
TARGET_VOLUME 75120671308 - -
TARGET_VOLUME 75120671309 - -
<<<

#-----End of sample target volumes file -----#

```

SAN Volume Controller and Storwize family target volumes file example

Refer to this example when you are editing the target volumes file for an SAN Volume Controller or Storwize family storage system configuration.

```

#***** First sample *****#
#
#=====#

>>> TARGET_SET VOLUMES_SET_1
TARGET_VOLUME svdftgt1 svdrsrc2 -
TARGET_VOLUME svdftgt2 svdfsrc3 -
TARGET_VOLUME svdftgt3 svdfsrc4 -
TARGET_VOLUME svdftgt4 svdfsrc5 -
TARGET_VOLUME svdftgt5 svdfsrc6 -
<<<

#=====#

```

The following sample profile is an example of a profile in a non-mirrored environment. Create three space-efficient disk-only backups and one dual backup, at midnight, per day.

```
>>> CLIENT
...
TSM BACKUP LATEST USE FOR DISK TSM
DEVICE_CLASS DISK_ONLY FROM 5:30 TO 23:59
DEVICE_CLASS DISK_TSM FROM 0:00 TO 05:29
<<<
>>> DEVICE_CLASS DISK_ONLY
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS 1 2 3
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS DISK_TSM
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS DUAL
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
```

This scenario illustrates a profile in a mirrored environment. On MIRROR_1, two space-efficient FlashCopy backups are created on Monday, Wednesday, and Friday. The backup that is created at midnight is copied to Tivoli Storage Manager. The backup that is created at noon is retained only on disk. The backup that is created on Monday is retained until the target sets are reused on Wednesday. On MIRROR_2, only one incremental FlashCopy backup was created on Sunday, Tuesday, Thursday, and Saturday. This backup is also copied to Tivoli Storage Manager. The backup is retained until the next incremental backup is started.

```
>>> CLIENT
...
TSM BACKUP LATEST USE FOR MIRROR_1 DISK_TSM MIRROR_2
DEVICE_CLASS MIRROR_1_DISK_ONLY USE_AT Mon Wed Fri FROM 5:30 TO 23:59
DEVICE_CLASS MIRROR_1_DISK_TSM USE_AT Mon Wed Fri FROM 0:00 TO 05:29
DEVICE_CLASS MIRROR_2_USE_AT SUN Tue Thu Sat
<<<
>>> DEVICE_CLASS MIRROR_1_DISK_ONLY
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS DO
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS MIRROR_1_DISK_TSM
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS DT
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS MIRROR_2
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE INCR
TARGET_SETS 1
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
```


This example is like the previous example, but the example does not create Tivoli Storage Manager backups from MIRROR_1. Rather, the example retains the space-efficient FlashCopy images for one week (same schedule).

```
>>> CLIENT
...
TSM_BACKUP_LATEST_USE_FOR_MIRROR_1_DISK_TSM_MIRROR_2
DEVICE_CLASS MIRROR_1_DISK_ONLY USE_AT Mon Wed Fri
DEVICE_CLASS MIRROR_2 USE_AT Sun Tue Thu Sat
<<<
>>> DEVICE_CLASS MIRROR_1_DISK_ONLY
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS 1A 1B 3A 3B 5A 5B
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS MIRROR_2
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE INCR
TARGET_SETS 1
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
```

Custom applications profile example

This example contains a sample profile for backing up and restoring data in a custom application environment.

```
>>> GLOBAL
# ACS_DIR /home/gbauser/acs
ACSD ehonda 61000
TRACE YES
<<<

>>> ACSD
ACS_REPOSITORY /home/gbauser/acs/repository
REPOSITORY_LABEL GBA
<<<

>>> OFFLOAD
BACKUP_METHOD TSM_CLIENT
# MODE FULL
ASNODENAME GBA_aha_target
# DSM_DIR
# DSM_CONFIG
# VIRTUALFSNAME fcm
<<<

>>> CLIENT
BACKUPIDPREFIX GBA___
APPLICATION_TYPE GENERIC
INFILE /home/gbauser/acs/infile
PRE_FLASH_CMD /home/gbauser/acs/scripts/preflash.cmd
POST_FLASH_CMD /home/gbauser/acs/scripts/postflash.cmd
TSM_BACKUP YES
# MAX_VERSIONS ADAPTIVE
# LVM_FREEZE_THAW AUTO
NEGATIVE_LIST NO_CHECK
# TIMEOUT_FLASH 120
# GLOBAL_SYSTEM_IDENTIFIER
DEVICE_CLASS STANDARD
<<<

>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC
```

```
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.101
# COPYSERVICES_USERNAME superuser
# CLONE_DATABASE NO
SVC_COPY_RATE 90
# SVC_CLEAN_RATE 50
# COPYSERVICES_COMMPROTOCOL HTTPS
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE
# COPYSERVICES_SERVERPORT 5989
FLASHCOPY_TYPE INCR
# COPYSERVICES_TIMEOUT 6
# RESTORE_FORCE NO
# STORAGE_SYSTEM_ID
# RECON_INTERVAL 12
BACKUP_HOST_NAME sagat
TARGET_SETS TS1 TS2 TS3
TARGET_NAMING %SOURCE_%TARGETSET
<<<
```

Appendix D. Accessibility features for the Tivoli Storage Manager product family

Accessibility features help users who have a disability, such as restricted mobility or limited vision to use information technology products successfully.

Accessibility features

The IBM Tivoli Storage Manager family of products includes the following accessibility features:

- Keyboard-only operation using standard operating-system conventions
- Interfaces that support assistive technology such as screen readers

The command-line interfaces of all products in the product family are accessible.

Tivoli Storage Manager Operations Center provides the following additional accessibility features when you use it with a Mozilla Firefox browser on a Microsoft Windows system:

- Screen magnifiers and content zooming
- High contrast mode

The Operations Center and the Tivoli Storage Manager server can be installed in console mode, which is accessible.

The Operations Center help system is enabled for accessibility. For more information, click the question mark icon on the help system menu bar.

Vendor software

The Tivoli Storage Manager product family includes certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for the accessibility information about its products.

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Glossary

A glossary is available with terms and definitions for the IBM Tivoli Storage Manager family of products.

See Tivoli Storage Manager glossary.

To view glossaries for other IBM products, see <http://www.ibm.com/software/globalization/terminology/>.

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