Tivoli® Storage FlashCopy Manager
Version 2.2

Installation and User's Guide for UNIX and Linux

SC27-2503-01

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Version 2.2

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Note:
Before using this information and the product it supports, read the information in "Notices" on page 245.

Edition notice

This edition applies to Version 2.2 of IBM Tivoli Storage FlashCopy Manager for UNIX and Linux (product number 5724-X94) and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters. This edition replaces SC27-2503-00.

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Preface

The subject of this publication is IBM® Tivoli® Storage FlashCopy® Manager for UNIX® and Linux®.

About this publication

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

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

- One of these database applications:
  - DB2® (native DB2 or DB2-based SAP® environments)
  - Oracle (native Oracle or Oracle-based SAP® environments)
- Custom applications such as file systems or other non-DB2 or non-Oracle databases
- One of these IBM storage systems used for the database:
  - IBM System Storage™ Disk Storage Model DS8000®
  - IBM System Storage SAN Volume Controller (SVC)
  - IBM XIV® Storage Systems
- One of these operating systems:
  - AIX®
  - Linux
  - Solaris

IBM Tivoli Storage FlashCopy Manager performs online or offline backups of DB2 or Oracle databases residing on snapshot-oriented storage systems. Optionally, it performs backups to Tivoli Storage Manager storage by using IBM Tivoli Storage Manager for Enterprise Resource Planning or Tivoli Storage Manager for Databases, as appropriate. The integration with the RMAN Media Management API maximizes the protection of data, thus providing a comprehensive storage management solution.

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 tape backup function of IBM Tivoli Storage FlashCopy Manager is needed.

Changes since the previous edition are marked with a vertical bar (|) in the left margin.

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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.

Publications

IBM Tivoli Storage FlashCopy Manager publications and other related publications are available online.

For IBM Tivoli Flash Copy Manager documentation, see: http://publib.boulder.ibm.com/infocenter/tsminfo/v6r2/topic/com.ibm.itsm.nav.doc/c_fcm_overview.html

You can download PDF versions of publications from this Information Center http://publib.boulder.ibm.com/infocenter/tsminfo/v6r2/index.jsp or from the IBM Publications Center at http://www.elink.ibmlink.ibm.com/publications/servlet/pbi.wss

You can also order some related publications from the IBM Publications Center Web site. The Web site provides information for ordering publications from countries other than the United States. In the United States, you can order publications by calling 800-879-2755.

IBM Tivoli Storage FlashCopy Manager publications

These publications are available to assist with using IBM Tivoli Storage FlashCopy Manager.

Table 1. Related IBM Tivoli Storage FlashCopy Manager publications

Publication title	Order number
IBM Tivoli Storage FlashCopy Manager for Windows: Installation and User's Guide	SC27-2504
IBM Tivoli Storage FlashCopy Manager Messages	SC27-2505
IBM Tivoli Storage FlashCopy Manager Quick Start Guide	CF2KTML

Table 2. Related storage system publications

Publication title	Order number
IBM System Storage DS8000 Introduction and Planning Guide	GC35-0515
IBM System Storage DS8000 Messages Reference	GC26-7914
IBM System Storage DS8000 Installation Guide	GC26-7910
IBM XIV® Storage System: Concepts, Architecture, and Usage	SG24-7659
IBM XIV® Storage System (Type: 2810) Model A14 (Gen 2) Introduction and Planning Guide for Customer Configuration	GA52-1327
IBM XIV® Storage System Software Host System Attachment Guide for AIX 1.0.3.1	GC27-2258
IBM XIV® Storage System User Manual Version 10.1	GC27-2213
IBM System Storage SAN Volume Controller Planning Guide	GA32-0551
IBM System Storage SAN Volume Controller Hardware Installation Guide	GC27-2132

Table 2. Related storage system publications (continued)

Publication title	Order number
IBM System Storage SAN Volume Controller Software Installation and Configuration Guide	SC23-6628
IBM System Storage SAN Volume Controller Host Attachment Guide	SC26-7905

Table 3. Related Tivoli Storage Manager publications

Publication title	Order number
IBM Tivoli Storage Manager for Enterprise Resource Planning: Data Protection for SAP® Installation and User's Guide for DB2	SC33-6341
IBM Tivoli Storage Manager for Enterprise Resource Planning: Data Protection for SAP® Installation and User's Guide for Oracle	SC33-6340
IBM Tivoli Storage Manager for Databases: Data Protection for Oracle for UNIX and Linux Installation and User's Guide	SC32-9064

Support information

You can find support information for IBM products from a variety of sources.

To search Internet resources, go to the support Web site for IBM Tivoli Storage FlashCopy Manager at http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_FlashCopy_Manager. From there, you can search a variety of available resources.

For detailed hardware, software, and system requirements of Tivoli Storage FlashCopy Manager V2.2, see http://www.ibm.com/support/docview.wss?uid=swg21428707.

For the requirements for all versions of Tivoli Storage FlashCopy Manager, see http://www.ibm.com/support/docview.wss?&uid=swg21427692 .

Chapter 1. Overview

Introductory information about IBM Tivoli Storage FlashCopy Manager is provided.

IBM Tivoli Storage FlashCopy Manager uses the copy services capabilities of intelligent disk subsystems to create point-in-time copies. These are application aware copies (FlashCopy® or snapshot) of the production data. This copy is then retained on disk as backup allowing for a fast restore operation (Flashback). IBM Tivoli Storage FlashCopy Manager also allows mounting the copy on an auxiliary server (backup server) as a logical copy. This copy (instead of the original data on the production server) is made accessible for further processing. This processing includes creating a tape backup or performing backup verification functions (for example, the Database Verify Utility).

In environments where Tivoli Storage FlashCopy Manager is used with Tivoli Storage Manager, automatic backups to Tivoli Storage Manager can be scheduled. The backup can start immediately after the point-in-time copy is created, or at another time when resources are available to complete the backup request. If a backup to Tivoli Storage Manager fails, Tivoli Storage FlashCopy Manager can restart the backup after the cause of the failure is corrected. In this case, data already committed to Tivoli Storage Manager is not re-sent. Tivoli Storage FlashCopy Manager can also use this point-in-time copy to create a clone database with or without changing the name of the cloned database.

Backup granularity

All copy services functions used by IBM Tivoli Storage FlashCopy Manager are at the volume group level.

In addition, multiple volumes that are organized into volume groups require IBM Tivoli Storage FlashCopy Manager to process these volume groups consistently. As a result, non-application data residing on a volume group that is processed by IBM Tivoli Storage FlashCopy Manager is included in the backup. Similarly, all data that resides on a volume group that is being restored is overwritten.

Note: Oracle Automatic Storage Management (ASM) uses the term *disk group* instead of the term *volume group*.

The terms "volume level" and "volume group level" are sometimes used interchangeably. All copy services functions used by IBM Tivoli Storage FlashCopy Manager are at the volume group level.

Supported applications

Overview information about the applications supported by IBM Tivoli Storage FlashCopy Manager is provided.

DB2 in SAP® and non-SAP® environments

Because SAP® environments are fully integrated with DB2, the DB2 backup command can be used in both environments. DB2 notifies Tivoli Storage FlashCopy Manager of the current environment to enable Tivoli Storage FlashCopy

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Manager to implement the appropriate workflow. Tivoli Storage FlashCopy Manager supports single partition databases, and logically or physically partitioned databases on file systems that are supported by Tivoli Storage FlashCopy Manager for your platform. DB2 backup options are documented in the DB2 user publications. Tivoli Storage FlashCopy Manager supports these DB2 backup functions:

- Full database backups, both online and offline
- Backups of selected database partitions
- Backups of database partitions including or excluding database logs

However, consider these guidelines when backing up DB2 databases:

- You cannot back up individual table spaces and archiving database logs. Consider Tivoli Storage Manager as a solution to those backup needs.
- In a multi-partition database environment, DB2 suspends all partitions sequentially (serial mode) for non-SAP® workloads. For SAP® workloads, all partitions are suspended in parallel (parallel mode).
- The **db2 backup** command is available in the DB2 Control Center. For SAP® environments, this command is also available in the Computing Center Management System (CCMS).

For DB2 in SAP environments, consider IBM Tivoli Storage Manager for Enterprise Resource Planning as a solution for backups to tape and archiving database log files.

SAP® for Oracle environments

SAP® BR*Tools 7.10 (or later) provides an extension to the backint interface. This extension enables BRBACKUP and BRRESTORE to back up and restore data at a volume group level. IBM Tivoli Storage FlashCopy Manager uses this interface extension to implement point-in-time copy backups of SAP® for Oracle databases.

You can use IBM Tivoli Storage FlashCopy Manager for SAP® for Oracle databases on file systems that are supported by IBM Tivoli Storage FlashCopy Manager on your platform. Although all backint backup functions are supported, use only volume copy backup operations. For example:

- Full database backups at the volume level
- Control files (that are backed up in the control run) after the volume copy backup into the IBM Tivoli Storage FlashCopy Manager repository completes

Consider IBM Tivoli Storage Manager for Enterprise Resource Planning as a solution for backups to tape and archiving database redo logs.

SAP® BR*Tools backup commands are also available in the CCMS.

Native Oracle environments

IBM Tivoli Storage FlashCopy Manager provides its own backup and recovery interface for native Oracle databases that creates full database backups and restores. Optionally, the database control files can be backed up into the IBM Tivoli Storage FlashCopy Manager backup repository. IBM Tivoli Storage FlashCopy Manager supports databases on JFS, JFS2, raw logical volumes, and Oracle ASM running on raw physical volumes. In those cases, IBM Tivoli Storage FlashCopy Manager supports these backup functions:

- Full database backups at a volume level.

- Back up of database control files into the IBM Tivoli Storage FlashCopy Manager repository after a full backup completes.
- Database restores with or without restoring database control files.

Custom application environments

IBM Tivoli Storage FlashCopy Manager supports snapshot backups of file systems that contain data that was created by custom applications. To prepare these applications for volume-level snapshots, preprocessing and postprocessing scripts can be used. These snapshots are managed as backup versions using IBM Tivoli Storage FlashCopy Manager management policies and remain available for fast restore operations. These snapshot backups can also be mounted on a secondary system. When Tivoli Storage Manager is available in the environment, IBM Tivoli Storage FlashCopy Manager can optionally create a backup to Tivoli Storage Manager storage using the Tivoli Storage Manager backup-archive client.

A practical example of how IBM Tivoli Storage FlashCopy Manager can be used with custom applications is with DB2 standby server environments. In this environment, IBM Tivoli Storage FlashCopy Manager creates snapshot backups of a DB2 high-availability disaster recovery (HADR) target. Although DB2 HADR systems cannot be directly backed up to Tivoli Storage Manager storage, snapshots of the DB2 HADR target can be directly backed up to Tivoli Storage Manager storage. IBM Tivoli Storage FlashCopy Manager provides sample preprocessing and postprocessing commands that stop the DB2 HADR target before the snapshot is taken and then restart DB2 after the snapshot completes.

Supported storage subsystems

IBM Tivoli Storage FlashCopy Manager and the required applications infrastructure rely on the copy-services capabilities of the storage subsystems.

IBM Tivoli Storage FlashCopy Manager currently supports copy services provided with the storage subsystems listed in this table:

Table 4. Supported storage subsystems and functionality

Device	COPY	INCR	NO COPY	Space efficient snapshots	LVM (AIX-only)	VIO (AIX-only)	Changes made to a mounted snapshot backup
DS8000	Yes	one per LVM mirror (at most)	restore not supported	N/A	Yes	Yes	Remains persistent and alters the content of the backup
SAN Volume Controller 5.1	Yes	Yes	Yes Includes space efficient copies if configured accordingly.	N/A	Yes	Yes	Remains persistent and alters the content of the backup
SAN Volume Controller 4.3.x	Yes	Yes	restore not supported	N/A	Yes	Yes	Remains persistent and alters the content of the backup

Table 4. Supported storage subsystems and functionality (continued)

Device	COPY	INCR	NO COPY	Space efficient snapshots	LVM (AIX-only)	VIO (AIX-only)	Changes made to a mounted snapshot backup
XIV®	N/A	N/A	N/A	Yes	Yes	POWER6 NPIV	Reverted during unmount and does not alter the backup, or remains persistent and alters the content of the backup. The second option is mandatory if LVM mirroring is used.

FlashCopy® Devices (SAN Volume Controller, DS8000)

Available FlashCopy features are dependent on the exact level of the storage subsystem used in the environment.

Depending on that level, IBM Tivoli Storage FlashCopy Manager provides support for the following FlashCopy® types:

Table 5. FlashCopy types and supported devices

FlashCopy Type	Description	Supported Devices
COPY	A COPY FlashCopy® is a point-in-time copy of a volume, followed by a subsequent background copy operation that creates a physical copy of the source volume.	DS8000, SAN Volume Controller
INCREMENTAL	Like a COPY FlashCopy® except that a reduced amount of data is copied between two consecutive FlashCopy® backups. Only those blocks that have changed after the previous FlashCopy® is created are copied to the target.	DS8000[1], SAN Volume Controller
NOCOPY	A FlashCopy® image that contains only those changes that occurred after the original FlashCopy® was created (no background copying). For SAN Volume Controller, NOCOPY FlashCopy® can be performed to a space efficient FlashCopy® target.	DS8000 [2], SAN Volume Controller[2]
FlashCopy to Space Efficient Volumes	For SAN Volume Controller, FlashCopy® can be performed to a space efficient target. In order to avoid the volume size increasing because of background copying, run the FlashCopy® to a space efficient target with option NOCOPY.	SAN Volume Controller[3]

Note:

1. DS8000 allows at most one INCREMENTAL FlashCopy® per source volume. When production volumes are mirrored using LVM mirroring or ASM failure groups, only one FlashCopy® backup of this type per volume mirror is created. 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 one target set is specified.
2. DS8000 and SAN Volume Controller 4.3.x do not allow restoring point-in-time copies that were created using NOCOPY. As a result, IBM Tivoli Storage FlashCopy Manager does not allow restoring backups of this type. However, these backups can be restored when using SAN Volume Controller 5.1. DS8000 and SAN Volume Controller 4.3.x and 5.1 supports mounting the image on a remote server and backing up the image to Tivoli Storage Manager.
3. FlashCopy® to space efficient volumes must be created using NOCOPY. See Note 2 for restrictions.

CIM Server

IBM Tivoli Storage FlashCopy Manager accesses FlashCopy® services on DS8000 or SAN Volume Controller through a CIM server. The storage subsystem microcode level determines whether this CIM server is embedded directly into the storage subsystem or must be installed and configured as a proxy CIM server in the environment.

Support for LVM Mirroring (AIX-only) and ASM Failure Groups

If AIX LVM mirroring is used in the environment, IBM Tivoli Storage FlashCopy Manager can create separate FlashCopy® images of either mirror. In an Oracle ASM environment, a FlashCopy® image of selected failure groups is created. However, the remaining failure groups must be sufficient to mount the corresponding disk group for this image to be created.

Support for virtual I/O (AIX-only)

DS8000 and SAN Volume Controller logical unit numbers (LUNs) can be attached to a host directly or using Virtual I/O (VIO). Both setups are supported, as long as 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® machine controlled by the IBM Hardware Management Console (HMC) or IBM® Integrated Virtualization Manager (IVM). It owns the hardware adapters or optical devices 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.

IBM 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 are not supported. Refer to the requirements checklist for details of the supported combinations of operating system and storage subsystem levels and for further references and resources.

Remote access to FlashCopy® images

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

IBM XIV Storage Devices

IBM XIV Storage System copy services differ significantly from FlashCopy® copy services.

Whenever IBM Tivoli Storage FlashCopy Manager creates a backup on an IBM XIV® Storage System, it performs a snapshot. This snapshot is always a space-efficient read only copy of the application. When the USE_WRITABLE_SNAPSHOTS parameter specifies NO, this image is not mounted directly to another host. Instead IBM Tivoli Storage FlashCopy Manager creates a duplicate from the snapshot as part of the mount procedure, which is removed once the backup is unmounted. A duplicate is a space-efficient logical copy of the snapshot. It is also writable.

Dependent software packages

IBM Tivoli Storage FlashCopy Manager requires the IBM XIV® Storage System command-line interface (XCLI) to be installed on all hosts where IBM Tivoli Storage FlashCopy Manager is installed. A CIM server is not required.

Support for LVM Mirroring (AIX-only) and ASM Failure Groups

If AIX LVM mirroring is used in the environment, IBM 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, the remaining failure groups must be sufficient to mount the corresponding disk group for this image to be created.

Support for virtual I/O (VIO) (AIX-only)

IBM XIV® Storage System and IBM Tivoli Storage FlashCopy Manager only support VIO with POWER6® n-port ID virtualization.

Remote access to snapshot backups

IBM Tivoli Storage FlashCopy Manager allows mounting a backup image to another host. Unlike FlashCopy® devices, IBM Tivoli Storage FlashCopy Manager creates a duplicate from the snapshot which is then mounted to 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. IBM Tivoli Storage FlashCopy Manager removes the duplicate during the unmount operation. All changes that were performed on the duplicate are undone at this point in time. A subsequent mount presents the image as created when the snapshot occurred.

Use of writable snapshots

IBM Tivoli Storage FlashCopy Manager optionally uses of IBM XIV® Storage System capabilities to restore writable snapshots. When this option is enabled, a mount operation does not create duplicates but directly mounts the original

snapshot to another host. All changes to the snapshot are preserved, and a subsequent mount (or backup operation) presents all changes that might have occurred to the snapshot while mounted. The use of writable snapshots is required in LVM mirroring environments.

For details see the USE_WRITABLE_SNAPSHOTS parameter.

Component overview

Introductory information is provided about the components that IBM Tivoli Storage FlashCopy Manager supports.

The following applications are the key components of the IBM Tivoli Storage FlashCopy Manager installation package:

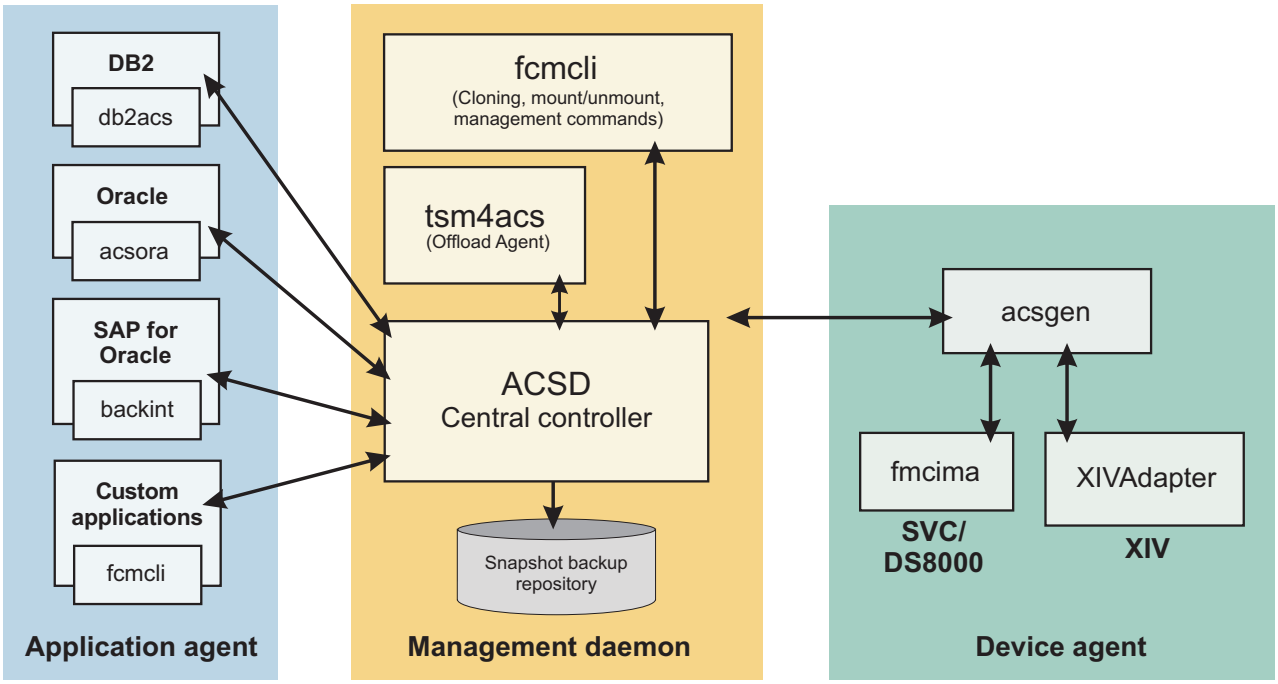

Figure 1. Overview of the IBM Tivoli Storage FlashCopy Manager installation package

Common IBM Tivoli Storage FlashCopy Manager components

A description of the software components that are shared by the individual database-platform versions of IBM Tivoli Storage FlashCopy Manager are provided.

Application Agent

The Application Client provides the necessary support for implementing snapshot-based backup and restore operations.

(DB2) The client is implemented as the *Snapshot Backup Library* (referred to as a *vendor library* in DB2 terms). The library is also a component of IBM Tivoli Storage FlashCopy Manager and is invoked by using the `"... use snapshot..."` phrase in the `'db2 backup database'` or `'db2 restore database'` commands.

(Oracle, SAP with Oracle) The client functions are acsora or backint.

(Custom applications) IBM Tivoli Storage FlashCopy Manager for Custom Applications provides custom application support with the fcmcli command.

Management Agent (acsd)
The Management Agent (acsd) coordinates the backup operation. It controls the backup flow and mediates between the application and device agents. The Management Agent also provides access to the snapshot backup repository which contains information about the valid snapshot backups and their relationships to snapshot-capable storage devices.

Device Agent for Generic Devices (acsgen)
The Device Agent for Generic Devices (acsgen) is an operating system independent and storage device independent software layer that interacts with operating system specific and storage device-specific adapters. 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.

CIM Adapter (fmcima)
The CIM Adapter (fmcima) is used with the Generic Device Agent (acsgen). It is the component that invokes a snapshot command on a FlashCopy(R) device (such as DS8000 and SAN Volume Controller) using the CIM interface.

XIV Adapter Java™ Archive (XivAdapter.jar)
The XIV Adapter (XivAdapter.jar) is used with the Generic Device Agent (acsgen). It communicates with acsgen and issues commands to the XIV® command-line interface (XCLI).

Query Capacity (fmquery)
The Query Capacity (fmquery) command lists all backups (FlashCopy or snapshot backups) that are registered in a particular repository. Use this command to periodically check the amount of storage space used for backups and to verify compliance with the licensed capacity amount.

Volume Group Takeover script (acsvg.sh) (AIX-only)
The Volume Group Takeover utility (acsvg.sh) is a shell script. It is only required in special high-availability scenarios where enhanced concurrent capable volume groups are used on production systems. In these situations, this script exports and reimports the volume groups on an HACMP™ takeover system after a snapshot restore is performed. This process is necessary in order to synchronize the AIX Object Data Manager (ODM) on the production and HACMP takeover systems.

Offload Agent (tsm4acs)
The primary role of the Offload Agent is to provide a single user interface for backing up an existing snapshot to Tivoli Storage Manager. IBM Tivoli Storage FlashCopy Manager includes a license file that enables the use of the enhanced functions of the Offload Agent. The Offload Agent also calls the generic device agent for mount and unmount operations on the backup systems.

Cloning CLI (fcmcli)
The IBM Tivoli Storage FlashCopy Manager manager executable, fcmcli, is also the cloning interface for Oracle, DB2, DB2 DPF databases in SAP and non-SAP environments on AIX, Solaris, and xLinux.

Advanced functions

Information is provided about advanced functions that enhance IBM Tivoli Storage FlashCopy Manager capabilities.

Mounting of backup images

IBM Tivoli Storage FlashCopy Manager can mount a backup image on a remote host. Although the characteristics of that image depend on the storage subsystem, the characteristics described in this section are common among all storage subsystems.

Use of multiple backup servers and backup server selection

A backup image created with IBM Tivoli Storage FlashCopy Manager can be mounted on only one host (backup server). This host is selected at the time of the backup according to backup criteria defined for the storage system in the DEVICE_CLASS sections. The association between DEVICE_CLASS sections and the backup hosts is established during configuration. As a result, a snapshot backup created for a certain DEVICE_CLASS is always mounted by the same backup server. In order to use multiple backup servers, subsequent backups have to be performed with a DEVICE_CLASS section that is associated with each backup server. Simultaneously mounting multiple backup generations of the same application to the same backup server is not allowed. However, single backup server can be used for multiple applications.

Forced mount

IBM Tivoli Storage FlashCopy Manager supports different levels of consistency features for point-in-time backup operations, such as suspend database or freeze I/O. Depending on the specified consistency level, IBM Tivoli Storage FlashCopy Manager might require a consistency check of the backup on a remote system. In those situations, IBM Tivoli Storage FlashCopy Manager requires at least one available backup server to mount the backup image for this consistency check (forced mount). This backup server might also be used to start a subsequent tape backup.

A forced mount is required during these circumstances:

- The database is running in an LVM mirrored environment on AIX
- FlashCopy cloning is used
- Conditions that require a forced mount for the different storage subsystem environments:

  XIV A forced mount is required if the profile parameter USE_CONSISTENCY_GROUPS is set to NO and a freeze or thaw was not used for the file systems.

  SVC or DS
  A forced mount is required if the profile parameter BACKUP_HOST_NAME is set to PREASSIGNED_VOLUMES and the operating system is Linux or Solaris.

  DS A forced mount is required if the profile parameter BACKUP_HOST_NAME is set to PREASSIGNED_VOLUMES and a freeze or thaw was not used for the file systems, and the operating system is AIX.

FlashCopy® back up of individual mirrors

Information is provided about the two types of mirroring that IBM Tivoli Storage FlashCopy Manager supports.

Mirroring using the AIX logical volume manager (LVM mirroring)

IBM Tivoli Storage FlashCopy Manager provides LVM mirroring support for DS8000, IBM XIV® Storage System, and SAN Volume Controller. For those devices, IBM 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 tape backups on either site with IBM Tivoli Storage FlashCopy Manager. In this situation, you do not have to transfer the backup image across sites. To perform this task, a backup server is required on either site where backup images can be mounted locally in order 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, IBM Tivoli Storage FlashCopy Manager can create two INCREMENTAL FlashCopy® backups for DS8000.

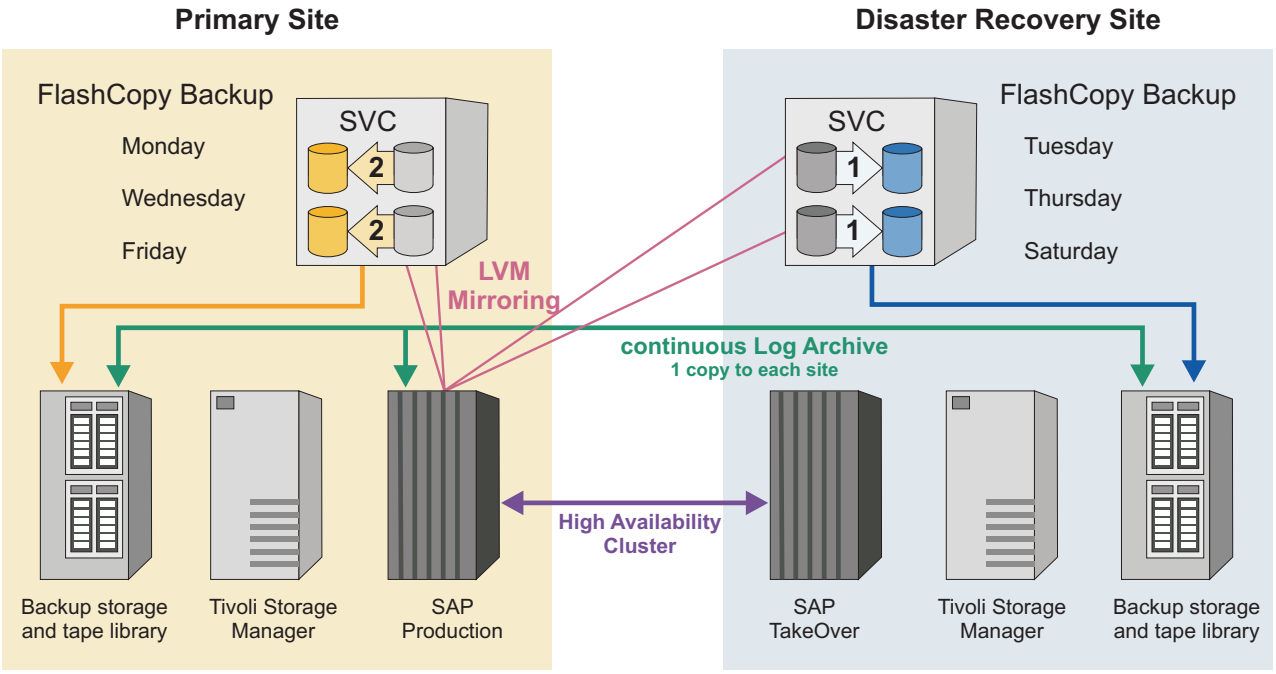

Figure 2. Cross-site mirrored SAP® Database protected with IBM Tivoli Storage FlashCopy Manager and Tivoli Storage Manager.

Support of AIX enhanced concurrent capable volume groups

In order to support high-availability environments, IBM Tivoli Storage FlashCopy Manager supports enhanced concurrent capable volume groups.

Support of Oracle ASM Failure Groups

ASM organizes data in disk groups which consist of a collection of disk drives located in the same loop as configured by the storage subsystem. IBM Tivoli Storage FlashCopy Manager uses an ASM instance to map these disk groups to physical disks. Each disk group can have multiple failure groups which are

redundant copies of each other. These failure groups can be used as a technique to mirror storage volumes. You can do this technique by defining disk groups with normal redundancy that are composed of two failure groups (or by defining disk groups with high redundancy that are composed of three failure groups), and by placing the volumes for each of the failure groups on a dedicated storage cluster. Although the default Oracle System ID (SID) for the ASM instance is +ASM, other SIDs are supported.

In such a configuration, IBM Tivoli Storage FlashCopy Manager is capable for creating FlashCopy® backups of an individual failure group for all supported storage devices (DS8000, SAN Volume Controller, and IBM XIV® Storage System).

Heterogeneous device mirroring

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

Integration with Tivoli Storage Manager

IBM Tivoli Storage FlashCopy Manager can back up data from a remote system (backup server) to Tivoli Storage Manager.

These components must be installed and configured on the backup server in order to back up to Tivoli Storage Manager:

- IBM Tivoli Storage Manager for Enterprise Resource Planning (SAP® with DB2, SAP® with Oracle)
- The DB2 native Tivoli Storage Manager agent (DB2 in non-SAP® environments)
- Tivoli Storage Manager for Databases (Oracle in non-SAP® environments)
- Tivoli Storage Manager Backup-Archive Client (custom application environments)

IBM Tivoli Storage FlashCopy Manager provides these functions with Tivoli Storage Manager:

- Back up to Tivoli Storage Manager immediately after the IBM Tivoli Storage FlashCopy Manager backup completes successfully.
- Perform the Tivoli Storage Manager backup with a separate schedule. This function allows delaying the backup to Tivoli Storage Manager to a time when the availability of tape drives is at its best.
- Manually restart a backup to Tivoli Storage Manager after an error. In this situation, data that has already been committed on the Tivoli Storage Manager server is not sent again.

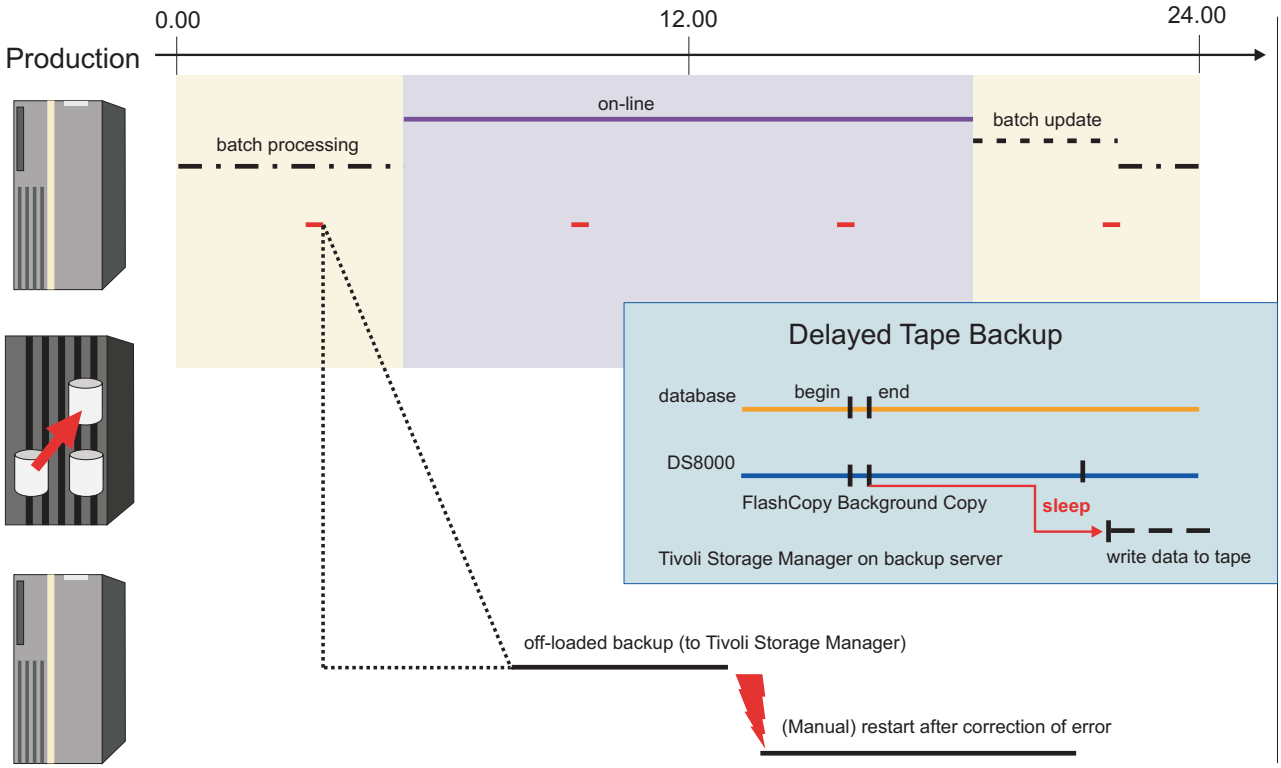

Figure 3. Overview of IBM Tivoli Storage FlashCopy Manager environment when integrated with Tivoli Storage Manager

Custom application support with Tivoli Storage Manager

IBM Tivoli Storage FlashCopy Manager for Custom Applications backs up custom applications that are not explicitly supported by IBM Tivoli Storage FlashCopy Manager.

IBM Tivoli Storage FlashCopy Manager for Custom Applications provides a generic snapshot backup for a file system or volume group with user exits that enable you to run preprocessing and postprocessing scripts to prepare the applications for volume level snapshots.

IBM Tivoli Storage FlashCopy Manager can create consistent snapshot images of one or more file systems on a production system. The snapshots are managed as backup versions using the existing version management policies of IBM Tivoli Storage FlashCopy Manager. The snapshots can be used as a source for instant restore operations. To support applications that need to be quiesced before a snapshot is created, IBM Tivoli Storage FlashCopy Manager provides presnapshot and postsnapshot user exits that enable you to prepare and resume the application before and after snapshot creation. You can also mount the snapshot backups on a secondary system. In Tivoli Storage Manager environments, IBM Tivoli Storage FlashCopy Manager can use the backup-archive client to initiate a subsequent backup to the Tivoli Storage Manager server.

Chapter 2. Preparing your IBM Tivoli Storage FlashCopy Manager environment

Information is provided about preparing the applications, files, parameters, and devices in your IBM Tivoli Storage FlashCopy Manager environment.

These steps assist with preparing the production system, validating the configuration, and adding backup servers to the environment (as a secondary setup). Review the IBM Tivoli Storage FlashCopy Manager prerequisite checklist available in the product release notes. The prerequisite checklist contains the most current requirement information and provides quick validation of your environment. IBM Tivoli Storage FlashCopy Manager depends on the correct setup of different subsystem components. These conditions are the minimum environment requirements:

- a suitable disk layout of the application on the production host
- correctly defined storage definitions on the storage subsystem
- proper connectivity from the production host to the storage subsystem

In an advanced configuration, the production system can be distributed across multiple hosts and storage subsystems. The storage subsystems can also be distributed across sites. Backup servers might be required for operations such as backing up data to Tivoli Storage Manager.

Capacity planning

Information is provided to help you estimate the storage capacities that are required to install and use IBM Tivoli Storage FlashCopy Manager.

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

- Space required for the global product installation on a system
- Space required for enabling each individual database instance with IBM Tivoli Storage FlashCopy Manager
- Space required on the storage device for the actual snapshot backups or clones

Global product installation

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

Table 6. Space requirements for a global product installation of IBM Tivoli Storage FlashCopy Manager

Operating system	Default installation path	Space required (MB)
AIX	/usr/tivoli/tsfcm/acs_2.2.0.0	650
Solaris	/opt/tivoli/tsfcm/acs_2.2.0.0	400
Linux	/opt/tivoli/tsfcm/acs_2.2.0.0	250

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Database instance activation

In addition to the space that is required for the global product installation, IBM Tivoli Storage FlashCopy Manager must be installed on each database instance that is enabled for snapshot-based data protection or cloning. FlashCopy Manager must also be installed on the database instances on a backup server unless it shares its FlashCopy Manager installation with the production server by using NFS.

The space required for each FlashCopy Manager enabled database instance is equal to the amount of space that is required for the global product installation.

Additional space is required for log files and trace files. Log and trace files are written continuously without automatically deleting the older ones. Hence, the amount of storage that is required for log and trace files can grow up to several hundred megabytes after a while. As a best practice, delete log and trace files manually or automatically with a custom script.

Note: For simple Oracle database instances, IBM Tivoli Storage FlashCopy Manager stores the database control files in the FlashCopy Manager repository for each snapshot backup. Furthermore, for standalone FlashCopy Manager installations without IBM Tivoli Storage Manager for Enterprise Resource Planning in an SAP with Oracle environment, all database files are stored in the repository when the backup_dev_type option specifies util_file or util_file_online, and the ALLOW_FULL_FILE_BACKUP parameter specifies YES in the CLIENT section of the FlashCopy Manager profile. If such a configuration is applied (even though it is not recommended), consideration must be given to the space requirements for the FlashCopy Manager repository, which would be negligible otherwise. The repository path can be freely configured so that it can be switched to a volume with sufficient space (using profile parameter ACS_REPOSITORY).

Snapshot copies

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

- The total size of all source volumes that are part of the volume group that contains the application data
- The type of snapshot (full copy versus space efficient)
- The rate that the source volumes are altered after a snapshot is taken (only applies to space-efficient snapshots)

On SAN Volume Controller and DS8000, full snapshot copies, in principle, require the same amount of space as the corresponding source volumes. Space-efficient copies on SAN Volume Controller and XIV initially require sparse space for metadata only. Its space demand grows with every block that is being changed on the corresponding source volume. Accordingly, the more source volume blocks that are changed, the more space is required for the target volumes that represent a snapshot copy of those applications.

Preparing the production environment

All IBM Tivoli Storage FlashCopy Manager backup operations are based on volume-level copy operations (provided by the storage subsystem). They are implemented at a volume group level.

For Oracle ASM environments, backup operations are implemented at the disk group level. IBM Tivoli Storage FlashCopy Manager determines the disk groups to be backed up by mapping application data to files and directories. These files and directories are then mapped to the disk groups that they belong to. As a last step, IBM Tivoli Storage FlashCopy Manager determines the volumes that are subordinate to a disk group. It then triggers the appropriate storage subsystem-specific commands for creating a disk group level copy on the storage device.

IBM Tivoli Storage FlashCopy Manager cannot create consistent point-in-time copies of data at a level less than a volume group. This condition is due to the nature of the copy services. As a result, IBM Tivoli Storage FlashCopy Manager requires a correct disk layout in order to operate correctly.

For native DB2 systems

Information is provided for preparing a native DB2 system.

IBM Tivoli Storage FlashCopy Manager requires this volume group structure:

- At least one volume group per database partition, containing table spaces and the local database directory.
- At least one volume group per database partition containing database log files.

In addition to storing this data in dedicated volume groups, those volume groups must reside on file systems that are supported by IBM Tivoli Storage FlashCopy Manager on your platform. Non-application data (that is stored on these volume groups) is also processed by IBM Tivoli Storage FlashCopy Manager and is included in the backup images. This non-application data is overwritten during a restore operation. As a result, do not store other objects (such as database instance binary files or log archives) on the volume groups used for backup data. If IBM Tivoli Storage FlashCopy Manager detects such data in one of the volumes to be backed up, the backup operation fails. You can change this behavior by specifying the NEGATIVE_LIST profile parameter with the appropriate value. See “IBM Tivoli Storage FlashCopy Manager profile parameters” on page 123 for information about the NEGATIVE_LIST profile parameter.

IBM Tivoli Storage FlashCopy Manager only processes table spaces, the local database directory, and log files. The following volume group layout is recommended for DB2:

Table 7. Volume group layout for DB2

Type of data	Location of data	Contents of data	Comments
Table space volume groups	supported storage subsystem	Table spaces Local database directory	dedicated volume groups per database partition are required
Log volume groups	supported storage subsystem	Log files	dedicated volume groups per database partition are required

Table 7. Volume group layout for DB2 (continued)

Type of data	Location of data	Contents of data	Comments
Instance	storage subsystem or local storage	DB2 instance directory DB2 binary files	Currently IBM Tivoli Storage FlashCopy Manager does not require a specific storage layout for those objects. However, the data must not be stored on one of the volume groups containing table spaces or logs.
Other data	N/A	data of other applications	
Archive	N/A	directory for the log archive	
rootvg	N/A	OS and other binary files	

You can also use only a single volume group per database partition that contains table spaces, the local database directory, and log files (if all backup and restore operations are including the log files). However, you might not be able to perform a roll forward recovery to the end of the logs because the latest online log files are overwritten by the log files contained in the backup. In addition, IBM Tivoli Storage FlashCopy Manager does not support non-mirrored databases where a single database partition is spread across multiple storage devices. In an AIX LVM mirroring environment, each mirror must reside within a separate storage cluster.

For SAP® on DB2

Information is provided for preparing an SAP® on DB2 system.

The recommended storage layout for SAP® on DB2 is identical to the storage layout described in "For native DB2 systems" on page 15. In addition, IBM Tivoli Storage FlashCopy Manager supports SAP® database environments where multiple logical partitions of a DB2 database reside within a single volume group. This setting is referred to as volume sharing (see the PARTITION_GROUP parameter for more details). With volume sharing, individual database partitions cannot be restored and the **db2 restore use snapshot** command cannot be used.

In addition, IBM Tivoli Storage FlashCopy Manager does not support non-mirrored databases where a single database partition is spread across multiple storage devices. In an LVM environment, each mirror must reside within a separate storage cluster.

For SAP® with Oracle

Information is provided for preparing an SAP® with Oracle system.

Tip: Review the exact volume layout specifications (supported through the SAP® BR*Tools Disk - Volume Backup function) that are available in the *SAP® Database Guide for Oracle*.

IBM Tivoli Storage FlashCopy Manager requires that all database files, online redo logs, and control files reside on file systems that are supported by IBM Tivoli Storage FlashCopy Manager on your platform. The data that resides under the sapdata, origlog, and mirrlog directories must reside on separate volume groups. If other data is stored within those volume groups, it is processed by IBM Tivoli Storage FlashCopy Manager and included in the IBM Tivoli Storage FlashCopy Manager backup image. This data is overwritten during a restore operation. As a result, do not store other objects (such as database instance binary files and offline

redo logs) on the volume groups used for backup data. If IBM Tivoli Storage FlashCopy Manager detects such data in one of the volumes to be backed up, the backup operation fails. You can change this behavior by providing SAP BR*Tools with a list of files and directories that are allowed to participate in the backup (see the util_vol_nlist keyword that is specified in the BR*Tools configuration file, init<SID>.sap), or disable SAP BR*Tools from checking for additional files at all by specifying util_vol_nlist = no_check. However, be aware that when util_vol_nlist = no_check is specified, SAP BR*Tools not only copies those files during backup, but also overwrites those files during restore.

IBM Tivoli Storage FlashCopy Manager only processes table spaces at the volume level. The following volume group layout is recommended for SAP® with Oracle:

Table 8. Volume group layout for SAP® with Oracle

Type of data	Location of data	Contents of data	Comments
sapdata	Supported storage subsystem	Database files Control files	One or more dedicated volume groups. It is allowed but not required that you are using dedicated volume groups for each sapdata subdirectory
origlog	Supported storage subsystem	Online redo logs Control files	one or more dedicated volume groups
mirrlog	Supported storage subsystem	Online redo logs Control files	one or more dedicated volume groups
other data	N/A	data of other applications	Recommended. Currently IBM Tivoli Storage FlashCopy Manager does not require a specific storage layout for those objects. However, the data must not be stored on one of the volume groups containing table spaces or logs.
rootvg	N/A	Operating system and other binary files	

IBM Tivoli Storage FlashCopy Manager does not support non-mirrored databases where the database is spread across multiple storage devices. In an LVM environment, each mirror must reside within a separate storage cluster.

For native Oracle systems (non-SAP®, non-ASM)

Information is provided for preparing a native Oracle system (non-SAP®, non-ASM).

IBM Tivoli Storage FlashCopy Manager processes database files at a volume level on native Oracle systems and requires these database files to reside on one or more dedicated volume groups. The database files must reside on file systems that are supported by IBM Tivoli Storage FlashCopy Manager on your platform, or raw

logical volumes. However, database control files must not reside in the same volume group as the database files. Raw physical volumes are only supported in ASM environments.

Non-application data (that is stored on these volume groups) is also processed by IBM Tivoli Storage FlashCopy Manager and is included in the backup images. This non-application data is overwritten during a restore operation. As a result, do not store other objects (such as database binary files, offline redo logs, or control files) on the volume groups used for backup data. If IBM Tivoli Storage FlashCopy Manager detects such data in one of the volumes to be backed up, the backup operation fails. You can change this behavior by specifying the NEGATIVE_LIST profile parameter with the appropriate value. See "IBM Tivoli Storage FlashCopy Manager profile parameters" on page 123 for information about the NEGATIVE_LIST profile parameter.

IBM Tivoli Storage FlashCopy Manager only processes table spaces. Use the following volume group layout for native Oracle systems (non-SAP®, non-ASM):

Table 9. Volume group layout for native Oracle systems (non-SAP®, non-ASM)

Type of data	Location of data	Contents of data	Comments
Table space volume groups	Supported disk subsystem	Table space files	Dedicated volume groups required
Online redo log volume groups	Supported disk subsystem To perform both cloning and FlashCopy backup, the online redo logs must reside on their own volumes on a supported disk subsystem separated from other files.	Online redo logs	Not required, but useful for FlashCopy backup. Required for cloning.
Binary files, control files	For cloning, at least one of the control files must reside on the same volume as the table space files or the online redo logs. If cloning and FlashCopy backup are performed, this control file must reside on the volumes of the online redo logs.	Binary files, control files	

Table 9. Volume group layout for native Oracle systems (non-SAP®, non-ASM) (continued)

Type of data	Location of data	Contents of data	Comments
Offline redo log volume group	N/A	Offline redo logs	Currently IBM Tivoli Storage FlashCopy Manager does not require a specific storage layout for those objects. However, the data may cannot be stored on one of the volume groups containing table spaces or redo logs.
Other data	N/A	data of other applications	
rootvg	N/A	OS and other binary files	

IBM Tivoli Storage FlashCopy Manager requires the use of a catalog database. IBM Tivoli Storage FlashCopy Manager does not support non-mirrored databases where the database is spread across multiple storage devices. In an LVM environment, each mirror must reside within a separate storage cluster.

If the operating system user uses a shell different from ksh, the Oracle-specific environment variables (such as ORACLE_HOME) and paths must be exported in a manner that makes them accessible if the `su - <oracle_user> -c` command is issued.

For Oracle ASM

Information is provided for preparing an Oracle ASM environment.

IBM Tivoli Storage FlashCopy Manager only supports Oracle ASM environments when ASM disk groups are set up on raw physical volumes. Since IBM Tivoli Storage FlashCopy Manager processes database files at the ASM disk group level, the database files are required to reside on dedicated disk groups. Non-application data (that is stored on these disk groups) is also processed by IBM Tivoli Storage FlashCopy Manager and is included in the backup images. This non-application data is overwritten during a restore operation. As a result, do not store other objects on the disk groups used for backup data. If IBM Tivoli Storage FlashCopy Manager detects such data in one of the volumes to be backed up, the backup operation fails. You can change this behavior by specifying the NEGATIVE_LIST profile parameter with the appropriate value. See "IBM Tivoli Storage FlashCopy Manager profile parameters" on page 123 for information about the NEGATIVE_LIST profile parameter.

IBM Tivoli Storage FlashCopy Manager only processes table spaces. The following disk group layout is recommended for Oracle ASM environments:

Table 10. Disk group layout for Oracle ASM

Type of data	Location of data	Contents of data	Comments
Table space disk groups	supported disk subsystem	Table space files	one or more ASM disk groups dedicated exclusively to the protected database
Online redo log disk groups	supported disk subsystem	Online redo logs	A separate disk group is currently not required, but recommended.

Table 10. Disk group layout for Oracle ASM (continued)

Type of data	Location of data	Contents of data	Comments
Offline redo log disk groups	N/A	Offline redo logs	Currently IBM Tivoli Storage FlashCopy Manager does not require a specific storage layout for those objects. They might reside within ASM or within the file system. However, this data must not be stored on one of the volume groups or disk groups containing table spaces or redo logs.
Binary files, control files	disk subsystem	Binary files, control files	
other data	N/A	data of other applications	
rootvg	N/A	Operating system and other binary files	

IBM Tivoli Storage FlashCopy Manager requires the use of a catalog database. Typically one ASM instance can serve multiple databases. IBM Tivoli Storage FlashCopy Manager supports such a setup as long as dedicated disk groups are used for each database. For normal-redundancy disk groups and high-redundancy disk groups, IBM Tivoli Storage FlashCopy Manager handles failure groups in a unique manner as described in "ASM failure group support" on page 24. For DS8000, IBM Tivoli Storage FlashCopy Manager does not use consistency groups. As a result, the only ASM environment supported on DS8000 is that where all table space files reside in one disk group. In addition, this disk group contains exactly one LUN on the DS8000. IBM Tivoli Storage FlashCopy Manager does not support databases that are distributed across multiple storage clusters, except in environments where failure groups are used in a manner where every storage cluster contains a complete image of the database.

While configuring the backup system for offload operations, specify ASM_DISKSTRING `/dev/rhdisk*` in the init<ASM_SID>.ora file. A disk group must also be created on the backup system in order to host the control file. This disk group must have the same name as the disk group where the control file resides on the production system. The repository directory where the control file is restored from (and temporarily stored for RMAN) must exist on the backup system. This directory is typically located under the $ORACLE_BASE/diag/$ORACLE_SID directory for an Oracle 11g database.

If the operating system user uses a shell different from ksh, the Oracle-specific environment variables (such as ORACLE_HOME) and paths must be exported in a manner that makes them accessible if the `su - <oracle_user> -c` command is issued.

For custom applications

Some prerequisites are necessary when preparing a custom application environment.

IBM 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 this data in dedicated volume groups, those volume groups must reside on a file system type that is supported by IBM Tivoli Storage

FlashCopy Manager (see the release notes for details). Any other data (that is stored on these volume groups) is also processed by IBM Tivoli Storage FlashCopy Manager, and it is included in the backup images. Note that the whole backup image will be restored and that any data on the file systems updated or created after the backup will be deleted. Therefore do not store any data that you do not want to restore within volume groups that are being processed by IBM Tivoli Storage FlashCopy Manager. If IBM Tivoli Storage FlashCopy Manager detects such data in one of the volumes to be backed up, the backup operation fails.

You can change this behavior by specifying the NEGATIVE_LIST profile parameter with the appropriate value. See "IBM Tivoli Storage FlashCopy Manager profile parameters" on page 123 for information about the NEGATIVE_LIST profile parameter.

Note: To achieve a transaction-consistent backup of your custom application by keeping its data on the snapshot copied file systems, you can configure IBM Tivoli Storage FlashCopy Manager such that it runs a pre-flash (or post-flash) command immediately prior to (or after) the creation of the snapshot. Those commands can be used to suspend and resume the application in order to create a consistent backup.

For DB2 high-availability disaster recovery server or DB2 standby server

Information is provided for preparing a DB2 high-availability disaster recovery (HADR) or DB2 standby server environment.

A DB2 HADR server or a DB2 standby server environment is protected by IBM Tivoli Storage FlashCopy Manager if and only if the corresponding primary DB2 database is also protected by IBM Tivoli Storage FlashCopy Manager.

Upon takeover, the protection of the former DB2 HADR standby environment can be continued by IBM Tivoli Storage FlashCopy Manager for DB2.

Consequently, the storage layout for a DB2 HADR or DB2 standby server environment must be identical to the storage layout described in "For native DB2 systems" on page 15. In addition, the names of files, file systems, and mount points must be are identical for both the DB2 primary and the DB2 standby environments.

Note: In a typical environment, both sides of a DB2 HADR or DB2 standby server environment can act as the primary or the standby system. To support such configurations, you can create a single profile at each site (see Figure 4 on page 22) that can be used regardless of whether the system is currently the active or inactive copy of DB2.

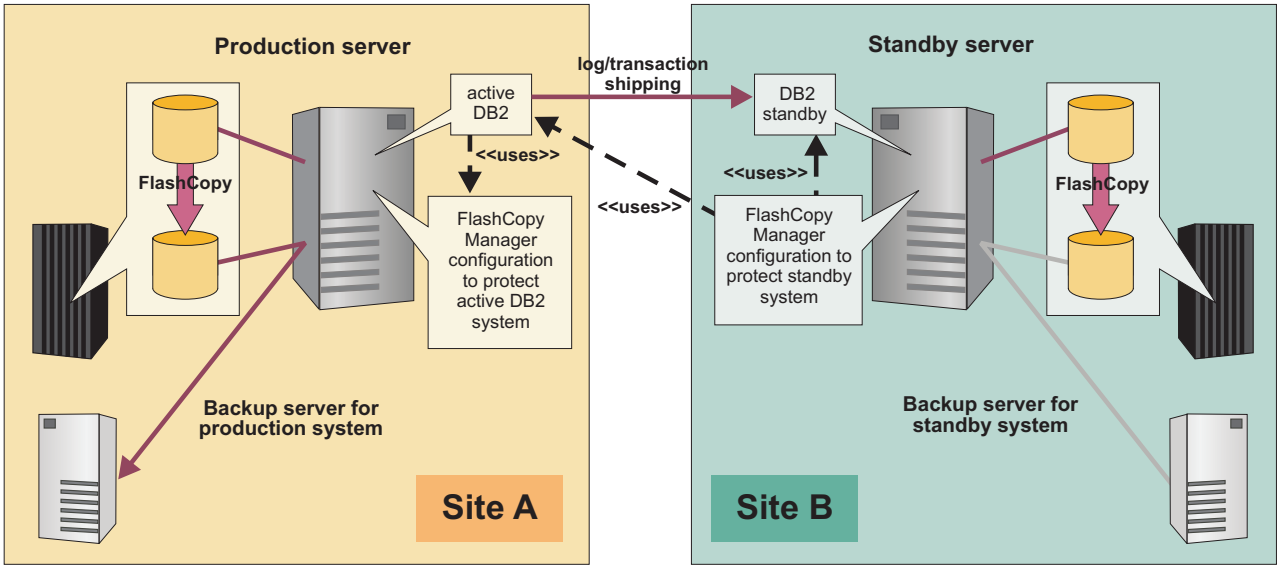

Figure 4. Protection of DB2 HADR standby nodes with IBM Tivoli Storage FlashCopy Manager for Custom Applications

It is important to note that although a single profile can be used on either side (for instance, one profile for the orange site and one profile for the green site), there are different commands for backing up DB2 while it is the primary (command: 'db2 backup use snapshot ...') or the standby or HADR system (command: fcmcli -f backup_db2standby ...'). In an environment where Tivoli Storage Manager is configured, this fact also affects the way IBM Tivoli Storage FlashCopy Manager triggers the Tivoli Storage Manager backup. While DB2 is active, IBM Tivoli Storage FlashCopy Manager issues a 'db2 backup' command for the backup to Tivoli Storage Manager. If DB2 is inactive, IBM Tivoli Storage FlashCopy Manager creates the backup using the Tivoli Storage Manager backup-archive client.

Restriction: Because IBM Tivoli Storage FlashCopy Manager communicates with the active site to query DB2 for a list of files to back up, the names of mount points and file systems containing DB2 data must be are identical in site A and site B.

Remember: Although you can create a single profile on either site that can be used regardless of whether this site is active or passive, you must install IBM Tivoli Storage FlashCopy Manager separately on each site. There is no installation option that installs IBM Tivoli Storage FlashCopy Manager on either site simultaneously.

Using symbolic links

IBM Tivoli Storage FlashCopy Manager follows symbolic links when application data is mapped to volume groups.

However, symbolic links might complicate volume-based backup operations. This complication is especially possible when a file system in a volume group points to an object in another file system, and this file system resides on a different volume group. Therefore, the recommended method is to avoid using symbolic links in your application environment.

Logical Volume Mirroring support (AIX-only)

IBM Tivoli Storage FlashCopy Manager supports environments where volume groups are mirrored between two storage clusters using Logical Volume Mirroring (LVM) on AIX.

This support is provided on DS8000, SAN Volume Controller, and IBM XIV® Storage System environments. When LVM is used to mirror volume groups between two storage clusters, a FlashCopy backup is created such that only one of the mirrors is being copied.

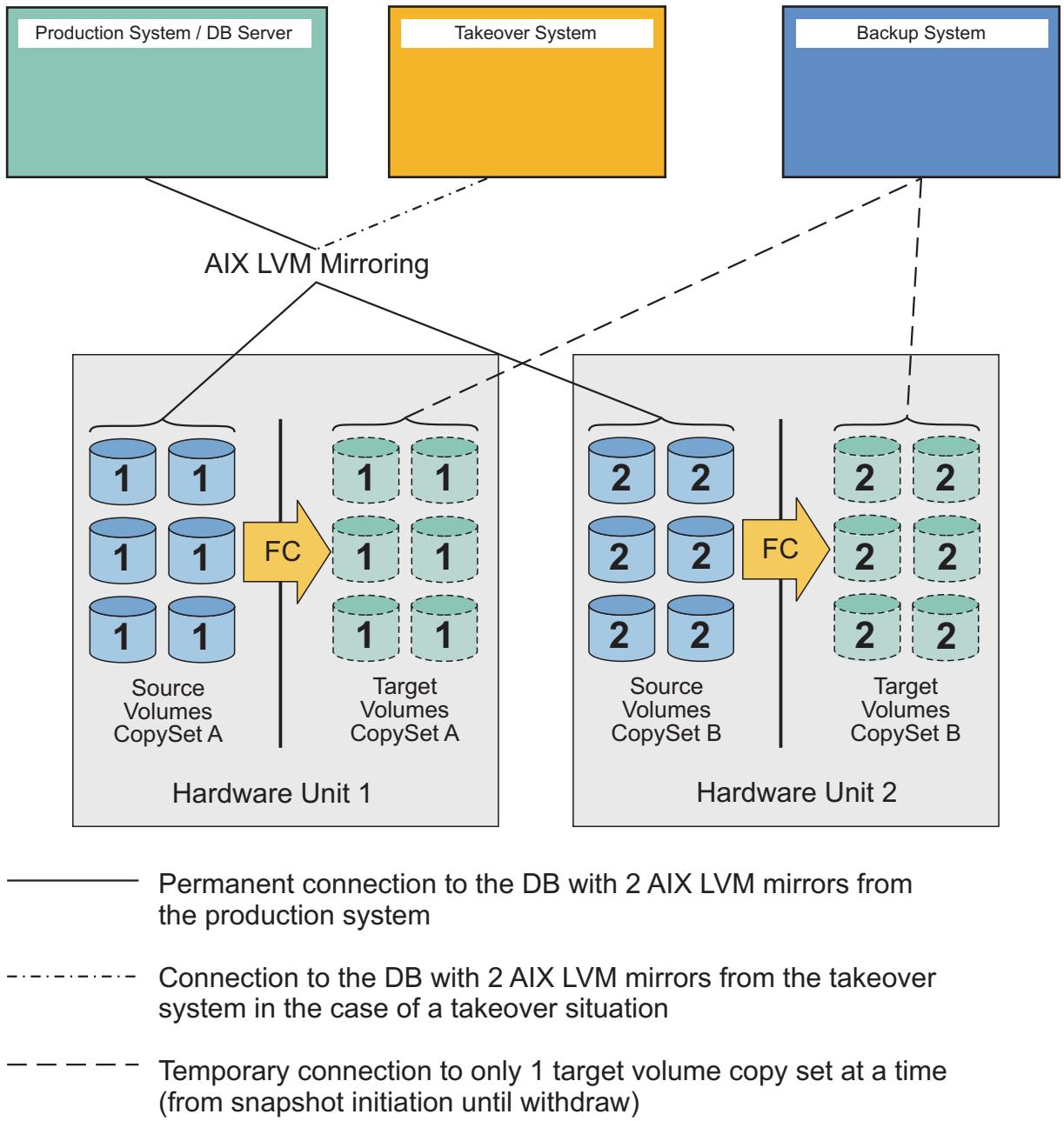

Figure 5. IBM Tivoli Storage FlashCopy Manager in an LVM environment

LVM provides these advantages:

- Only one of the two LVM mirrors are used in the FlashCopy® process, which saves the number of needed target volumes and reduces the time 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 and non-LVM 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.
- IBM Tivoli Storage FlashCopy Manager provides information about asymmetrical LVM mirror setups when encountered, which cannot only prevent the FlashCopy® backup from running in unfavorable situations but can also reveal a general deficiency of the high-availability setup as well.

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

In order to configure IBM Tivoli Storage FlashCopy Manager for LVM mirroring, define both storage subsystems within the IBM Tivoli Storage FlashCopy Manager profile. Use the DEVICE_CLASS parameter to allow IBM Tivoli Storage FlashCopy Manager to select the storage subsystem. At least one backup server is required so that IBM 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, IBM Tivoli Storage FlashCopy Manager runs all the commands required to prepare the LVM environment again for the second mirror. The administrator is informed by message FFM0755I (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.

ASM failure group support

Oracle Automatic Storage Management (ASM) failure groups allows backups of disk groups. These backups are like backups of individual mirrors in an LVM mirroring environment.

When the ASM database is set up with normal (or high) redundancy, and all the disk groups are composed of two (or three) failure groups that reside on two (or three) respective storage clusters, IBM Tivoli Storage FlashCopy Manager creates a backup entirely within only one of the storage clusters. As a result, all the storage clusters must be defined within the IBM Tivoli Storage FlashCopy Manager profile (using the DEVICE_CLASS profile parameter). These definitions must specify that IBM Tivoli Storage FlashCopy Manager selects the cluster for the current operation. When an ASM disk group is set up with normal redundancy, the backup completes even if one of the failure groups is not located on the storage device.

Also, when an ASM disk group is set up with high redundancy, the backup completes even if two of the failure groups are not located on the storage device.

Consider these additional guidelines when using ASM failure groups:

- In situations where all failure groups are residing on one storage cluster, IBM Tivoli Storage FlashCopy Manager backs up all failure groups.
- IBM Tivoli Storage FlashCopy Manager is not required to split the failure groups on a remote system. For LVM environments, mirrors are required to be split on the backup system.
- Failure group support does not require a backup server. (For LVM environments, a backup server is required.)
- In order to avoid additional I/O load during restore, IBM Tivoli Storage FlashCopy Manager does not recreate failure groups when completing a restore. In order to regain the wanted redundancy level, manually add the missing failure groups after restore.

Preparation of the storage device

Consider these guidelines when preparing the storage device.

IBM XIV® Storage System

The storage device and its storage volumes must be accessible from all backup servers in the environment when using IBM XIV® Storage Systems.

In addition, the IBM XIV® Storage System command-line interface (XCLI) must be installed on the production system and on all backup systems of the environment. A typical IBM XIV® Storage System profile entry is provided here:

```
>>>
DEVICE_CLASS XIV
COPYSERVICES_HARDWARE_TYPE  XIV
PATH_TO_XCLI    path where XCLI is installed
COPYSERVICES_SERVERNAME  xiv_hostname
COPYSERVICES_USERNAME   admin
RECON_INTERVAL    12
GRACE_PERIOD    24
USE_WRITABLE_SNAPSHOTS   AUTO
USE_CONSISTENCY_GROUPS   YES
BACKUP_HOST_NAME   backup_host
<<<
```

You can set up policies within the IBM XIV® Storage System that deletes snapshots created with IBM Tivoli Storage FlashCopy Manager. For that purpose, IBM Tivoli Storage FlashCopy Manager periodically checks whether backups on the storage subsystem are still valid. This checking process is referred to as reconciliation. The reconciliation interval can be specified by the profile parameter RECON_INTERVAL (in hours). During this reconciliation process, however, IBM Tivoli Storage FlashCopy Manager also removes snapshots on the storage device it created and that are not reflected in the IBM Tivoli Storage FlashCopy Manager repository. This action occurs even though they have not been deleted. This situation is unlikely and can only occur when the IBM Tivoli Storage FlashCopy Manager repository is removed or restored to a prior point in time. To avoid accidentally deleting these snapshots, the reconciliation process bypasses snapshots created within the time interval specified with the GRACE_PERIOD parameter.

The USE_WRITABLE_SNAPSHOTS parameter specifies whether writable snapshots can be used for restore operations. If writable snapshots are used, no

duplicates are created during mount operations and all changes applied to the snapshot are preserved. Writable snapshots are only required in LVM mirroring environments.

The USE_CONSISTENCY_GROUPS parameter determines if all volumes are used concurrently in the FlashCopy operation by unifying them in one consistency group. This group is then used in the FlashCopy in one atomic operation. This option requires that for one database instance, all volumes managed by IBM Tivoli Storage FlashCopy Manager reside in the same storage pool. In addition, they must not already belong to any consistency group. The use of consistency groups is only required for ASM environments and is optional in other environments.

IBM System Storage DS8000 and SAN Volume Controller

Information is provided about CIM server and target volume requirements for DS8000 and SAN Volume Controller.

IBM Tivoli Storage FlashCopy Manager uses a CIM server to communicate with a storage cluster. Starting with SAN Volume Controller 4.3.1 and DS8000 R4.1, this CIM server is embedded into the storage device. As a result, it does not need to be installed and configured separately. For prior SAN Volume Controller and DS8000 releases, a proxy CIM server is required and must be configured to manage the necessary storage clusters. Refer to the DS8000 and SAN Volume Controller documentation for configuration details. IBM Tivoli Storage FlashCopy Manager supports both configuration options for the SAN Volume Controller and DS8000 releases that support both a proxy CIM server and an embedded CIM server.

Unlike IBM XIV® Storage Systems, IBM Tivoli Storage FlashCopy Manager requires that suitable FlashCopy backup target volumes be created in advance on SAN Volume Controller and DS8000. In order to provide a target set definition to IBM Tivoli Storage FlashCopy Manager, you must organize target volumes into target sets, where each target set represents one backup generation. Although IBM Tivoli Storage FlashCopy Manager automatically matches source volumes to suitable target volumes, 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 are ignored.

Reconciliation of FlashCopy backups

FlashCopy backups that are stored on disk storage subsystems require reconciliation in certain situations.

Situations might occur when the FlashCopy backups identified in the IBM Tivoli Storage FlashCopy Manager repository become invalid. The following scenario describes the circumstances that cause FlashCopy backups to become invalid:

Withdrawal of a source volume and target volume relationship
During a backup that specifies FLASHCOPY_TYPE NOCOPY or INCREMENTAL, the source volume and target volume relationship is validated as part of the backup operation. Using these FlashCopy types, when a source and target volume relationship is withdrawn, the target volume goes offline or is left in an inconsistent state. However, for FLASHCOPY_TYPE COPY backups, IBM Tivoli Storage FlashCopy Manager is unable to distinguish whether the relationship was withdrawn because the background copy process has completed successfully, or whether the relationship was manually withdrawn before the background copy process has completed.

Environment conditions:

- SAN Volume Controller 4.3 or 5.1
- DS8000

Space-efficient multitarget FlashCopy on SAN Volume Controller

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

In the SAN Volume Controller 5.1 environment, the following situations might cause space-efficient targets to be deleted:

Backup operations and cloning operations
An IBM 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 for each FLASHCOPY_TYPE value. When the FlashCopy backup that is available on the target set is not the oldest backup, then the older backups are destroyed during the backup operation. This situation can also happen when a new FlashCopy cloning operation is started with the force option (-F).

Restore operation
An IBM Tivoli Storage FlashCopy Manager restore operation destroys any FlashCopy backups that are newer than the backup that is being restored.

Target volume storage space exceeded
When the available storage capacity of a space-efficient FlashCopy target volume is exceeded, the target volume status changes to offline. As a result, the data that resides on the target volume is destroyed.

SAN Volume Controller 5.1

SAN Volume Controller 5.1 introduces new capabilities for IBM Tivoli Storage FlashCopy Manager.

SAN Volume Controller 5.1

SAN Volume Controller 5.1 adds a new feature to cascading FlashCopy that allows IBM Tivoli Storage FlashCopy Manager to restore FlashCopy backups before completion of a background copy. This feature is essential to enable space efficient volumes as backup targets. It is essential because the background copy rate has to be set to zero in order to prevent the FlashCopy target from becoming fully allocated.

Because of this new feature, consider these consequences when setting up IBM Tivoli Storage FlashCopy Manager with SAN Volume Controller 5.1:

Physical capacity
The physically allocated capacity of a space efficient target volume must be sized sufficiently. It must be large enough to contain all changes that occur to your production environment between the current and the subsequent backup. If it is not large enough, the target volume goes offline and the corresponding backup becomes invalid.

Tip: SAN Volume Controller allows creating “auto-expandable” target volumes. In this case, additional storage is assigned to the target whenever storage capacity decreases and sufficient extra capacity is available.

FlashCopy relationships

During a restore, IBM Tivoli Storage FlashCopy Manager needs to stop all FlashCopy relations. These relations consist of relations that were established after (and including) the point in time when the backup was created. As a result, 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. The same restriction applies to FULL or INCREMENTAL FlashCopy backups, as long as the background copy has not been deleted.

In order to check if a backup will be deleted, you can query the usability state of IBM Tivoli Storage FlashCopy Manager backups. If the backup will be deleted, the DESTRUCTIVELY_RESTORABLE state is set during restore. Otherwise, the state is set to REPETITIVELY_RESTORABLE.

Target sets

IBM 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 relation. This situation implies that whenever IBM Tivoli Storage FlashCopy Manager reuses a target set, it deletes all backups that have been created before this point in time. In a non-mirrored environment, this action is always the case when these settings exist:

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

In a mirrored environment, this action is always the case when the CLIENT section of the profile contains one DEVICE_CLASS statement per LVM mirror. If multiple device classes are specified within this statement, each device class must manage the same number of target sets.

Recommendations

Recommendations for SAN Volume Controller 5.1 environments:

- Do not use space-efficient volumes as source volumes.
- 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 at most for disk-only backups. Use one DEVICE_CLASS statement at most for dual backups (disk plus tape) as well. 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+TSM backup at 00:15.

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

- The backup from which you are currently restoring, and all backups taken after that point in time, are deleted when this condition exists:
  - The usability state of the corresponding backup indicates that the backup is DESTRUCTIVELY_RESTORABLE.

  The backup is not deleted when the backup was created with FLASHCOPY_TYPE FULL or INCR, and the background copy completed.

Examples

Example 1: This 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
...
<<<
```

Example 2: This scenario illustrates a profile in a mirrored environment. On MIRROR_1, two space efficient FlashCopy backups were created on Monday, Wednesday, and Friday. The backup created at midnight is copied to Tivoli Storage Manager. The backup created at noon is retained only on disk. The backup 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 full backup completes.

```
>>> 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_1_DISK_TSM 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 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
...
<<<
```

Example 3: This example is like Example 2 but it does not create Tivoli Storage Manager backups from MIRROR_1. Rather, it 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
...
<<<
```

Target set definitions

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

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

Target set definition files

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

IBM Tivoli Storage FlashCopy Manager attempts to match source volumes to suitable targets within a target set during backup. To determine source target relations in advance, specify a source name with a target in the target set definition file. In this situation, the relation between the source and target is required. Backup processing fails if one of the targets is unavailable for the specified source. See "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183 for details on the target selection algorithms.

If IBM 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. Since 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 using multiple backup servers within your environment, use multiple target set definition files.

Example

This example is of a target set definition file for a database running on DS8000:

```
>>> 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
                     # definiton (source name following target name)
TARGET_VOLUME 40C13158 40613158
TARGET_VOLUME 40D13158 40713158
TARGET_VOLUME 40E13158 40813158
<<<
```

Target set definition file for multi-partition DB2 databases

Multi-partition DB2 database target set definitions must be specified for each partition.

As a result, the contents of the target set definition file is separated into multiple sections. One section is used for each partition, as shown in this example:

```
>>> TARGET_SET SET_1 # FCM determines a suitable target for every source
 >>> PARTITION NODE0000
TARGET_VOLUME 40913158
TARGET_VOLUME 40A13158
<<<
 >>> PARTITION NODE0001
TARGET_VOLUME 40B13158
TARGET_VOLUME 50913158
TARGET_VOLUME 50A13158
TARGET_VOLUME 50B13158
TARGET_VOLUME 51713158
<<<
 >>> PARTITION NODE0002
TARGET_VOLUME 51813158
TARGET_VOLUME 52113158
TARGET_VOLUME 52313158
 <<<
<<<
```

A single backup server environment (for a multi-partition DB2 database) can be distributed across multiple servers. In this situation, make sure that the target volumes in the target set definition file are assigned to the correct host. For best results, assign all target volumes in the target set definition file (and that are associated with the same partition) to the same host. In environments where multiple partitions reside on the same volume group (volume sharing), target set definition files need to specify certain values. See the PARTITION_GROUP parameter for more information.

Referring to target set definitions from the profile

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

In this example profile, the keywords are in bold:

```
>>> 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, associate each DEVICE_CLASS section with a unique target set definition file for best results. If all target sets within the target set definition file are then assigned to the same host, all target sets associated with a single DEVICE_CLASS can be mounted from 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.

IBM Tivoli Storage FlashCopy Manager supports using a naming convention (instead of a definition file) for target set definitions on SAN Volume Controller. IBM 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 (`TARGET_SETS 1 2 3`). A TARGET_NAMING rule is also specified that determines the name of the target volume from the name of the source. For example, if the database is stored on a volume named db_vol, the targets required by IBM Tivoli Storage FlashCopy Manager are db_vol_bt1, db_vol_bt2, and db_vol_bt3. These targets depend on the target set 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
<<<
```

Target set definition files for users who are upgrading from Tivoli Storage Manager for Advanced Copy Services

IBM Tivoli Storage FlashCopy Manager can read target set definition files that were used with Tivoli Storage Manager for Advanced Copy Services 6.1.

Set the TARGET_SETS parameter to VOLUMES_DIR. Then use the VOLUMES_DIR parameter to point to the location where the target set definitions previously resided. For example:

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

Note: The VOLUMES_DIR parameter is deprecated. Use the VOLUMES_FILE or TARGET_NAMING parameters for new configurations.

Selecting the FLASHCOPY_TYPE

DS8000 and SAN Volume Controller supports various FlashCopy® types which provide different capabilities for your backup strategy.

Using different FlashCopy® types for different backup generations is a valid strategy for IBM 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 IBM Tivoli Storage FlashCopy Manager to select the appropriate DEVICE_CLASS section for the next backup. See the DEVICE_CLASS parameter in the CLIENT section for more information.

If the FLASHCOPY_TYPE is changed for one DEVICE_CLASS, then a special approach should be taken:

1. Unmount the backup if it is currently mounted on a backup system.
2. Delete the backup with the delete force option. For details on which commands to use, see "Deleting IBM Tivoli Storage FlashCopy Manager snapshot backups" on page 91.
3. Change the FLASHCOPY_TYPE in the DEVICE_CLASS and run a new backup with the new FLASHCOPY_TYPE.

Table 11. Selecting the FLASHCOPY_TYPE for DS8000 and SAN Volume Controller

FLASHCOPY_TYPE	DS8000	SAN Volume Controller[1]
COPY	Can be used for backup and restore. Protects from physical failures of the source volumes once the background copy has completed.	Can be used for backup and restore. Protects from physical failures of the source volumes once the background copy has completed. It is not recommended to create a COPY FlashCopy® to a space efficient target. This recommendation is because the target eventually becomes fully allocated due to background copying of data.
INCR	Recommended option for DS8000. Same characteristics as COPY FlashCopy® but with less data being copied in the background. DS8000 allows at most one INCR FlashCopy® per source volume. In mirroring environments, this setting allows it to retain one 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 one target set is specified.	Same characteristics as COPY FlashCopy® but with less data being copied in the background. It is not recommended to create an INCR FlashCopy to a space efficient target. This recommendation is because the target eventually becomes fully allocated due to background copying of data.

Table 11. Selecting the FLASHCOPY_TYPE for DS8000 and SAN Volume Controller (continued)

FLASHCOPY_TYPE	DS8000	SAN Volume Controller[1]
NOCOPY	Can be mounted remotely but cannot be restored.	Can be mounted remotely. SAN Volume Controller 5.1 is required to restore from a NOCOPY FlashCopy. Can be used to create a FlashCopy® to a space efficient target, but does not offer protection from physical failures to the source volume. **Note:** Space efficient target volumes can reach capacity limits in which case they go offline. When this situation occurs, you lose the current backup and all older backups which have not yet reached FULL_COPY. You can choose to create space efficient targets with the AUTOEXPAND option. In this case, the target is allocated more physical storage in order to prevent going offline.

Note:

1. See "SAN Volume Controller 5.1" on page 27 for planning and configuration details when using SAN Volume Controller 5.1.

Integration with Metro Mirror and Global Mirror

IBM Tivoli Storage FlashCopy Manager backs up data on DS8000 and SAN Volume Controller with volumes that are simultaneously used as Metro Mirror and Global Mirror sources.

For SAN Volume Controller however, any existing Metro Mirror and Global Mirror relation must be stopped before attempting a restore operation. Although DS8000 supports using FlashCopy® targets as Metro Mirror and Global Mirror sources, it is not recommended when using IBM Tivoli Storage FlashCopy Manager. Using FlashCopy® targets as Metro Mirror and Global Mirror sources is not supported on SAN Volume Controller.

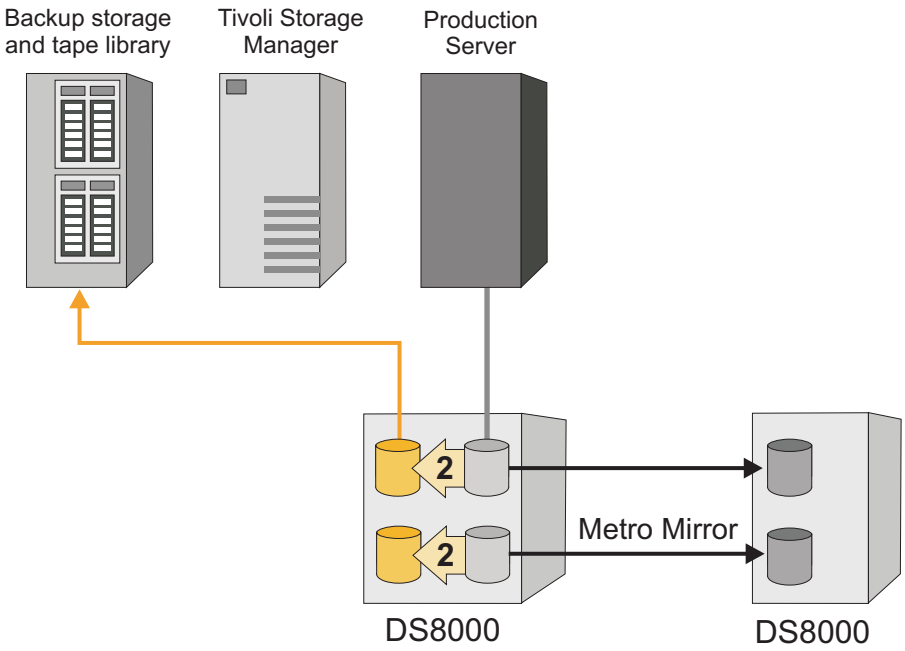

Figure 6. Metro Mirror and Global Mirror relations

A note on LVM mirroring and ASM failure group environments

In LVM mirroring and ASM failure group environments, multiple DEVICE_CLASS configuration sections (one section per storage cluster or LVM mirror) are required.

This requirement is needed even in those cases where IBM Tivoli Storage FlashCopy Manager is connected to a proxy CIM server that manages both storage clusters. In addition, the storage system ID must be specified in the IBM Tivoli Storage FlashCopy Manager DEVICE_CLASS configuration section. It must also be specified if only one storage system is managed from the CIM server. For example:

```
>>> DEVICE_CLASS MIRR_1
COPYSERVICES_HARDWARE_TYPE   DS8000
COPYSERVICES_PRIMARY_SERVERNAME  <hostname>
STORAGE_SYSTEM_ID   13158
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  <hostname>
STORAGE_SYSTEM_ID   12067
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 reside on the same storage subsystem.

Table 12. STORAGE_SYSTEM_ID parameter description

Parameter Name	Value
STORAGE_SYSTEM_ID *hardware ID*	In an LVM mirror environment, this parameter specifies the name of the cluster for SAN Volume Controller. For DS8000 and XIV®, this parameter specifies the serial number that contains a complete set of at least one copy of all database logical volumes that are subject to the backup process. Only the volumes on this cluster are used during the backup. Default: None. Ignored if not defined.

Preparation of the backup and cloning servers

A backup server or a clone server is an auxiliary host where IBM Tivoli Storage FlashCopy Manager can mount some or all of its backups or clones.

In environments where Tivoli Storage Manager is used, backup servers also offload the workload of a Tivoli Storage Manager backup to an alternate machine. Multiple backup or clone servers for a single application are also supported, and also sharing a backup or clone server among multiple applications. However, IBM Tivoli Storage FlashCopy Manager does not allow backup images or clone images to be mounted directly on the production system. As a result, a backup or clone server is always required to be a separate host.

Determining the number of backup and clone servers in the environment

Once the production database has been prepared for use with IBM Tivoli Storage FlashCopy Manager, determine how many backup servers are needed in your environment. If FlashCopy Cloning is used, determine how many clone servers are needed. A clone server can also be used as a backup server and vice versa.

A backup server allows the mounting of a backup image. If IBM Tivoli Storage FlashCopy Manager is used in combination with Tivoli Storage Manager, IBM Tivoli Storage FlashCopy Manager also uses a backup server to create a backup to Tivoli Storage Manager.

At least one backup server is required, when the following situations exist or tasks are planned. If FlashCopy cloning is used, a clone server is always required.

- Mount backups on another system (for example, on the backup server)
- Create a backup to tape for instance using Tivoli Storage Manager
- IBM Tivoli Storage FlashCopy Manager enforces a mount during backup. This enforcement occurs when these conditions exist:
  - The database is running in an LVM mirrored environment on AIX
  - FlashCopy cloning is used
  - Conditions that require a forced mount for the different storage subsystem environments:

    XIV A forced mount is required if the profile parameter USE_CONSISTENCY_GROUPS is set to NO and a freeze or thaw was not used for the file systems.

SVC or DS
A forced mount is required if the profile parameter BACKUP_HOST_NAME is set to PREASSIGNED_VOLUMES and the operating system is Linux or Solaris.

DS A forced mount is required if the profile parameter BACKUP_HOST_NAME is set to PREASSIGNED_VOLUMES and a freeze or thaw was not used for the file systems, and the operating system is AIX.

The number of required backup servers is then determined by the number of servers from where you access backup images. For example, to access backup images on either site of a disaster recovery environment, at least two backup servers are needed.

The number of clone servers is determined by the number of servers on which you want to have a cloned database of your production database. Backup servers and clone servers can reside on the same machine.

For a physically partitioned DB2 database, multiple backup servers are allowed to be used. The physical partitioning of the production system is not required to be identical to the physical partitioning of the backup system.

A backup server can also simultaneously be used for multiple applications.

Installation prerequisites for a backup or clone server

A host that is used as a backup or clone server must be at the same operating system level as the production system.

A database instance is required on each backup server (except for Oracle in an SAP® environment and for custom application support). For Oracle ASM, an ASM instance is required on each backup server (a single ASM instance can be used for multiple production systems).

If IBM Tivoli Storage FlashCopy Manager is used in combination with Tivoli Storage Manager, a backup server can also be used. This backup server is used to offload the backup workload of a Tivoli Storage Manager backup from the production system to a backup server. IBM Tivoli Storage FlashCopy Manager uses these application agents for offload backup:

- DB2 native Tivoli Storage Manager agent for non-SAP® DB2 environments
- IBM Tivoli Storage Manager for Enterprise Resource Planning for SAP® on DB2 and SAP® on Oracle
- Tivoli Storage Manager for Databases for Oracle in non-SAP® environments
- IBM Tivoli Storage FlashCopy Manager for Custom Applications

The appropriate database instance and application agent are required to be installed and configured on the backup server.

As a result, IBM Tivoli Storage FlashCopy Manager requires these settings:

- The user name and group name of the database instance owner on the production system are also available on the backup server with the same user ID (UID) and group ID (GID).

- For DB2 (SAP® and non-SAP®): A database instance with the same version as the database instance on the production server is required to be installed on the backup server.
- For non-SAP® Oracle: A database instance with the same version as the database instance on the production server is required to be installed on the backup server.
- For all applications: For log file archiving and database backups to Tivoli Storage Manager of the cloned database, the appropriate Tivoli Storage Manager application agent as previously identified is installed and configured. The Tivoli Storage Manager application version on the clone server must be the same level on the production server.

For FlashCopy cloning, the appropriate database instances and application agents are required to be installed and configured on the clone server. For Oracle, only one clone instance is required. For DB2, two instances are required: the instance with the same name as the production instance, and a second instance with the name of the cloned instance in which the cloned database is created.

As a result, IBM Tivoli Storage FlashCopy Manager requires the following settings for FlashCopy cloning:

- For DB2 (SAP® and non-SAP®): The user name and group name of the database instance owner on the production system are also available on the clone server with the same user ID (UID) and group ID (GID). Another user and group with a different user ID (UID) and group ID (GID) is available on the clone server for the clone instance.
- For DB2 (SAP® and non-SAP®): Two database instances with the same version as the database instance on the production server are required to be installed on the clone server. One database contains the production instance name and the other contains the clone instance name.
- For DB2 (SAP® and non-SAP®): The user name and group name of the clone database instance owner on the clone system are available on the clone server with a different user ID (UID) and group ID (GID).
- For Oracle (SAP® and non-SAP®): A clone database instance with the same version as the database instance on the production server is required to be installed on the clone server with the clone instance name.
- For all applications: The appropriate Tivoli Storage Manager application agent is installed and configured. The Tivoli Storage Manager application version on the clone server must be the same level on the production server.

For Oracle in SAP® environments, Oracle instances or SAP® BR*Tools are not required to be installed on the backup and clone servers.

Update the Tivoli Storage Manager password on the production server and all backup servers whenever it changes. When Tivoli Storage Manager is configured to use PASSWORDACCESS GENERATE, the password might change without notification. If the Tivoli Storage Manager application is configured to use PASSWORDACCESS GENERATE, use the Tivoli Storage Manager proxy-node capability to avoid authentication errors upon password reset. Create one node (data node) on the Tivoli Storage Manager server to which all application agents (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.

Backup and clone server assignment

IBM Tivoli Storage FlashCopy Manager allows backups and clones to be mounted; however, each backup or clone image can only be mounted on one server.

To perform a mount, issue the mount request command (tsm4acs -f mount) on the production server, or issue a create clone (tsm4acs -f create_clone) or refresh clone request (tsm4acs -f refresh_clone). IBM Tivoli Storage FlashCopy Manager selects the backup or clone server on which the backup or clone is mounted in the following manner:

1. It determines the name of the device configuration section (DEVICE_CLASS) which was used to create the backup or clone.
2. It then determines those servers which are eligible to mount backups or clones for this DEVICE_CLASS configuration section.

On each backup or clone server, mount agents (that were initialized with DEVICE_CLASS names through command-line entries) are running. As a result, the association between both is indirectly established. The volumes that need to be mounted must also be assigned to the selected backup or clone servers before attempting a mount. For IBM XIV® Storage Systems, this assignment is automatically performed during the mount request. In mirroring environments, the device configuration section refers to that storage cluster on which the backup or clone was created. For Oracle environments and for each DB2 database partition, IBM Tivoli Storage FlashCopy Manager allows for exactly one backup or clone server per DEVICE_CLASS. If the identified servers have not yet mounted another backup or clone image, the mount request is propagated to those servers. The backup or clone is then mounted.

When SAN Volume Controller is used with BACKUP_HOST_NAME <backup_server_hostname>, the volumes are also mapped dynamically on SAN Volume Controller. For details, see the description for the BACKUP_HOST_NAME parameter in “Profile parameter notes” on page 168.

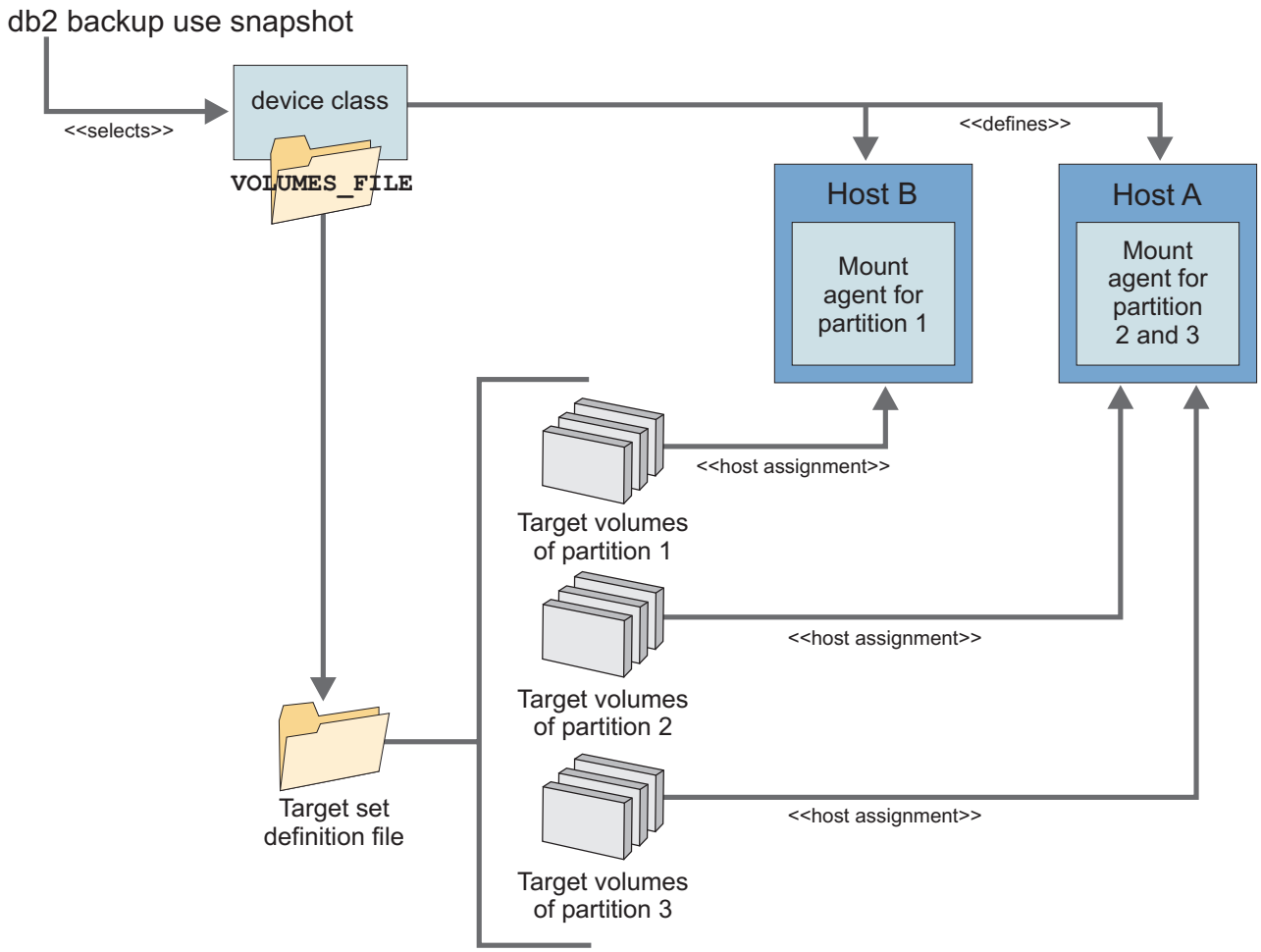

Figure 7. IBM Tivoli Storage FlashCopy Manager host assignments for DB2.

For DS8000 and SAN Volume Controller, IBM Tivoli Storage FlashCopy Manager requires the target volumes to be preassigned to a specific backup or clone server. Because a DEVICE_CLASS always directs mount requests to the same server, assign target volumes to a particular backup or clone server before mounting. This task is accomplished by ensuring that 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 all targets associated with a single device class are always mounted from the same backup or clone server.

When SAN Volume Controller is used with BACKUP_HOST_NAME <backup_server_hostname>, the volumes are also mapped dynamically on SAN Volume Controller. For details, see the description for the BACKUP_HOST_NAME parameter in "Profile parameter notes" on page 168.

Managing backups and clones with the DEVICE_CLASS parameter

Use the DEVICE_CLASS parameter in the CLIENT section to select the storage device configurations for backups, and use the DEVICE_CLASS parameter in the CLONING section to select the storage device configurations for cloning.

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

- Partition number
- Day of week
- Time of backup
- Device class used by last backup operation
- (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 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 or SAN Volume Controller
- The type of FlashCopy® backup to be performed (for example, INCR, COPY)
- The mount location of the backup
- Whether a backup to Tivoli Storage Manager server storage is created from the snapshot

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 created to MIRROR_2 are backed up to Tivoli Storage Manager server storage:

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

This example creates backups of a partitioned DB2 database with five partitions. While partition 0 uses DEVICE_CLASS PARTITION0, the partitions 1-4 use DEVICE_CLASS PARTITIONX:

```
>>> CLIENT
DEVICE_CLASS PARTITION0 ON_DBPARTITIONNUMS 0
DEVICE_CLASS PARTITIONX ON_DBPARTITIONNUMS 1 2 3 4
[...]
<<<
```

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 YES
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 YES 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
[...]
<<<
```

This example demonstrates how to create clone databases on different clone servers from the same production database. In this scenario there are two clone servers, each one using a different device class. host1 uses DEVICE_CLASS CLONE1 and host2 uses DEVICE_CLASS CLONE2. When a clone request is started with clone database B01 selected, this clone is created with DEVICE_CLASS CLONE1 and it is created on clone server host1.

```
>>> CLONING
DEVICE_CLASS CLONE1 USE_FOR_CLONING B01 C01
DEVICE_CLASS CLONE2 USE_FOR_CLONING B02 C02
<<<
>>> DEVICE_CLASS CLONE1
CLONE_DATABASE YES
...
<<<
>>> DEVICE_CLASS CLONE2
CLONE_DATABASE YES
...
<<<
```

Chapter 3. Installing IBM Tivoli Storage FlashCopy Manager

Installation consists of installing the product code and then setting up your environment.

The installation procedure consists of these tasks:

1. "Preparing the environment for installation"
2. Installing the IBM Tivoli Storage FlashCopy Manager product code
   - "Installing on the production server and remotely on the backup or clone server" on page 47
   - "Installing separately on the backup or clone server" on page 50
3. "Setting up the disk storage environment" on page 51

Note: For cloning, the equivalents of the backup server, backup node, and backup system are the clone server, clone node, and clone system.

Preparing the environment for installation

The environment requires certain preparations before attempting to install IBM Tivoli Storage FlashCopy Manager.

Important: Before attempting to install IBM Tivoli Storage FlashCopy Manager, make sure to review the prerequisite checklist available from the release notes. Also, make sure to read and understand the installation and setup concepts presented in this section.

The IBM Tivoli Storage FlashCopy Manager prerequisite checklist provides guidance for checking the hardware, software, and environment requirements needed for successful installation. Use the IBM Tivoli Storage FlashCopy Manager installation sheet (provided within the prerequisite checklist) to collect all information needed for the product installation.

Overview: Installing the product code

IBM Tivoli Storage FlashCopy Manager must be installed on the production system. Optionally, it can also be installed on the backup system. In an environment that contains physically partitioned DB2 databases, IBM Tivoli Storage FlashCopy Manager only needs to be installed on one of the production systems. The IBM Tivoli Storage FlashCopy Manager installation directory is as follows (hereafter referred to as FCM_INSTALL_DIR):

- (AIX): `/usr/tivoli/tsfcm/acs_2.2.0.0`
- (Linux): `/opt/tivoli/tsfcm/acs_2.2.0.0`
- (Solaris): `/opt/tivoli/tsfcm/acs_2.2.0.0`

During installation, the IBM Tivoli Storage FlashCopy Manager installer also activates the database instance for later use with IBM Tivoli Storage FlashCopy Manager. During this activation step, the installer launches a setup script that copies all necessary files from the IBM Tivoli Storage FlashCopy Manager installation directory to a database instance-specific installation directory, and also sets their access rights.

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Tip: The activation of additional database instances can be done later or at anytime by invoking the setup script with the option -a install as the root user.

The default database instance-specific installation directory (hereafter referred to as INST_DIR) is as follows:

- (DB2) `<Instance owner $HOME directory>/sqllib/acs/`
- (Oracle) `<Instance owner $HOME directory>/acs/`

For custom applications, the default installation directory is `$HOME/acs`.

Overview: Setting up your environment

After installation (and activation) completes, use the setup script to set up IBM Tivoli Storage FlashCopy Manager for use with your environment. You only need to set up your environment once after the initial activation of the product. Setup is required on the production system and is optionally available on the backup system.

During setup, IBM Tivoli Storage FlashCopy Manager creates the following:

- ACS_DIR configuration directory as specified in the profile if it is different from the INST_DIR created during activation.
- Profile within ACS_DIR configuration directory
- A link (`INST_DIR/profile`) to the profile located in the ACS_DIR configuration directory if it is different from INST_DIR
- A password file within `ACS_DIR/shared`
- `/etc/inittab` entries for daemon processes

The setup script can be used to install IBM Tivoli Storage FlashCopy Manager on multiple backup nodes from the production system. To enable backup nodes for remote installation and configuration from the production system, Open Secure Shell (OpenSSH) must be installed on these backup nodes. In addition, when the setup script is used to update the profile, you are prompted whether to update the backup system nodes. NFS shares between the production system and backup system nodes are not required for this type of remote installation. OpenSSH is the preferred method for IBM Tivoli Storage FlashCopy Manager but NFS shares are still supported but OpenSSH is now the preferred method for IBM Tivoli Storage FlashCopy Manager.

When INST_DIR is NFS-shared with other nodes, IBM Tivoli Storage FlashCopy Manager needs to be configured on only one production system node (for federated DPF environments only on one node), and on the backup system. NFS shares are not required when using Open Secure Shell (OpenSSH) to install IBM Tivoli Storage FlashCopy Manager on the backup system nodes.

If both the configuration directory (ACS_DIR) and the database instance-specific installation directory (INST_DIR) are NFS-shared between all production system and backup system nodes, IBM Tivoli Storage FlashCopy Manager is best administered only from the production system (for Oracle or DB2) or master production system node (for physically partitioned DB2 environments). The master production system node is the production system on which IBM Tivoli Storage FlashCopy Manager was installed. For the initial configuration, IBM Tivoli Storage FlashCopy Manager needs to be installed, activated, and configured on the production system, and afterwards configured on the backup system. The installation and activation steps on the backup system can be skipped. Upgrades

and reconfiguration should only be performed on the master production system node. There is typically no need for invoking the setup script on the backup system after initial configuration. However, you must edit the inittab entries on the backup system even though the installation and configuration directories are NFS shared. Exceptions to this rule might include:

- The use of alternative storage hardware may require a reconfiguration of IBM Tivoli Storage FlashCopy Manager on the backup system
- Changes to the scheduling policy for offloaded TSM backups may require you to reconfigure the backup system

In these cases, you need to stop IBM Tivoli Storage FlashCopy Manager on the production system before reconfiguration of the backup system. Otherwise you will be prompted to stop IBM Tivoli Storage FlashCopy Manager on the production system. See Chapter 5, "IBM Tivoli Storage FlashCopy Manager commands and scripts," on page 73 for details regarding how to stop an activated IBM Tivoli Storage FlashCopy Manager instance.

Installing on the production server and remotely on the backup or clone server

IBM Tivoli Storage FlashCopy Manager must be installed on the production server as described in this procedure in order to successfully perform backup and restore operations. This procedure also describes how to optionally install the product remotely on the backup server using OpenSSH.

The IBM Tivoli Storage FlashCopy Manager installation packages are delivered as InstallAnywhere individual files. They are provided on an installation disc or from an image downloaded from Passport Advantage®. These files use the following name format:

```
2.2.0.0-TIV-FCM-<OS-platform>.bin
```

Throughout this procedure, available values for `OS-platform` are `AIX`, `Linuxx86_64`, and `SolarisSparc`. The installation must be performed as **root** user.

1. Log in to the production server as user ID **root**.
2. Use one of these three modes to install IBM Tivoli Storage FlashCopy Manager:
   - **Graphic mode**

     Graphic mode 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 install in graphic mode, specify this command and press **Enter**:

     ```
     ./2.2.0.0-TIV-FCM-<OS-platform>.bin
     ```
   - **Console mode**

     To install in console mode, specify this command, and press **Enter**:

     ```
     ./2.2.0.0-TIV-FCM-<OS-platform>.bin -i console
     ```
   - **Silent mode**

     Silent mode installs and distributes IBM Tivoli Storage FlashCopy Manager in the non-graphic console mode. Since it requires additional tasks, instructions for this installation mode are available in "Installing IBM Tivoli Storage FlashCopy Manager in silent mode" on page 228.
3. Follow the InstallAnywhere instructions that display.

4. Check the summary issued by InstallAnywhere for successful installation. If an error occurs during the installation process, check the error messages in the output carefully and correct the problems. After correcting the errors repeat the installation procedure.
5. Log in to the production server:
   - (DB2) as the database instance owner and change to the directory INST_DIR
   - (Oracle or SAP® with Oracle) as the database instance owner and change to the directory INST_DIR
   - (Custom applications) as the application backup user and change to the directory FCM_INSTALL_DIR
6. Start the setup script (without options) by entering the appropriate command for your database environment and press **Enter**:
   - DB2: `./setup_db2.sh`
   - Oracle or SAP® with Oracle: `./setup_ora.sh`
   - Custom applications: `./setup_gen.sh`
7. Follow the setup script instructions that display. Refer to the completed IBM Tivoli Storage FlashCopy Manager installation sheet identified in "Preparing the environment for installation" on page 45. These questions must be answered during configuration. The questions might not be in the order described in this step.
   a. Choose the type of configuration to perform:
      - `(1) On-site Production Server configuration with optional remote Backup Server configuration.`

        This selection guides you through the configuration of IBM Tivoli Storage FlashCopy Manager on the production server. It also provides the option to remotely synchronize the configuration of one (or more) backup servers using OpenSSH.
      - `(2) On-site Backup Server configuration.`

        This selection guides you through the configuration of IBM Tivoli Storage FlashCopy Manager on the backup server as a separate installation. See "Installing separately on the backup or clone server" on page 50 for details about this configuration.

   b. `Select one of these configurations:`

      ```
      (1) backup only
      (2) cloning only
      (3) backup and cloning
      ```

      Specify whether to configure the database instance for cloning, backup, or both:
      - Enter `1` to configure FlashCopy Manager for backup only.
      - Enter `2` to configure FlashCopy Manager for cloning only.
      - Enter `2` to configure FlashCopy Manager or backup and cloning.

   c. `Are you going to perform offloaded backups to Tivoli Storage Manager? [Y|N]`
      - Specify `YES` to configure support for offloaded tape backups. The profile parameter configuration responds to this decision by displaying or concealing the respective sections and parameters.

        Note: (SAP® with Oracle) If `YES` is specified, manually update the IBM Tivoli Storage Manager for Enterprise Resource Planning profile (init<SID>.utl) after configuration completes. This update is required

since the IBM Tivoli Storage FlashCopy Manager profile does not contain a CLIENT section after this configuration.

- Specify `NO` to configure support for disk-based snapshot backups only.

d. `Do you want offloaded tape backups being triggered right after snapshot? [Y/N]`

Offloaded backups to Tivoli Storage Manager are performed by the IBM Tivoli Storage FlashCopy Manager offload agent (tsm4acs). Determine when to start the offloaded backup to Tivoli Storage Manager:

- Start it immediately after the FlashCopy backup completes.
- Start it at a later time by using a strategy that schedules backups on an individual basis. For example, schedule the FlashCopy backup to occur at midnight and the offloaded backup to Tivoli Storage Manager to occur at 4 am. The backup to Tivoli Storage Manager can also be delayed further until the necessary resources in Tivoli Storage Manager server are available.

Specify `YES` to perform the backup to Tivoli Storage Manager immediately after the FlashCopy backup completes. The offload agent (tsm4acs) is added to the /etc/inittab.

Specify `NO` to schedule offloaded backups individually. This answer requires the scheduled backup process to be invoked manually. For example add a crontab entry. The default value is to run tsm4acs as a daemon process on the production server. In high-availability (HA) environments, nothing is added to /etc/inittab since tsm4acs must be added to the HA script instead.

e. `IBM Tivoli Storage FlashCopy Manager requires at least two daemon processes to be running at all times. FlashCopy Manager can add the necessary daemon process to the inittab. Alternatively, you can choose to start and stop the processes yourself, for instance, if you want to include the processes in your HA policy.`

`Do you want FlashCopy Manager to create the inittab entries for you? [Y/N]`

IBM Tivoli Storage FlashCopy Manager requires at least two daemon processes to be running at all times. Typically, the configuration wizard registers the IBM Tivoli Storage FlashCopy Manager management daemon (acsd) and generic device agent (acsgen) in the /etc/inittab on the production server. These two daemon processes will be started even after a system reboot. If you are installing IBM Tivoli Storage FlashCopy Manager in an HA environment, these two daemon processes must be started from your HA environment. Add them to your HA startup scripts. In addition, you must set up a mechanism to restart the daemon processes whenever they terminate, similar to what the "respawn" feature of the inittab does.

- Specify `YES` for the required executable files (including command-line options) to display and for these two daemon processes NOT to be added to the /etc/inittab. You must make sure that they are started by your HA startup scripts and that they are restarted whenever they are terminated.
- Specify `NO` to use /etc/inittab. This value is the default behavior.

f. `Do you want to install a new backup server using the OpenSSH protocol? [Y/N]`

IBM Tivoli Storage FlashCopy Manager requires a backup server to be available when these conditions exist:

- Offloaded backups to Tivoli Storage Manager are performed.
- FlashCopy backup consistency must be verified during a forced mount.

See “Preparation of the backup and cloning servers” on page 37 and “Managing backups and clones with the DEVICE_CLASS parameter” on page 42 for helpful information about these conditions.

Specify `YES` to use 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. Either select a DEVICE_CLASS from the list displayed on the console or press **Enter** to select all listed DEVICE_CLASS parameters.

Specify `NO` if one of these conditions exist:

- OpenSSH is not available.
- The INST_DIR and ACS_DIR are shared between the production system and backup system using NFS.
- You want to configure the backup system in a separate step.

g. `If this DB2 instance is a DB2 standby server source or target, or is a source or target in a DB2 HADR configuration, you can also back up the database while it serves as the standby (or HADR) target.`

`Do you want to configure IBM Tivoli Storage FlashCopy Manager to also protect the database while it acts as a standby (or HADR) target? [Y/N]`

Specify `YES` to back up a DB2 standby server. An additional DB2STANDBY section is added to the profile. If you are using an offloaded backup configuration, an offload section "OFFLOAD_DB2STANDBY" is added as well.

Online help is available for the actual profile parameters but not for the questions themselves. To display help information for each profile parameter, type `?` and press **Enter**. Help is best viewed in a terminal window set for at least 130 characters. The configuration wizard can create multiple entries of the same profile parameter with different values. Specify `y` when `Do you want to add another instance of this parameter?` displays. To delete an entry from the profile for one of these parameters, type `!d` when prompted the parameter value.

Important: After this procedure completes, you are prompted whether to deploy the configuration to one or multiple backup systems. This deployment associates the device classes (that are specified in the profile) with the backup systems. This association is used for mounting at a later time.

Installing separately on the backup or clone server

This separate installation of IBM Tivoli Storage FlashCopy Manager on the backup servers is only necessary if the recommended remote installation could not be used.

Only use this procedure when either of these situations exist:

- An OpenSSH setup is not available.
- The NFS sharing of INST_DIR and ACS_DIR from production system to the backup system is not possible.

Note: NFS sharing of INST_DIR and ACS_DIR is not recommended unless you have a DB2 DPF environment with multiple nodes.

Information about when a backup server is needed is available in these sections:

- “Preparation of the backup and cloning servers” on page 37

- "Managing backups and clones with the DEVICE_CLASS parameter" on page 42

1. Log in to the backup server as user ID **root**.
2. Use one of these three modes to install IBM Tivoli Storage FlashCopy Manager:
   - **Graphic mode**

     Graphic mode requires a graphical X Window 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 install in graphic mode, specify this command and press **Enter**:

     ```
     ./<version>-TIV-FCM-<OS-platform>.bin
     ```

   - **Console mode**

     To install in console mode, specify this command and press **Enter**:

     ```
     ./<version>-TIV-FCM-<OS-platform>.bin -i console
     ```

   - **Silent mode**

     Silent mode installs and distributes IBM Tivoli Storage FlashCopy Manager in the non-graphic console mode. Since it requires additional tasks, instructions for this installation mode are available in "Installing IBM Tivoli Storage FlashCopy Manager in silent mode" on page 228.
3. Follow the InstallAnywhere instructions that display.
4. Check the summary issued by InstallAnywhere for successful installation. If an error occurs during the installation process, check the error messages in the output carefully and correct the problems. After correcting the errors repeat the installation procedure.
5. Log in to the production server:
   - (DB2) as the database instance owner and change to the directory INST_DIR
   - (Oracle or SAP® with Oracle) as the database instance owner and change to the directory INST_DIR
   - (Custom applications) as the application backup user and change to the directory FCM_INSTALL_DIR
6. Start the setup script (without options) by entering the appropriate command for your database environment and press **Enter**:
   - DB2: `./setup_db2.sh`
   - Oracle or SAP® with Oracle: `./setup_ora.sh`
   - IBM Tivoli Storage FlashCopy Manager for Custom Applications: `./setup_gen.sh`
7. Follow the setup script instructions that display. See "Installing on the production server and remotely on the backup or clone server" on page 47 for more information about the configuration wizard.

Setting up the disk storage environment

Each disk storage system requires its own unique configuration tasks.

Follow the steps in the appropriate procedure for your disk storage environment. Be aware that on 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. See "Preparing the production environment" on page 15 for details about the volume group layout requirements.

Note: IBM XIV® Storage Systems do not require any of the steps documented in this procedure.

Defining Logical Unit Numbers on DS8000 storage subsystems

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

Perform these steps so that the proper LUNs are defined on both the production system and backup system:

1. Use the DS8000 Storage Manager to create two (or more) LUNs on the production system:

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

   Note the following:

   - This example creates two LUNs.
   - These LUNs are the location where your database will reside.
   - The size of the LUNs is dependent upon the size of the database.
   - The size of the source volumes on the production system and size of the target volumes on the backup system must be the same.
   - Both the Source Volume and Target Volume must be defined on the same storage subsystem.

2. Use the DS8000 Storage Manager to create the same number of LUNs for the backup system as were created for the production system in Step 1:

   ```
   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 system.

3. Identify the serial numbers of the target LUNs 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 system 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 LUNs:

   ```
   TARGET_VOLUME 75019013300
   TARGET_VOLUME 75019013400
   ```

   This setting specifies the target volumes to which the database will be backed up.

Defining virtual disks on SAN Volume Controller

Virtual disks must be defined for the SAN Volume Controller.

This procedure uses the SAN Volume Controller Console to complete the tasks. Be aware that the SAN Volume Controller command line interface can also be used.

These instructions assume the following conditions exist:

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

Perform these steps so that the proper vdisks are created on both the production system and backup system:

1. Create a Virtual Disk using the Managed Disk Group:

   ```
   Work with Virtual Disks-> Virtual Disks -> Create Virtual Disks
   ```

   Map the Virtual Disk to the hosts that were created for the production and backup systems.
2. Define the TARGET_VOLUME parameter in the target volumes file specified by the VOLUMES_FILE profile parameter with the appropriate vdisk names of the target LUNs:

   ```
   TARGET_VOLUME A01pro1_1_t1
   TARGET_VOLUME A01pro1_2_t1
   ```

   Assuming the SAN Volume Controller source volumes are named `A01pro1_1` and `A01pro1_2`, then it is also possible to use the TARGET_SETS profile parameter with a value of 1 and specify the TARGET_NAMING parameter value as `%SOURCE_t%TARGETSET`. Using this target naming definition, the source volume `A01pro1_1`, with target set named 1, results in target volume `A01pro1_1_t1`.

Chapter 4. Operating with IBM Tivoli Storage FlashCopy Manager

Information needed to back up and restore data on FlashCopy devices and snapshot devices with IBM Tivoli Storage FlashCopy Manager is provided. Information about database cloning is also provided.

Review the information carefully before performing a backup, restore, or cloning operation.

Backing up data with IBM Tivoli Storage FlashCopy Manager

Detailed instructions regarding how to back up DB2 (native and SAP® on DB2), Oracle (native), SAP® with Oracle databases, and custom applications (using IBM Tivoli Storage FlashCopy Manager for Custom Applications) are provided.

IBM Tivoli Storage FlashCopy Manager provides two basic backup methods:

- Snapshot backups on storage systems
- Off-loaded tape backups to Tivoli Storage Manager

Backing up a DB2 database

Specific command entries are used when backing up a DB2 database.

The following table summarizes the command entries according to the database configuration and type of backup:

Table 13. Summary of Backup Commands for DB2

Database Configuration	Snapshot Backup (Disk Only)	Backup to TSM		
		From Production Database (Tape Only)	Integrated with Snapshot	From Existing Snapshot
DB2 (Native)	db2 backup .... use snapshot ...	db2 backup ...use tsm	db2 backup .... use snapshot[1]	fcmcli -f tape_backup[2]
DB2 (SAP®)	db2 backup .... use snapshot ...	db2 backup... load <library> or backom	db2 backup .... use snapshot[1]	fcmcli -f tape_backup[2]

Note:

1. In addition, the profile parameter TSM_BACKUP is set to YES and the Offload Agent (tsm4acs) is running in daemon mode on the production server.
2. In addition, the profile parameter TSM_BACKUP is set to YES and the Offload Agent (tsm4acs) is *not* running in daemon mode.

Snapshot backup is described in more detail in the DB2 High Availability Feature documentation. The 'db2 backup database' command with the 'use snapshot' option is described in the DB2 *Command Reference*.

As of DB2 V9.5, the DB2 Data Partitioning Feature (DPF) has a single system view (SSV) mode to back up a multi-partition database with a single command entry. Typical db2 backup commands using IBM Tivoli Storage FlashCopy Manager would appear in this format:

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- Multipartition database: `db2 backup db <dbname> on all dbpartionnums use snapshot`
- Single partition database: `db2 backup db <dbname> use snapshot`

If a different IBM Tivoli Storage FlashCopy Manager profile is used, specify the default INST_DIR/acs/profile. In this case, the command would be as follows: `db2 backup db <dbname> on all dbpartionnums use snapshot options "PROFILE=<path to profile/name of profile>"`

DB2 backups to a Tivoli Storage Manager server

IBM Tivoli Storage FlashCopy Manager relies on standard DB2 mechanisms to back up a snapshot image to Tivoli Storage Manager tape.

DB2 operates in either of the following environments:

- IBM Tivoli Storage Manager for Enterprise Resource Planning in an SAP environment
- DB2 native Tivoli Storage Manager agent in a native DB2 environment.

A Tivoli Storage Manager backup is performed by the following:

- The TSM_BACKUP profile parameter in the IBM Tivoli Storage FlashCopy Manager profile initiates a tape backup from the snapshot target set when the snapshot has completed.
- The 'tape_backup' function of IBM Tivoli Storage FlashCopy Manager (fcmacli), backs up a previously generated snapshot.

IBM Tivoli Storage FlashCopy Manager and IBM Tivoli Storage Manager for Enterprise Resource Planning use their own profiles. The IBM Tivoli Storage FlashCopy Manager profile contains a separate section (OFFLOAD) that defines the parameters related for tape backup.

Every time a profile is created or modified, the IBM Tivoli Storage FlashCopy Manager profile wizard prompts to specify whether off-loaded backups will be performed. When YES is specified, the OFFLOAD section is added to the profile and the TSM_BACKUP parameter is added to the CLIENT section.

Related concepts

"IBM Tivoli Storage FlashCopy Manager profile description" on page 117

Backups without snapshot backup disks:

Partial backups of a database (such as tablespace backups) can be performed on the production system.

The db2 backup command might access Tivoli Storage Manager for ERP (if installed). IBM Tivoli Storage FlashCopy Manager is not accessed for partial backups.

Serial and parallel backup modes for DB2 database partitioning feature partitions:

DB2 backs up database partitioning feature (DPF) partitions in either serial mode or parallel mode.

These modes are determined by DB2 and cannot be configured by the user:

Serial mode
In serial mode (used for a native DB2 database), the partitions are processed sequentially: each partition is suspended, the snapshot created, and the partition resumed before the next partition is processed. IBM Tivoli Storage FlashCopy Manager returns an error during a backup if multiple partitions share a physical volume. A restore operation is always performed on a single partition.

Parallel mode
(SAP®) In parallel mode (default mode for an SAP DB2 database), all partitions are suspended before DB2 issues snapshot requests. The requests are then performed in parallel on all partitions. IBM Tivoli Storage FlashCopy Manager allows multiple logical partitions to share a physical volume when these logical partitions are grouped together in a PARTITION_GROUP. In this situation, fcmcli must be used to perform the restore. The restore proceeds in parallel for all the logical partitions specified in PARTITION_GROUP.

Related tasks

Chapter 5, "IBM Tivoli Storage FlashCopy Manager commands and scripts," on page 73

Related reference

"IBM Tivoli Storage FlashCopy Manager profile parameters" on page 123

"Offload Agent (tsm4acs)" on page 111

Backing up a native Oracle database

IBM Tivoli Storage FlashCopy Manager integrates with multiple components when backing up an Oracle database.

This table summarizes the command entries according to the type of backup:

Table 14. Summary of Backup Commands for Native Oracle

Snapshot Backup (Disk Only)	Backup to Tivoli Storage Manager		
	From Production Database (Tape Only)	**Integrated with Snapshot**	**From Existing Snapshot**
acsora -f backup	RMAN using Data Protection for Oracle	'acsora -f backup' with profile parameter TSM_BACKUP set to YES and Offload Agent (tsm4acs) running in daemon mode on the production server	'tsm4acs -f tape_backup' with profile parameter TSM_BACKUP set to YES and Offload Agent (tsm4acs) not running in daemon mode

IBM Tivoli Storage FlashCopy Manager backs up the database control file and the database profile on the production system to the IBM Tivoli Storage FlashCopy Manager repository. These files are required by IBM Tivoli Storage FlashCopy Manager on the backup system to start the database instance and to perform the

off-loaded backup to the Tivoli Storage Manager server. Furthermore, the database control file can be optionally restored during a FlashCopy® restore (profile parameter DATABASE_CONTROL_FILE_RESTORE).

IBM Tivoli Storage FlashCopy Manager does not back up the transaction logs of the Oracle database. The database administrator is responsible for periodically backing up the Oracle database transaction logs. It is recommended that the transaction logs be backed up to the Tivoli Storage Manager server after every full database online backup.

Backups to a Tivoli Storage Manager server on native Oracle

A IBM Tivoli Storage FlashCopy Manager backup to Tivoli Storage Manager server storage is an integral part of your overall backup strategy.

Perform regular FlashCopy backups of your databases as a part of your backup strategy. In addition, perform FlashCopy backups when any configuration changes are made to your database. Adding new physical disks, new logical volumes, new file systems, or new database containers are some (but not all) examples of such configuration changes. Be aware of these considerations when using Tivoli Storage Manager:

- Data Protection for Oracle must be configured on the backup server.
- The RMAN backup script created by the user must contain the Data Protection for Oracle TDPO_OPTFILE environment variable. Specify the fully qualified path name to the tdpo.opt options file with the TDPO_OPTFILE environment variable. The allocate channel command and the ENV parameter MUST be specified on the same line. Also, the database command MUST be specified on a line separate from the backup command in the RMAN backup script. See "Example RMAN backup script" on page 211.

Manually backing up a native Oracle database:

A manual backup performs a one time backup of an Oracle database.

Table 15. Files used during a manual backup

File name	Description	Default Location
acsora	IBM Tivoli Storage FlashCopy Manager production system executable file	INST_DIR/acs
fcmcli	IBM Tivoli Storage FlashCopy Manager production and backup system executable file	INST_DIR/acs
profile	IBM Tivoli Storage FlashCopy Manager profile	`ACS_DIR/profile`

1. Log on to the production system as the database instance owner.
2. Run the **backup** command:

   ```
   acsora -f backup
   ```

Related concepts

"IBM Tivoli Storage FlashCopy Manager profile description" on page 117

Fully automating a native Oracle database backup:

A fully automated backup uses a server script to fully automate online backups of Oracle databases.

The backups on the production system can be run manually or via a scheduler.

A distinction must be made between *synchronous* and *asynchronous* offloaded backups. Synchronous means that the backup on the backup host starts as soon as a FlashCopy® has been performed. In this case, the Offload Agent (tsm4acs) is started as a daemon by the init process. Asynchronous means that offloaded backups are triggered manually or triggered by another scheduler by invoking fcmcli. This is useful if the backup should be delayed until required resources are available. During the installation on the production server the user is asked how he wants to run offloaded backups.

Related concepts

"IBM Tivoli Storage FlashCopy Manager profile description" on page 117

Backing up an SAP® with Oracle database

IBM Tivoli Storage FlashCopy Manager integrates with multiple components when backing up an SAP® with Oracle database.

The following table summarizes the command entries for backing up an SAP® database using Oracle:

Table 16. Summary of Backup Commands (SAP® with Oracle)

Snapshot Backup (Disk Only)	Backup to Tivoli Storage Manager		
	From Production Database (Tape Only)	**Integrated with Snapshot**	**From Existing Snapshot**
brbackup -d util_vol ...	brbackup -d util_file ...	brbackup -d util_vol[1]	fcmcli -f tape_backup[2]

Note:

1. In addition, the profile parameter TSM_BACKUP is set to YES and the Offload Agent (tsm4acs) is running as a daemon on the production server.
2. In addition, the profile parameter TSM_BACKUP is set to YES and the Offload Agent (tsm4acs) is *not* running as a daemon.

The following parameters are used in the init<DBSID>.sap configuration files in these scenarios:

- **backup_dev_type**: Determines the backup medium that is used. The default is tape. In order to create a snapshot backup using IBM Tivoli Storage FlashCopy Manager, this parameter must be set to util_vol or to util_vol_online. Recommendation: Minimize the time during which the database is degraded.
- **util_par_file**: Specifies the path to the profile (sent to backint) using the -p parameter. Typically this is the .utl file.
- **util_path**: Specifies the path to the backint executable. If not specified, the backint executable in /usr/sap/<SID>/SYS/exe/run is used.
- **util_options**: Specifies the option argument which is appended to the backint call.
- **util_vol_unit**: Specifies the smallest unit that can be backed up with a snapshot or clone. Refer to the description of util_vol_unit in "SAP® BR*Tools configuration profile (.sap)" on page 140 for further details.

Backup scenario 1: IBM Tivoli Storage FlashCopy Manager only

This scenario demonstrates how the SAP® BR*Tool brbackup interacts with IBM Tivoli Storage FlashCopy Manager (backint) during backup operations. The SAP® BR*Tool brbackup calls backint with these command line parameters:

-t volume, -t volume_online
IBM Tivoli Storage FlashCopy Manager (backint) uses the snapshot technology available on the FlashCopy device.

-t file, -t file_online
IBM Tivoli Storage FlashCopy Manager (backint) transfers the Oracle control files into the IBM Tivoli Storage FlashCopy Manager repository. Since IBM Tivoli Storage Manager for Enterprise Resource Planning is not installed in this scenario, backint is not available in the `/usr/sap/<SID>/SYS/exe/run` directory. Therefore, the util_path parameter must specify the IBM Tivoli Storage FlashCopy Manager INST_DIR in the SAP® BR*Tools profile (init<DBSID>.sap).

The configuration in this scenario is for a **diskonly** backup.

Contents of the SAP® BR*Tools profile (init<DBSID>.sap):

```
backup_dev_type = util_vol | util_vol_online
util_par_file = <ACS_DIR>/profile
util_path = <INST_DIR>
```

Settings of the IBM Tivoli Storage FlashCopy Manager profile <ACS_DIR>/profile:

```
TSM_BACKUP   NO
```

- All files are transferred to the IBM Tivoli Storage FlashCopy Manager repository when `backup_dev_type` specifies `util_file` or `util_file_online`, and the ALLOW_FULL_FILE_BACKUP parameter specifies YES in the CLIENT section of the flashcopymanagerprofile file. However, such an operation should not be performed unless absolutely necessary because all files are transferred into the repository and there are performance impacts in the IBM Tivoli Storage FlashCopy Manager repository related to backup, restore, and space availability. Even for diskonly backups an integration with Tivoli Storage Manager or a third-party tape backup product should be the preferred solution. See Backup scenario 2 and Backup scenario 3.
- The parameter ALLOW_FULL_FILE_BACKUP specifies YES in the CLIENT section of the flashcopymanagerprofile file.

Backup scenario 2: IBM Tivoli Storage FlashCopy Manager and IBM Tivoli Storage Manager for Enterprise Resource Planning installed

This scenario demonstrates how the same backint profile (init<DBSID>.utl) and SAP® BR*Tools profile (.sap) can be used for a *diskonly* backup and a *dual* backup.

A diskonly backup is a backup that is created using snapshot technology with IBM Tivoli Storage FlashCopy Manager. The backup is not copied to Tivoli Storage Manager.

A Tivoli Storage Manager only backup is a snapshot that has been created for the sole purpose of creating a Tivoli Storage Manager backup from it. The snapshot is mounted on a secondary system and copied to Tivoli Storage Manager for that purpose.

A dual backup is a hybrid of a diskonly and a Tivoli Storage Manager only backup. A dual backup is a diskonly backup that is afterwards also copied to Tivoli Storage Manager.

Therefore at least two device classes are needed in the backint profile (init<DBSID>.utl). They can be scheduled using concepts described in "Managing backups and clones with the DEVICE_CLASS parameter" on page 42. One device class is used for diskonly backups and one for dual backups. As a result, the TSM_BACKUP_FROM_SNAPSHOT parameter value is dependent on the device class because of the USE_FOR settings. Here it is prepared so it can be used for a diskonly backup and a dual backup as well.

Important: For this configuration, the FlashCopy Manager profile has no CLIENT section. Some of the parameters that are typically contained in the CLIENT section need to be stated in the `.utl` file instead. Furthermore, some of the parameters appear in the `.utl` file under a different name (for example, TSM_BACKUP becomes TSM_BACKUP_FROM_SNAPSHOT). For more information, refer to the parameters marked with a "+" symbol in the SAP with Oracle column in the table in "IBM Tivoli Storage FlashCopy Manager profile parameters" on page 123. More parameters must be copied out of the FlashCopy Manager profile and into the `.utl` file (for example, the parameters in the GLOBAL section).

These two links are used in this scenario:

- A link named *backint* in `/usr/sap/<SID>/SYS/exe/run` points to backint that resides in the IBM Tivoli Storage Manager for Enterprise Resource Planning installation directory.
- A link named *backint_volume* in `/usr/sap/<SID>/SYS/exe/run` points to backint that resides in the IBM Tivoli Storage FlashCopy Manager installation directory.

Settings of the common IBM Tivoli Storage FlashCopy Manager .utl file (commonprofile.utl):

```
TSM_BACKUP_FROM_SNAPSHOT NO USE_FOR DISKONLY
TSM_BACKUP_FROM_SNAPSHOT YES USE_FOR DUAL
DEVICE_CLASS DISKONLY USE_AT Mon Wed Fri
DEVICE_CLASS DUAL USE_AT Sun Tue Thu Sat
```

Note: The use of multiple device classes and TSM_BACKUP_FROM_SNAPSHOT parameters in the SAP® backint profile requires IBM Tivoli Storage Manager for Enterprise Resource Planning 6.1.1 (or later). For prior releases of IBM Tivoli Storage Manager for Enterprise Resource Planning, control the device class by defining multiple BR*Tools configuration profiles (.sap) in your environment.

Contents of the common SAP® BR*Tools profile (init<DBSID>.sap):

```
backup_dev_type = util_vol | util_vol_online
util_par_file = <ORACLE_HOME>/dbs/init<DBSID>.utl
```

- IBM Tivoli Storage FlashCopy Manager is invoked with `-t volume` or `-t volume_online` to perform the snapshot part of the backup.

- The SAP® control files are backed up to the Tivoli Storage Manager server for **diskonly** and **dual** backups. This is the recommended backup location for the control files. To back up the control files into the IBM Tivoli Storage FlashCopy Manager repository, specify the IBM Tivoli Storage FlashCopy Manager installation directory with the `util_path` option in the SAP® BR*Tools profile (init<DBSID>.sap).

The IBM Tivoli Storage Manager for Enterprise Resource Planning executable is invoked from `/usr/sap/<SID>/SYS/exe/run` and invokes *backint_volume*, which links to IBM Tivoli Storage FlashCopy Manager to perform the snapshot part of the backup. Invoking IBM Tivoli Storage FlashCopy Manager with the options -t file | -t file_online fails when TSM_BACKUP_FROM_SNAPSHOT=YES is specified. This is because during dual backups, the Oracle control files should be backed up to Tivoli Storage Manager for reliability reasons.

During the restore operation, the same init<DBSID>.sap files used during the original backup operation must be specified. For dual backups with IBM Tivoli Storage FlashCopy Manager and IBM Tivoli Storage Manager for Enterprise Resource Planning, use the init<DBSID>.sap file to restore both backups: **diskonly** and **dual**. IBM Tivoli Storage Manager for Enterprise Resource Planning delegates the restore of the snapshot backup to IBM Tivoli Storage FlashCopy Manager.

Backup scenario 3: IBM Tivoli Storage FlashCopy Manager and third-party tape backup product

This scenario demonstrates how IBM Tivoli Storage FlashCopy Manager and a third-party tape backup product are used in parallel. To perform **diskonly** backups, the contents of the SAP® BR*Tools profile (init<DBSID>.sap) and the IBM Tivoli Storage FlashCopy Manager profile (<ACS_DIR>/profile) are the same as shown in Scenario 1.

There are two alternatives that you can use to perform the tape backup:

1. Offload the snapshot that is managed by IBM Tivoli Storage FlashCopy Manager to tape from a backup server with a third-party product. In this case you must mount the snapshot to a backup server using the 'fcmcli -f mount' command. Then you can offload the mounted backup to tape, and afterwards unmount the snapshot using 'fcmcli -f unmount'. In this scenario your tape backup product must be able to do a redirected restore to the production system.
2. Do a tape backup from the production system with a third-party product and use IBM Tivoli Storage FlashCopy Manager to create complementary snapshot backups for faster recovery.

   In this case, you can use the third-party tool configuration as-is without any changes, because the FlashCopy Manager installation does not replace the backint executable located in `/usr/sap/<SID>/SYS/exe/run` that is provided by the third-party vendor. For this FlashCopy Manager configuration you can proceed exactly as described in Scenario 1.

Fully automating an SAP® with Oracle database backup

A scheduled backup starts the backup operation automatically instead of manually.

A Tivoli Storage Manager schedule or crontab (UNIX or Linux) command are examples of those schedules that can be used to automatically run the snapshot disk backups on the production system. Any other suitable scheduler can also be employed.

(SAP®) The SAP® DBA Planning Calendar (either transaction DB13 or DBACOCKPIT) can be used to schedule backups with IBM Tivoli Storage FlashCopy Manager when the SAP® BR*Tools profile (init<DBSID>.sap) is set up correctly.

Backing up file systems or custom applications

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

You can use IBM Tivoli Storage FlashCopy Manager to create a consistent snapshot image of a file system or custom application on a production system. Custom applications are file systems or any database applications other than DB2, Oracle, and SAP with Oracle (for example, Domino®, MAX DB, and WebSphere®). The snapshots are managed as backup versions using the version management policies of FlashCopy Manager. The snapshots can be used as a source for instant restore operations.

You can also mount snapshot backups on a secondary system, and in Tivoli Storage Manager environments, the Tivoli Storage Manager backup archive client can be used to initiate a subsequent backup to the Tivoli Storage Manager server.

You can use the `fcmcli -f backup` command to protect any application or file system.

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

1. Create a list of files and directories that have to be backed up. This list can be the directories for the DB2 table spaces and the online redo logs. If the storage device supports space-efficient snapshots, you might also include some of the Tivoli Storage Manager disk storage pools such as file pools or 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 preflash.sh and postflash.sh scripts files that shut down and restart the Tivoli Storage Manager server, which in this case is the custom application. Add these scripts to the CLIENT section of the IBM Tivoli Storage FlashCopy Manager profile.
3. Create a snapshot backup of the environment by issuing the following command:

   ```
   fcmcli -f backup -I <infile> -p profile
   ```

   IBM Tivoli Storage FlashCopy Manager typically invokes the postflash.sh script about 10 seconds after the preflash.sh script ends. Within that time period FlashCopy Manager creates an offline backup of the data. As a result, the Tivoli Storage Manager server is offline for a short time.

Depending on the value of the parameter TSM_BACKUP in the FlashCopy Manager profile, FlashCopy Manager afterward triggers a Tivoli Storage Manager backup of the snapshot image using the backup-archive client.

The snapshot must be backed up to another Tivoli Storage Manager server to obtain a useful backup. Because FlashCopy Manager is not aware of data that has been protected, it cannot determine that FlashCopy Manager is set up correctly.

Backing up DB2 HADR and DB2 standby servers

You can use IBM Tivoli Storage FlashCopy Manager for Custom Applications to create snapshot backups of a DB2 HADR server.

Although DB2 HADR systems cannot be backed up to a Tivoli Storage Manager server directly, snapshot backups and subsequent backups of the snapshot files are possible. You can use a presnapshot command to stop the DB2 HADR server, and use a postsnapshot command to resume DB2.

Use the `fcmcli -f backup_db2standby` command to create snapshot backups of a DB2 HADR or DB2 standby servers. This command is a variant of the `tsm4acs -f backup` command that backs up custom database applications. Before starting the backup process, IBM Tivoli Storage FlashCopy Manager communicates with DB2 to determine the list of file systems that must be protected. Sample implementations for presnapshot and postsnapshot user exits are provided. These sample scripts shut down and restart the DB2 standby server. You can customize the sample scripts.

After a DB2 takeover, the DB2 HADR standby server becomes the DB2 HADR primary server. After this takeover occurs, you are required to use the DB2 snapshot backup command for backup instead of using the backup_db2standby function. IBM Tivoli Storage FlashCopy Manager is aware of this requirement and allows you to share the profile for both types of backups so that you only need to use a different command to start your database backup depending on the current DB2 HADR database role.

It is best practice to use the same device classes for the DB2 snapshot backups and for the DB2 HADR or standby server backups. Normally there is no reason why a different device class is used for those two backup types as the storage system where the DB2 database is stored is the same and also the source volumes and target volumes are the same.

(DS and SAN Volume Controller only): If for any reason you decide to have different device classes for the two backup types but you use the same target volumes, then a DB2 snapshot backup overwrites the backup from a DB2 HADR standby server backup or vice versa, but the inquire command still shows both backups as valid.

Because IBM Tivoli Storage FlashCopy Manager cannot directly communicate with the standby server, FlashCopy Manager queries the DB2 instance running on the production server using DB2 remote connections, and relies on the assumption that the file names for the production server database and the standby server database are identical.

Although you cannot create a Tivoli Storage Manager backup from a standby server, IBM Tivoli Storage FlashCopy Manager triggers a file-based Tivoli Storage Manager backup from the snapshot that DB2 is not aware of. You cannot use DB2

for a database restore from the file-based Tivoli Storage Manager backups. Use the Tivoli Storage Manager backup-archive client to restore the files that have been backed up to the Tivoli Storage Manager serve. Then recover the database using the DB2 recover command.

Restoring data with IBM Tivoli Storage FlashCopy Manager

Detailed instructions regarding how to restore DB2 (native and SAP® on DB2), Oracle (native), SAP® with Oracle databases, and custom applications (using IBM Tivoli Storage FlashCopy Manager for Custom Applications) are provided.

IBM Tivoli Storage FlashCopy Manager provides two basic restore methods:

- Restoring data from a snapshot on the storage subsystem.
- Restoring data from Tivoli Storage Manager.

Restoring a DB2 database

Specific command entries are used when restoring a DB2 database.

The following table summarizes the command entries according to the database configuration and type of restore:

Table 17. Summary of Restore Commands for DB2

Database Configuration	Snapshot Restore	Restore from Tivoli Storage Manager
DB2 (Native)	db2 restore .... use snapshot ...	db2 restore ... or db2 recover...
DB2 (SAP)	db2 restore .... use snapshot ...	db2 restore ..., db2 recover... or backom

Depending on the options specified in the `db2 backup database ... use snapshot ...` command when the snapshot was created, both backup types (snapshot and Tivoli Storage Manager) for a particular backup level may be eligible for a restore. A snapshot backup type might not be eligible for restore (even though the snapshot backup request completed successfully) because the background copy has not yet completed. Restore from snapshot backups will handle backup objects residing on the target volumes created in the backup operation with a snapshot process. These objects are referred to as snapshots.

In a more complex environment, a restore of a DB2 multi-partition snapshot might use these commands:

```
(catalog node first)
db2_all "<<+0< db2 restore db H80 use snapshot without prompting"
(remaining nodes)
db2_all "<<-0< db2 restore db H80 use snapshot without prompting"
```

(DB2 on SAP®): If the snapshot backup was performed with the PARTITION_GROUP parameter, then the restore cannot be performed with the db2 restore command. In this situation, you must use the IBM Tivoli Storage FlashCopy Manager fcmcli command with this syntax:

```
fcmcli -f restore -d <dbname> -B <backupID> -P <partition group name>
```

If more than one partition group was used during the backup, then the restore operation must be performed for all partition groups.

DB2 backup history file overview

DB2 provides its own history file that stores all information about backup, restore, and changes in the database (such as adding containers to a tablespace).

Issue one of these commands to list information from the backup history file:

```
db2 list history backup all for <SID>
```

or

```
db2 list history rollforward all for <SID>
```

For more information about the **db2 list history** command, see *IBM DB2 Command Reference*.

To restore a backup that was performed on the local production system, you can find the timestamp of the backup with the **db2 list history** command.

Restoring a native Oracle database

Specific command entries are used when restoring a native Oracle database.

The following table summarizes the command entries according to the type of restore:

Table 18. Summary of Restore Commands for Native Oracle

Snapshot Restore	Restore from Tivoli Storage Manager
acsora -f restore [-b backup_ID]	Using Data Protection for Oracle, RMAN.

This section describes how to restore your Oracle database using the snapshot restore feature.

Snapshot restore for native Oracle databases

This scenario demonstrates how to perform a snapshot restore of the Oracle database myDB when FLASHCOPY_TYPE COPY is specified in the profile and no new file systems or logical volumes have been created on the LUNs that myDB resides on since the database was originally backed up.

The following conditions are assumed in the scenario described in this section:

- The redo logs for *myDB* reside in a volume group not shared with any datafiles.
- The Oracle control files are created in volume groups not shared by Oracle datafiles.
- The Oracle datafiles are created on the snapshot devices.

Follow these steps to perform a snapshot restore of database *myDB*:

1. Make sure the database to be restored is stopped. Log on to the production system and issue the following command:

   ```
   acsora -f restore
   ```

   This restores the latest backup. To restore an older backup the backup_ID of this backup needs to be specified as in

   ```
   acsora -f restore -b <backup ID>
   ```

   `acsora -f inquire` (or `acsutil`) can be used to query for existing backup ID's.
2. After snapshot restore processing completes, you must recover the database.

- If DATABASE_CONTROL_FILE_RESTORE YES is specified in the profile, you must perform an incomplete recovery.
- If DATABASE_CONTROL_FILE_RESTORE NO is specified in the profile, you must perform a complete recovery.

At this point, snapshot restore processing is complete.

If snapshot restore processing completes successfully, you are now able to start the recovery of the restored database *myDB* and afterwards, open the database. If your snapshot restore was not successful and you receive an error message, see the log file for assistance.

Restoring a native Oracle database from Tivoli Storage Manager

Tivoli Storage Manager backups are restored as an entire database (Restore Method One) or with datafile granularity (Restore Method Two). RMAN must be used to perform restore procedures.

Restore Method One (Entire Database):

Perform these tasks to restore Tivoli Storage Manager backups as an entire database. (Restore Method One) or with data file granularity (Restore Method Two).

Perform these steps to restore an entire database backup:

1. Shut down the database (if necessary):
   ```
   shutdown;
   ```
2. Mount the database:
   ```
   startup mount;
   ```
3. Start RMAN and connect to the target database and the recovery catalog:
   ```
   rman target username/password rcvcat username/password@connect_string
   ```
4. Issue the RMAN **run** command by specifying the allocation of channels and the restoration of the database. This example is from an AIX installation:
   ```
   run
   {
   allocate channel t1 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   allocate channel t2 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   allocate channel t3 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   allocate channel t4 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   restore database;
   }
   ```
   This example also applies to Linux and Solaris, except that the path to the `tdpo.opt` file might be different. On Linux and Solaris, the path is likely to start with `/opt/tivoli`.
5. Recover the database (as needed) by connecting to the target database:
   ```
   recover database;
   ```

If your restore is not successful and you receive an error message, see the error log file (tdphw.log by default) for assistance.

Restore Method Two (Data File Only):

Perform these tasks to restore IBM Tivoli Storage FlashCopy Manager backups with data file granularity.

Complete the following steps to restore a data file only:

1. Shut down the database if it is not already shut down:

   ```
   shutdown;
   ```

2. Mount the database:

   ```
   startup mount;
   ```

3. Start RMAN and connect to the target database and the recovery catalog. Enter the following command on one line:

   ```
   rman target username/password rcvcat username
     /password@connect_string
   ```

   The RMAN command in the preceding example is divided to accommodate page formatting. The actual RMAN command string is on one line.

4. Issue an RMAN **run** command by specifying the allocation of channels and the restoration of the data file *n*, where *n* is the number of the data file. This example is from an AIX installation:

   ```
   run
   {
   allocate channel t1 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   allocate channel t2 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   allocate channel t3 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   allocate channel t4 type 'sbt_tape' parms
   'ENV=(TDPO_OPTFILE=/usr/tivoli/tsm/client/oracle/bin/tdpo.opt)';
   restore datafile n;
   }
   ```

   This example also applies to Linux and Solaris, except that the path to the tdpo.opt file might be different. On Linux and Solaris, the path is likely to start with `/opt/tivoli`

5. Bring the data file online with the following SQL command, where *n* is the number of the data file:

   ```
   alter database datafile n online;
   ```

6. Recover the data file as needed by connecting to the target database and issuing:

   ```
   recover datafile n;
   ```

If your restore is not successful and you receive an error message, see the error log file for assistance.

Restoring an SAP® with Oracle database

Specific command entries are used when restoring an SAP® with Oracle database.

The SAP® BR*Tool BRRECOVER for Oracle databases is used as a database administration tool to help recover your database. BRRECOVER can be used from these interfaces:

- BRRECOVER command line interface
- BRTOOLS with character-based menus or GUI

BRRECOVER can be used for these tasks:

- Complete database recovery
- Database point-in-time (PIT) recovery
- Tablespace PIT recovery
- Whole database reset
- Restore of individual backup files
- Restore and application of offline redo log files
- Disaster recovery

See the SAP® BR*Tools documentation for information regarding restore and recovery strategies.

The following table summarizes the command entries according to the type of restore:

Table 19. Summary of Restore Commands for SAP® with Oracle

Snapshot Restore	Restore from Tivoli Storage Manager
brrestore -d util_vol	brrestore -d util_file
brrecover	brrecover

Restoring file systems or custom applications

You can use the `fcmcli -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 IBM Tivoli Storage FlashCopy Manager for all of the snapshot backups that have been taken using the `fcmcli -f inquire` command. To restore a file system or custom application, do the following steps:

1. Specify what data you want to query. Use one of the following methods:
   - Specify #NULL to query IBM Tivoli Storage FlashCopy Manager for a list of all backup
   - Specify a backup ID to query the details of a particular snapshot backup
   - Use the `fcmcli -f inquire_detail` function to query additional information about the backup (for example, the type of snapshot, the background copy progress, and so on).
2. After running the query, use the `fcmcli -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 IBM 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. Although IBM Tivoli Storage FlashCopy Manager performs restores at a volume level, additional data might be restored as part of the volume restore operation. You can use the parameter NEGATIVE_LIST to specify what actions IBM 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 FlashCopy Manager provides assistance in

creating a Tivoli Storage Manager backup from a snapshot, FlashCopy Manager does not provide any assistance 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 by comparing the 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 by comparing the FlashCopy Manager backup ID with the name of the archive description of the Tivoli Storage Manager backup.

Restoring DB2 HADR and DB2 standby server environments

You can use the `fcmcli -f restore_db2standby` command to restore a IBM Tivoli Storage FlashCopy Manager snapshot backup of a DB2 HADR server.

This function is a variant of the `fcmcli -f restore` function that relies on parameters that are optimized for DB2 standby databases. When starting this command on the DB2 HADR standby server, IBM Tivoli Storage FlashCopy Manager tries to stop the DB2 database manager. If the DB2 database is still activated or DB2 HADR is still running, the restore_db2standby function fails because it cannot stop the DB2 database manager. Before starting the restore, the database must be deactivated and DB2 HADR must be stopped first. The database deactivation and stoppage are intentionally not done by IBM Tivoli Storage FlashCopy Manager.

A restore operation of an offloaded tape backup from Tivoli Storage Manager can be performed by directly running Tivoli Storage Manager backup-archive client commands on the production system. IBM Tivoli Storage FlashCopy Manager is not needed in this case. To do this efficiently, use proxy node setups, although FlashCopy Manager does not help in the setup and configuration of proxy nodes.

IBM Tivoli Storage FlashCopy Manager maintains a backup ID that can uniquely identify any snapshot backup. Because backup-archive client backups are not associated with backup IDs, there is no correlation between a snapshot backup and its corresponding Tivoli Storage Manager backup, other than the time when either backup was created. In configurations where the offloaded Tivoli Storage Manager backup is scheduled at a different time from the snapshot backup, this correlation can be difficult to achieve. If you want to maintain that relationship explicitly, IBM Tivoli Storage FlashCopy Manager can use the archive method for offloaded Tivoli Storage Manager backups. This way, IBM Tivoli Storage FlashCopy Manager can correlate both backup methods by using the snapshot backup ID as the archive description for the offloaded backup.

Database cloning

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

Databases are cloned frequently for the following business needs:

- To test new developments with the actual production data by creating test and quality assurance systems that are recreated regularly from the production systems
- To create a migration or upgrade system from a production system before introducing a new product release or new functions into production
- To create education systems from a master training system to reset before starting a new course
- To create dedicated reporting systems to offload workload from the production environment

The database cloning process can be done by either physically or logically copying the data or by running a redirected restore. Using traditional methods like redirected restore has various challenges, including system downtime and degraded system performance during the cloning process.

IBM Tivoli Storage FlashCopy Manager cloning

IBM Tivoli Storage FlashCopy Manager uses the FlashCopy or snapshot function of the storage systems for database cloning. This method eliminates downtime and minimizes the impact on the production database.

Furthermore, IBM Tivoli Storage FlashCopy Manager provides a framework for executing user-defined preprocessing and postprocessing scripts. This framework allows the fully automated creation of database clones, which eliminates the need for an intermediate backup. As a result, the time to generate a cloned database is reduced from hours to minutes.

With IBM Tivoli Storage FlashCopy Manager, a cloning process can be started with an online or offline source database (DB2 or Oracle). For online FlashCopy Manager cloning, the source database is suspended for a short time. The suspension occurs when the storage system creates its FlashCopy or snapshot of the source database.

The cloned database (target database) can have the same database name as the source database. The cloned database can also be renamed to any valid database name during the FlashCopy Manager cloning process. IBM Tivoli Storage FlashCopy Manager requires the cloned database to be created on a different database server than the source database server regardless of whether the clone database name is changed.

IBM Tivoli Storage FlashCopy Manager cloning process

Information about the IBM Tivoli Storage FlashCopy Manager cloning process is provided.

The IBM Tivoli Storage FlashCopy Manager cloning process is initiated by either of the following commands, with the appropriate command-line options:

- `fcmcli –f create_clone`
- `fcmcli –f refresh_clone`

Te following processing occurs:

1. The selected preprocessing scripts are run , including stopping the clone database. This step only occurs when using the `refresh_clone` command with the `-X <pre-processing configuration file>` option.
2. The FlashCopy clone is unmounted on the clone system. This step is only occurs when using `refresh_clone` function.
3. A new FlashCopy clone is created, including the suspension and resumption of the source database, and mounted on the clone system.
4. The cloned database is recovered.
5. The cloned database is renamed to the target database name.
6. IBM Tivoli Storage FlashCopy Manager starts the cloned database.
7. The selected postprocessing scripts are run to cleanup the clone database. This step only occurs when the `–Y <post-processing configuration file>` option is used.

Database cloning preprocessing and postprocessing

Repetitive processing steps that occur before and after database cloning can be automated by scripts.

The required functions in the automated scripts depend largely on the cloning environment. Because all possible environments cannot be covered by one package, preprocessing and postprocessing must be considered outside the scope of FlashCopy Manager cloning.

IBM Tivoli Storage FlashCopy Manager provides a framework in which you can run shell scripts and DB2 or Oracle SQL scripts on the clone system. Run the shell scripts before a clone database is unmounted and after a new clone database has been created. With this capability, you gain the ability and flexibility to fully automate the cloning process.

For more information about the preprocessing and postprocessing configuration files, see “Configuration files used for cloning” on page 192.

Chapter 5. IBM Tivoli Storage FlashCopy Manager commands and scripts

A list of various commands and scripts that are used with IBM Tivoli Storage FlashCopy Manager operations is provided.

Backup and restore commands and utilities

The commands to trigger a snapshot backup or snapshot restore, and to inquire and delete snapshot backups within the IBM Tivoli Storage FlashCopy Manager repository are described.

Backup and restore commands for DB2

IBM Tivoli Storage FlashCopy Manager fully integrates with DB2 backup utilities like the `db2 backup` and `db2 restore` commands that are documented in detail in the *DB2 Command Reference*. In this section, information about FlashCopy Manager specific extensions of the DB2 backup and restore interfaces is provided.

For detailed information about how to use DB2 to create snapshot backups, see the *DB2 Command Reference*.

You can use the options in the following table as parameters in the `<option string>` option to be specified with the following commands:

- `db2 backup db <dbname> [...] use snapshot options "<option string>"`
- `db2 restore db <dbname> [...] use snapshot options "<option string>"`
- `db2acsutil [...] options "<option string>"`

where `"<option string>"` has the form `"<parameter>[=<value>] [<parameter>[=<value>] ...]"`.

Table 20. Options available for db2 backup, db2 restore, and db2acsutil

Parameter	Value	Default
PROFILE	Absolute path and file name of profile	<ACS_DIR>/profile
TSM_BACKUP	YES, MANDATE, LATEST, NO See Table 35 on page 126 for detailed explanations of these values	As specified in the profile
DELETE_FORCE	No value. See note.	For DS8000 and SAN Volume Controller, incremental FlashCopy Relations are not withdrawn
DEVICE_CLASS	*device_section_name* in profile	As specified in the profile

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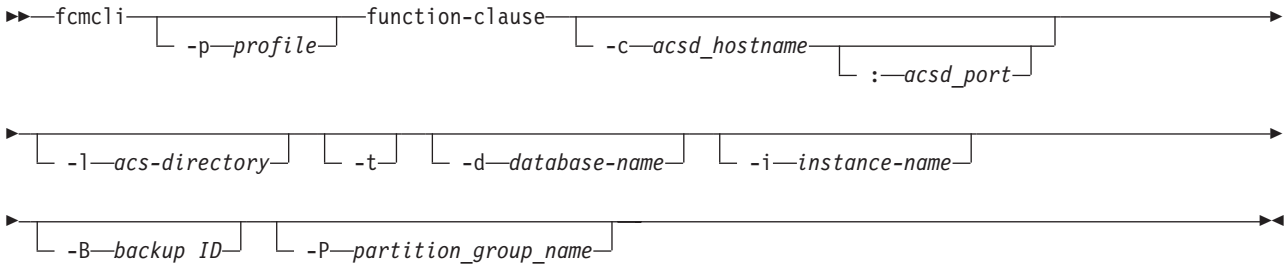
Table 20. Options available for db2 backup, db2 restore, and db2acsutil (continued)

Parameter	Value	Default
Note: 1. (DELETE_FORCE) Applies to db2acsutil only: • In conjunction with 'db2acsutil delete', withdraws any FlashCopy relations currently in effect for the target set represented by the backup (applicable to CIM devices only). A manual withdraw of FlashCopy relations is needed in case of a restore when multiple target sets are in use and at least one target set other than the one to be restored is in a NOCOPY or INCR FlashCopy® relation. • In conjunction with 'db2acsutil query', also lists backups deleted without the DELETE_FORCE option. 2. (TSM_BACKUP), (DEVICE_CLASS) Applies to `db2 backup` only.		

fcmcli -f [inquire, inquire_detail, delete, restore]

The fcmcli command provides an extension to the native DB2 utilities that enables you to query the FlashCopy Manager repository for valid snapshot backups and to restore snapshot backups by bypassing the `db2 restore ... use snapshot` command.

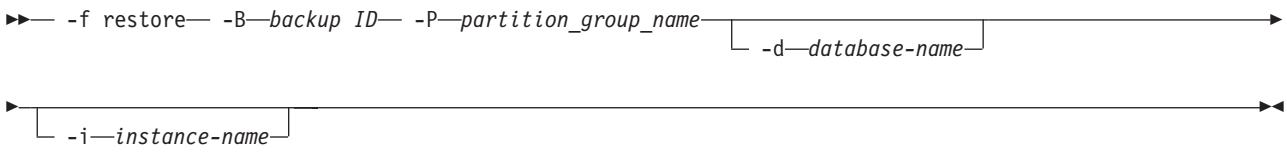
The latter command might be needed in partitioned DB2 environments with SAP workload, where multiple DB2 partitions reside on a single volume group (whose backups cannot be restored directly from DB2).



The values for the `function-clause` parameter are described in the following sections.

function-clause: FlashCopy operations of DB2 with partition group

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy restores of DB2 with partition group:



function-clause: FlashCopy operations of DB2 with and without partition group

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy inquire and delete of DB2:

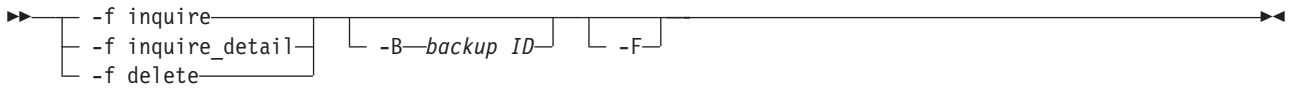


Table 21. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command

Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_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>
-d database-name	Database name. Required for '-F' option.	No limitation.
-i instance-name	Instance name to apply to the command. Required for '-F' option.	No limitation.
-F	(DELETE_FORCE flag) Applies to inquire, inquire_detail and delete: • With the `delete` function, withdraws any FlashCopy relations currently in effect for the target set represented by the backup (applicable to DS and SAN Volume Controller only). • With the `inquire[_detail]` function, also lists backups deleted without the DELETE_FORCE flag.	None.
-t	Start with trace on.	Trace off
-v	Display version.	
-h	Display help text.	
-B	The Backup ID as displayed by `fcmcli -f inquire [_detail]` or `db2acsutil`.	None.
-P	The name of a partition group as specified in the profile with the PARTITION_GROUP parameter. See Table 35 on page 126 for details.	None.

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. Further, the return code is 1 if

one or more minor issues occurred that are not critical but should be checked to prevent major issues later. Return code 2 indicates that an error occurred during the command execution.

The following sections describe the details of the various functions specified with the '-f' option of the IBM Tivoli Storage FlashCopy Manager command **fcmcli**.

-f inquire:

This command queries the backup repository and list all available backups.

This command is of special interest in environments where multiple partitions reside on the same volume group (volume sharing).

-f inquire_detail:

This command queries the backup repository and lists all available backups.

This command is similar to -f inquire but prints additional information like usability states and background copy progress for each backup. This command is of special interest in environments where multiple partitions reside on the same volume group (volume sharing).

-f delete:

The delete function is used as part of the version control mechanism of IBM Tivoli Storage FlashCopy Manager and can only be called by IBM Tivoli Storage FlashCopy Manager itself or by a user. The delete function can only be used to delete full backups.

You can use the delete function to delete a snapshot and eventually free the resources that are associated with this particular backup. The exact behavior of the delete function depends on the characteristics of the storage device. The -f delete function operates exclusively on snapshot backups. Backups to Tivoli Storage Manager are not affected by this command.

The impact of the deletion on the snapshot or FlashCopy relations is dependent on the storage system:

- IBM XIV Storage System: The snapshot is not deleted when the delete command is issued.
- IBM System Storage DS8000 and SAN Volume Controller: The FlashCopy relations are not deleted when the delete command is issued. Specify the -F option to force the deletion of the FlashCopy relations on these storage systems.

The following example shows the syntax as database instance owner on the production system:

```
./fcmcli -f delete [-F]
```

-f restore:

This command starts a restore operation in environments where multiple partitions reside on the same volume group.

See Table 35 on page 126 for details about how to use this command with the PARTITION_GROUP parameter.

For such environments the DB2 restore interface cannot be used and fcmcli -f restore serves as an alternative interface to trigger the restore operation. During the restore operation the DB2 database will be stopped and a FlashCopy restore is initiated. After the restore operation is completed the database will be started and initialized. The following parameters are also required in order to perform the -f restore operation:

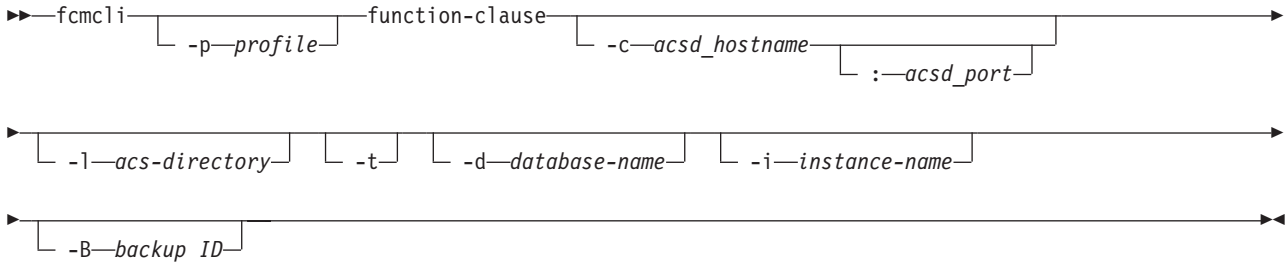
```
-d database-name
-B backup-id
-P partition_group-name
```

The restore operation is performed for all partitions that correspond to the specified partition group.

fcmcli -f *_db2standby - support of DB2 standby server (DB2 HADR) environments

Information for the support of DB2 standby server and DB2 HADR environments are provided.

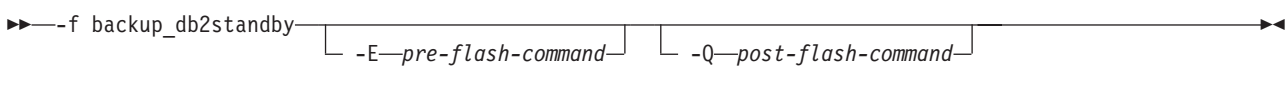
IBM Tivoli Storage FlashCopy Manager for Custom Applications enables you to create snapshot backups of DB2 standby server and DB2 HADR environments, and to create a backup to Tivoli Storage Manager from a snapshot using the Tivoli Storage Manager backup-archive client. Both of these functions are an extension to the native DB2 backup interface and therefore cannot be invoked with native DB2 utilities such as the `db2 backup` and `db2 restore` commands.



The values for the `function-clause` parameter are described in the following sections.

function-clause: FlashCopy operations of DB2 HADR databases

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy backups of DB2 HADR databases:



The following functions are supported by the fcmcli command option -f 'function' for FlashCopy restore, inquire, and delete of DB2 HADR databases:

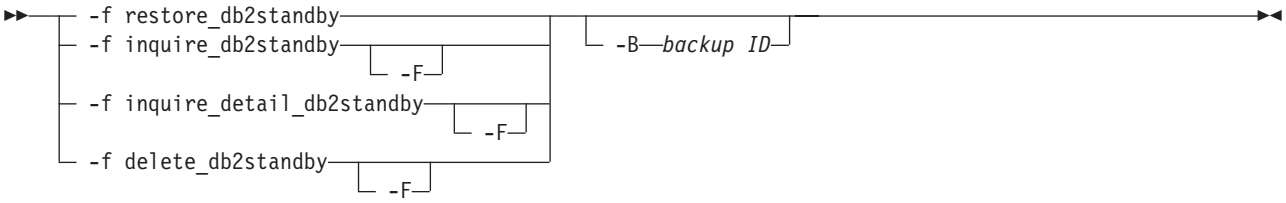


Table 22. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command for DB2 standby server and DB2 HADR environments

Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_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>
-d database-name	Database name. Required for '-F' option.	No limitation.
-f backup_db2standby	Back up a DB2 standby server.	
-f restore_db2standby	Restore a DB2 HADR snapshot backup.	
-f delete_db2standby	Unmount and delete a snapshot of a DB2 standby server.	
-f inquire_db2standby	Query the backup repository and list all available backups.	
-f inquire_detail_db2standby	Query the backup repository and list all available backups in detail.	
-E preflash command	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.	
-Q postflash command	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.	

Table 22. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command for DB2 standby server and DB2 HADR environments (continued)

Option	Description	Default
-i instance-name	Instance name to apply to the command. Required for '-F' option.	No limitation.
-F	(DELETE_FORCE flag) Applies to 'inquire_db2standby', 'inquire_detail_db2standby' and 'delete_db2standby': • With the 'delete_db2standby' function, withdraws any FlashCopy relations currently in effect for the target set represented by the backup (applicable to DS and SAN Volume Controller only). • With the 'inquire[_detail]_db2standby' function, also lists backups deleted without the DELETE_FORCE flag.	None.
-t	Start with trace on.	Trace off
-v	Display version.	
-h	Display help text.	
-B	The Backup ID as displayed by 'fcmcli -f inquire [_detail]' or 'db2acsutil'.	None.

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. Further, the return code is 1 if one or more minor issues occurred that are not critical but should be checked to prevent major issues later. Return code 2 indicates that an error occurred during the command execution.

The following sections describe the details of the various functions specified with the '-f' option of the IBM Tivoli Storage FlashCopy Manager command **fcmcli**.

-f backup_db2standby:

This command backs up a DB2 high-availability disaster recovery (HADR) target database.

The -f backup_db2standby function operates like the fcmcli -f backup function. However, instead of requesting the user to specify a list of files for backup, this command retrieves this information from the active DB2 instance. It is important that the names of the files and file systems from the active DB2 database (HADR primary) match the names of files and file systems of the standby server (HADR secondary). The editable sample preflash and postflash command files assist you to shut down and restart the DB2 standby server (HADR secondary). This action creates a consistent backup image.

The following figure illustrates the workflow that is executed from this command.

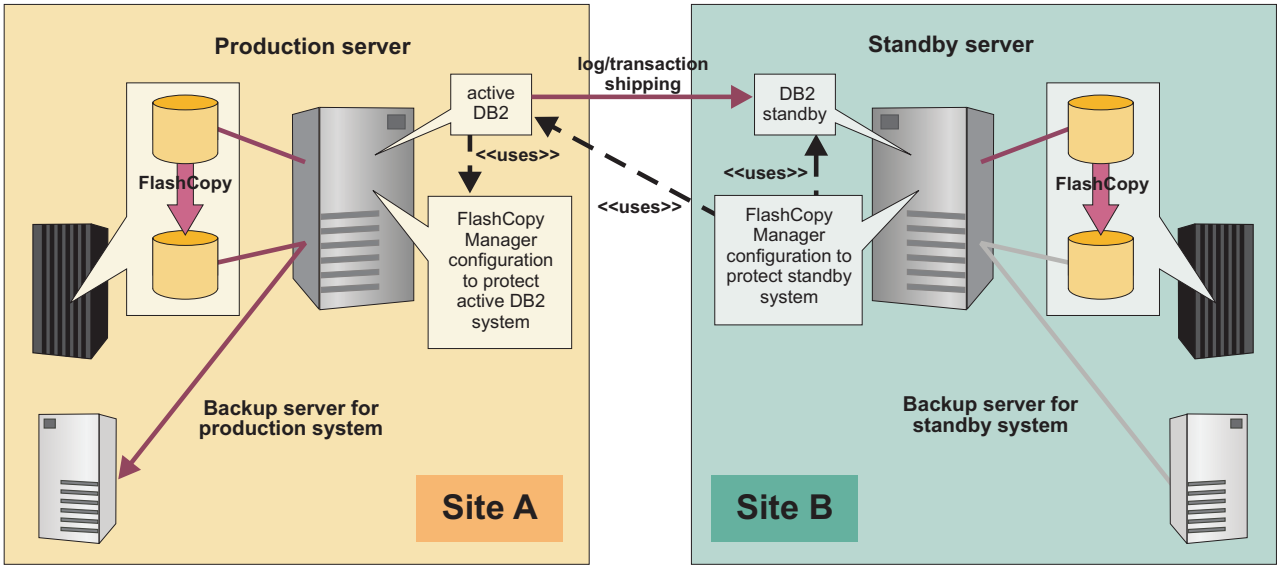


Figure 8. Protection of DB2 HADR standby nodes with IBM Tivoli Storage FlashCopy Manager for Custom Applications

1. It starts with connecting to the active DB2 database (for example site A) to retrieve a list of files from the active database.
2. This list of files is then translated into a list of volumes and LUNs in site B, using the assumption that the names of DB2 files and file systems in site A are identical to the names of files and file systems in site B.
3. The preflash script is invoked. The preflash script typically stops the DB2 standby system in order to enable FlashCopy Manager to create a consistent snapshot backup.
4. Once the snapshot has been taken, the postflash command is invoked, which typically starts the DB2 standby system again.

-f inquire_db2standby:

This command queries the backup repository and list all available backups.

This command applies to DB2 HADR standby server environments. To run the -f inquire_db2standby command, you can specify the following parameter to get an overview of the files that are contained in the snapshot backup:

```
-B backup-id
```

-f inquire_detail_db2standby:

This command queries the backup repository and list all available backups.

This command is similar to the -f inquire_dbstandby command but prints additional information like usability states and background copy progress (if available) for each backup. This command applies to DB2 HADR standby server environments. To run the -f inquire_detail_db2standby command, you can specify the following parameter to get an overview of the files that are contained in the snapshot backup:

```
-B backup-id
```

-f restore_db2standby:

This command restores a DB2 high-availability disaster recovery (HADR) target database.

During the restore operation, the DB2 database is stopped and a FlashCopy restore is initiated. After the restore operation is completed, the database is started and initialized. The following parameter is also used when performing -f restore_db2standby operations:

```
-B backup ID
```

-f delete_db2standby:

This Offload Agent command unmounts and deletes a snapshot of a DB2 standby server that was created with the backup_db2standby function.

You can use the delete_db2standby function to delete a snapshot and eventually free the resources that are associated with this particular backup. The exact behavior of the delete_db2standby function depends on the characteristics of the storage device. The -f delete_db2standby function operates exclusively on snapshot backups. Backups to Tivoli Storage Manager are not affected by this command.

The impact of the deletion on the snapshot or FlashCopy relations is dependent on the storage system:

- IBM XIV Storage System: The snapshot is not deleted when delete_db2standby is issued.
- IBM System Storage DS8000 and SAN Volume Controller: The FlashCopy relations are not deleted when delete_db2standby is issued. Specify the `-F` option to force the deletion of the FlashCopy relations on these storage systems.

This example shows the syntax as database instance owner on the production system:

```
./fcmcli -f delete_db2standby [-F]
```

Backup and restore commands for Oracle

Commands to back up and restore native Oracle and SAP with Oracle databases are provided.

acsora - User interface for Oracle in non-SAP environments

The production system user interface (acsora) performs commands on a native Oracle environment.

The acsora syntax is as follows:

```
acsora [-p profile] -f <function> [-B backupID] [-F]

where <function> is one of:
        backup
        restore
        delete
        inquire
        inquire_detail
```

Option	Description	Default
-p profile	Full path and name of the profile used by the Management Agent The Management Agent uses the 'GLOBAL' and 'ACSD' sections of the profile.	<ACS_DIR>/profile
-B backupID	Backup ID for restore, delete, inquire functions	
-f backup	Backup database	Function backup if -f is not specified.
-f restore	Restore database	
-f delete	Delete snapshot backup	
-f inquire	List snapshot backups	
-f inquire_detail	List snapshot backups	
-F	When specified with the -f delete or -f inquire options, the -F option withdraws source and target relationships.	

The return code of acsora is 0 if it finishes the request without an error. The return code 1 indicates one (or more) minor issues occurred during the process. Although not considered critical, resolve these minor issues to prevent potential critical issues at a later time. Return code 2 indicates that an error occurred during command processing and that the operation did not complete successfully.

-f backup

This command backs up the Oracle database according to the profile settings.

Example (backup database):

```
acsora -f backup
```

-f restore

This command restores the Oracle database from the backup specified by the backup ID, or the latest backup.

The Oracle database is available for immediate use after performing a snapshot restore and a roll-forward recovery. However, for DS8000 and SAN Volume Controller, background copy processing from the target volumes to the source volumes might require additional time to complete, especially if FLASHCOPY_TYPE COPY is specified. Although the database is available, you cannot perform an IBM Tivoli Storage FlashCopy Manager restore until background copy processing completes.

Example (restore specified backup):

```
acsora -f restore -B A0FZ36AY8G
```

See “Restoring a native Oracle database from Tivoli Storage Manager” on page 67 and “Restoring a native Oracle database” on page 66 for detailed instructions on how to restore your Oracle database.

-f inquire

This command lists the details for the snapshot backup denoted by the backup ID (if specified using the '-B' option), or all backups.

Example (list all backups):

```
acsora -f inquire
```

-f inquire_detail

This command queries the backup repository and list all available backups.

This command is like the -f inquire command, but it prints additional information like usability states and background copy progress (if available) for each backup.

-f delete

This command deletes the snapshot backup denoted by the entered backup ID.

Example (deleted specified backup):

```
acsora -f delete -B A0FZ36AY8G
```

BR*TOOLS - User interface for Oracle in SAP environments

Because IBM Tivoli Storage FlashCopy Manager fully integrates with SAP BR*TOOLS, IBM Tivoli Storage FlashCopy Manager does not provide a native user interface. Information is provided about the query and deletion of snapshot backups, operations that are not directly supported with BR*TOOLS.

For detailed information about how to use BR*TOOLS to create snapshot backups, see *SAP® Database Guide for Oracle*.

Note: IBM Tivoli Storage FlashCopy Manager provides a console user interface that can be used to bypass BR*TOOLS for query and restore operations (see "acsutil - Snapshot Object Manager for Oracle" on page 85).

Important: If you are not using IBM Tivoli Storage Manager for Enterprise Resource Planning, in order to not overwrite an existing 'backint' executable program that is used for traditional backups, IBM Tivoli Storage FlashCopy Manager does not install the 'backint' executable to the default path in `/usr/sap/<SID>/SYS/exe/run`. In order to invoke FlashCopy Manager, you therefore must invoke the executable that is located in the FlashCopy Manager installation directory (<INST_DIR>).

If you have installed IBM Tivoli Storage Manager for Enterprise Resource Planning, you can invoke the backint executable from the default installation path.

Inquire and delete using the backint interface.

The syntax of the backint command is as follows:

```
backint  [-p profile]
         -f <function>
         -t <backup_type>
         [-F]
```

```
where <function> is one of:

       inquire
       inquire_detail
       delete

and <backup_type> is one of:

       volume
       file
```

Table 23. Parameters for IBM Tivoli Storage FlashCopy Manager Invocation as 'backint'

Option	Meaning	Default
-p	IBM Tivoli Storage FlashCopy Manager Backint profile (see "IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)" on page 135)	
-f inquire or inquire_detail	Inquire function with or without detailed information about the backups.	
-f delete	Delete function	
-t volume	This option can be used to manage snapshot backups created with FlashCopy Manager.	
-t file	Use this option to manage files that have been backed up directly to the FlashCopy Manager repository. **Note:** When IBM Tivoli Storage Manager for Enterprise Resource Planning is installed, both options are also supported by IBM Tivoli Storage Manager for Enterprise Resource Planning. However, in this case option "-t file" is used to manage backups that have been sent to the Tivoli Storage Manager server instead.	
-F	Force option to be used with inquire, inquire_detail, or delete functions. When used with inquire or inquire_detail, all available backups as well as all backups marked for deletion display. When used with the delete function, it withdraws the source target FlashCopy® relations on DS8000 or SAN Volume Controller.	

-f inquire or -f inquire_detail

The **inquire** function, normally invoked by SAP® BR*Tools and BRRESTORE, will be used to query the Tivoli Storage Manager server for backup IDs or files which belong to a particular backup ID. For troubleshooting, however, it might be necessary to invoke this function manually from the command line as follows.

```
backint -p /oracle/<SID>/dbs/init<SID>.utl -f inquire -t volume
```

IBM Tivoli Storage FlashCopy Manager prompts you to enter the inquiry in one of four formats. These are:

1. **#NULL** - to display all backup IDs saved so far. A typical line of the response could be:

   ```
   #BACKUP JE0___A0DNE9Z74C
   ```

   The backup ID in this case is `JE0___A0DNE9Z74C` (`#BACKUP` is not part of the backup ID). The first six characters are the user defined prefix. The next 10 characters represent a unique ID of the backup.
2. **BackupID** - to display all of the files which belong to this backup ID. A typical result could be:

   ```
   #BACKUP JE0___A0DNE9Z74C  /oracle/C21/dbs/initC21.utl.
   ```

3. **#NULL `filename`** - to display all of the backup IDs corresponding to this file. *Filename* requires an input consisting of path and name of the file.
4. **BackupID `filename`** - to verify whether a particular file has been saved under a certain backup ID. *Filename* requires an input consisting of path and name of the file.

-f delete

The **delete** function is used as part of the version control mechanism of IBM Tivoli Storage FlashCopy Manager and can only be called by IBM Tivoli Storage FlashCopy Manager itself or by a user. The delete function allows you to delete full backups only.

This function can be invoked from the command line as follows:

```
backint -p /oracle/<SID>/dbs/init<SID>.utl -f delete -t volume
```

You will be prompted to enter the backup ID.

acsutil - Snapshot Object Manager for Oracle

The Snapshot Object Manager for Oracle (acsutil) provides a snapshot backup query and restore interface for native Oracle and SAP with Oracle environments.

Functions of the 'acsutil' command

The Snapshot Object Manager for Oracle (acsutil) provides a front-end for acsora to show available backups, perform restores, and delete unwanted backups. It communicates with acsora via input and output files.

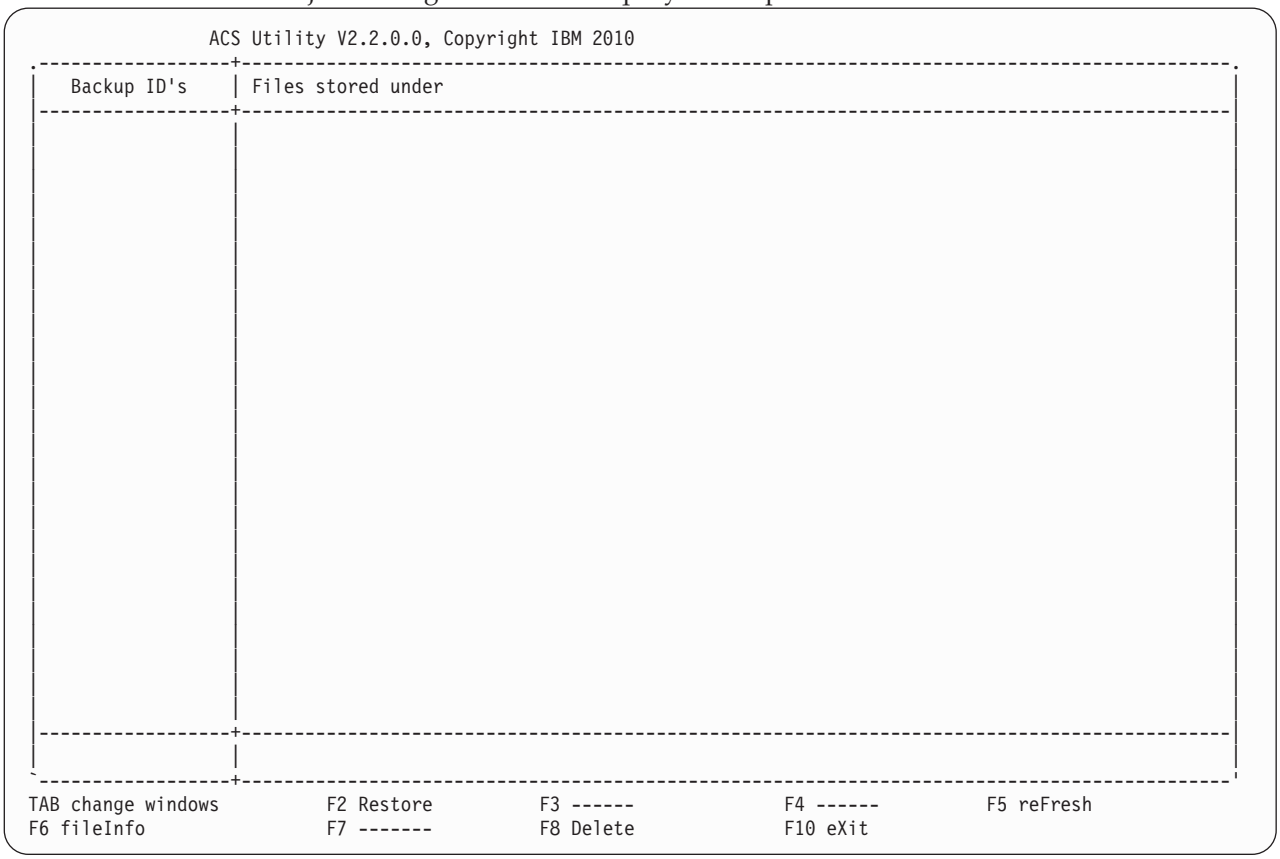
Syntax of the 'acsutil' command

```
acsutil [-p <profile>]
```

Parameter	Description	Default
-p profile	IBM Tivoli Storage FlashCopy Manager profile	<ACS_DIR>/profile

The Snapshot Object Manager user interface consists of a split window, which is character based.

The first step is an automatic inquire operation for all backup IDs. The following figure shows the screen layout for the list of backup IDs found by the Snapshot Object Manager when the inquiry is complete.



All backup IDs found in the IBM Tivoli Storage FlashCopy Manager repository are shown on the left. To the right of each backup ID, all the files belonging to that backup ID are displayed. You can select individual backup IDs

If you mark the backup ID you are interested in and then press the Tab key to move the cursor to the right-hand panel, all file names belonging to the marked backup ID will be displayed.

Up, Down, Left, Right - Move cursor
Move the highlighted cursor in the direction indicated on the key.

Tab - Switch window side
Move the cursor between the left and right sides of the window.

F2 - Restore
Restore the marked backup ID.

F5 - Refresh
Refresh the list of backup IDs and file names.

F6 - Fileinfo
Opens a separate window to display file information.

For backup IDs, the sequence number (backup version count) is shown.

F8 - Delete
Delete the selected backup ID and all corresponding files.

F10 - Exit
Exit from Snapshot Object Manager

ENTER - Mark/unmark backup ID
Mark or unmark the backup ID below the cursor.

The Snapshot Object Manager can delete backup IDs with all included files. It is not possible to delete single files within a backup ID. To delete a backup ID it must be highlighted. After pressing F8 you have to confirm the deletion operation. The backup ID and all included files are deleted.

For each restore, a log file will be created.

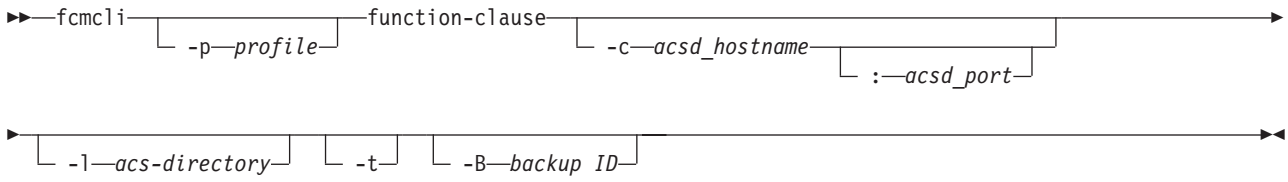
Backup and restore commands for custom applications

The FlashCopy Manager command line interface (fcmcli) can be used to create snapshot backups, snapshot restores, inquire, and delete operations for applications for which no native backup adapter exists.

When invoking the fcmcli command, you must provide a list of files for which a snapshot backup is to be created. You can specify the list of files either through the configuration file or through the command line interface. Optionally, you can provide fcmcli 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 has been taken.

If specified, those scripts are invoked immediately before and after the snapshot is created in order to minimize application downtime.



The values for the `function-clause` parameter are described in the following sections.

function-clause: FlashCopy operations of custom applications

The following functions are supported by the fcmcli command option -f 'function' for IBM Tivoli Storage FlashCopy Manager for Custom Applications backups of custom applications:

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy restores, inquire, and delete of custom applications:

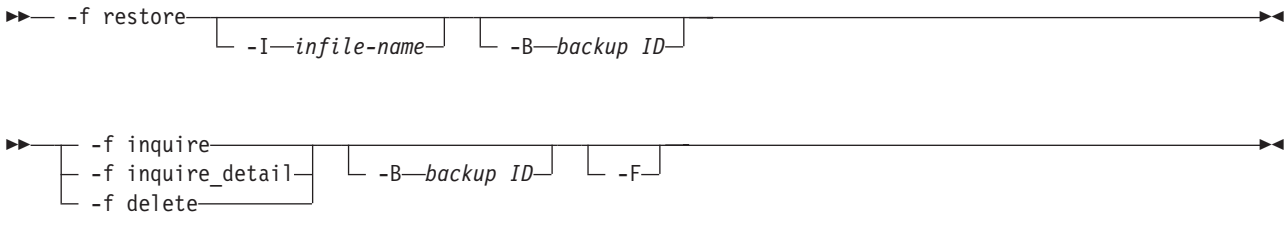


Table 24. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command for custom applications

Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_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.	
-E preflash command	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.	
-Q postflash command	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.	
-I infile	Overrides the value of the INFILE parameter as specified in the CLIENT section of the profile. The fcmcli functions inquire, inquireDetails, and delete do not recognize the infile parameter. The function restore accepts infile as an optional parameter.	

Table 24. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' 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.
-t	Start with trace on.	Trace off
-v	Display version.	
-h	Display help text.	
-B	The Backup ID as displayed by `fcmcli -f inquire [_detail]` or `db2acsutil`.	None.

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. The return code is 1 if one or more minor issues occurred which are not critical but should be checked to prevent major issues later. Return code 2 indicates that an error occurred during the command execution.

The following sections describe the details of the various functions specified with the '-f' option of the IBM Tivoli Storage FlashCopy Manager command **fcmcli**.

-f backup

This command creates a FlashCopy backup of custom applications, such as a list of file systems that you provide.

Before and after snapshot creation, IBM Tivoli Storage FlashCopy Manager can optionally call a user exit that quiesces and resumes all applications that store data within those file systems.

When this command is called, it is also determined if the snapshot is retained locally (for disk-only backup) or backed up at a later time to Tivoli Storage Manager. As a backup method for the subsequent Tivoli Storage Manager backup, FlashCopy Manager for Custom Applications uses the Tivoli Storage Manager backup-archive client.

The following optional parameters can be used with the `fcmcli -f backup` command:

```
-I <infile>
-E <preflash command>
-Q <postflash command>
```

`-I <infile>` specifies the name of a file that contains a list of all the objects that is processed by FlashCopy Manager.

`-E <preflash command>` specifies the name of a script or executable program that is called immediately before the snapshot. The pre-flash script is typically used to quiesce an application.

`-Q <postflash command>` specifies the name of a script or executable program that is called immediately after the snapshot. The post-flash script is typically used to resume an application.

-f inquire

This command queries the backup repository and list all available backups.

This command is of special interest in environments where multiple partitions reside on the same volume group (volume sharing).

-f inquire_detail

This command queries the backup repository and lists all available backups.

This command is similar to -f inquire but prints additional information like usability states and background copy progress for each backup. This command is of special interest in environments where multiple partitions reside on the same volume group (volume sharing).

-f delete

The delete function is used as part of the version control mechanism of IBM Tivoli Storage FlashCopy Manager and can only be called by IBM Tivoli Storage FlashCopy Manager itself or by a user. The delete function can only be used to delete full backups.

You can use the delete function to delete a snapshot and eventually free the resources that are associated with this particular backup. The exact behavior of the delete function depends on the characteristics of the storage device. The -f delete function operates exclusively on snapshot backups. Backups to Tivoli Storage Manager are not affected by this command.

The impact of the deletion on the snapshot or FlashCopy relations is dependent on the storage system:

- IBM XIV Storage System: The snapshot is not deleted when the delete command is issued.
- IBM System Storage DS8000 and SAN Volume Controller: The FlashCopy relations are not deleted when the delete command is issued. Specify the -F option to force the deletion of the FlashCopy relations on these storage systems.

The following example shows the syntax as database instance owner on the production system:

```
./fcmcli -f delete [-F]
```

-f restore

For custom applications, you can use the fcmcli -f restore command to do a full or partial snapshot restore of the data that has been backed up.

- To restore a full snapshot, provide the backup ID of a particular snapshot backup by specifying the -B backup-id parameter. You can obtain the backup ID by using the fcmcli -f inquire command. To restore the latest backup, specify #NULL.
- To restore only a portion of the snapshot backup, IBM Tivoli Storage FlashCopy Manager can also specify a list of files explicitly using the -I <infile> option. Be aware that even though IBM Tivoli Storage FlashCopy Manager restores data at a volume level, additional data might be restored as part of the volume restore operation. You can use the NEGATIVE_LIST parameter to specify what action IBM Tivoli Storage FlashCopy Manager takes in these situations.

Deleting IBM Tivoli Storage FlashCopy Manager snapshot backups

IBM Tivoli Storage FlashCopy Manager snapshot backups can be deleted from the snapshot repository.

It is typically not required to 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. IBM XIV® Storage Systems allow you to create as many snapshot backups as needed, and old backups can be deleted manually. Old backups can also be deleted automatically by using the MAX_VERSIONS (MAX_SNAPSHOT_VERSIONS) parameter.

Perform these tasks to manually delete a IBM Tivoli Storage FlashCopy Manager snapshot backup:

1. Run the following command to unmount the file systems and export the volume groups on a backup system where the backup using this target set is currently mounted. This step can be omitted if the backup is not currently mounted.

   ```
   fcmcli -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 by starting one of these appropriate utilities:
   - (DB2) `db2acsutil delete`
   - (Native Oracle) `acsora -f delete -B <backupID>`
   - (SAP on Oracle) `backint -f delete [-b <backupID>]`
   - (Custom applications) `fcmcli -f delete -B <backupID> [-F]`

Note: (IBM XIV® Storage System): These commands delete the snapshot backup in the IBM Tivoli Storage FlashCopy Manager snapshot repository, and the snapshot on the IBM XIV® Storage System is also deleted.

Note: (DS8000 or SAN Volume Controller): These commands delete the snapshot backup in the IBM Tivoli Storage FlashCopy Manager snapshot repository only. The source and target relations on DS8000 or SAN Volume Controller are not withdrawn.

In case you plan to remove a target volume from a target set or you plan to remove a complete target set, you must first run the following steps to free up the target volumes:

1. Run this command to unmount the file systems and export the volume groups on a backup system where the backup using this target set is currently mounted:

   ```
   fcmcli -f unmount [-T <backupID>]
   ```

   This step can be omitted if the backup is currently not 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 by starting one of these appropriate utilities:
   - (DB2) `db2acsutil delete options "DELETE_FORCE"`
   - (Native Oracle) `acsora -f delete -F -B <backupID>`
   - (SAP with Oracle) `backint -f delete -F [-b <backupID>]`

   The actual withdraw of the source and target FlashCopy relationship is done by the IBM Tivoli Storage FlashCopy Manager generic device agent (acsgen) as a background operation and it can be delayed as long as 10 minutes. Do not try to reuse the target volumes before the actual withdraw completes successfully.

Checking the status of snapshot backups in the IBM Tivoli Storage FlashCopy Manager repository

Ensure that you routinely check the status of the IBM Tivoli Storage FlashCopy Manager repository.

To check the current status of snapshot backups in the IBM Tivoli Storage FlashCopy Manager repository, the following command can be used (depending on the database type):

- (DB2) `fcmcli -f inquire[_detail]`
- (DB2) `db2acsutil query status`
- (Native Oracle) `acsora -f inquire[_detail]`
- (Native Oracle) `acsutil`
- (SAP® with Oracle) `backint -f inquire[_detail] -t volume|file -p <SAP® Backint profile (.utl)>`
- (SAP® with Oracle) `acsutil`
- (Custom applications) `fcmcli -f inquire[_detail]`

When using the `inquire_detail` command with the appropriate tool, output similar to the following displays:

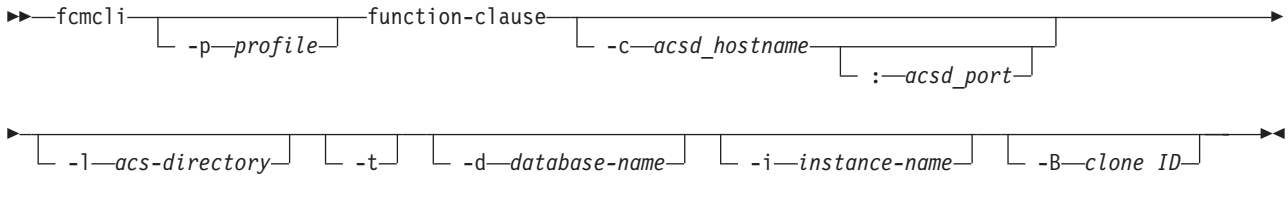
```
#BACKUP C01___A0FY303K6B IN_PROGRESS -
TARGET_SET=1,REMOTELY_MOUNTABLE,REPETITIVELY_RESTORABLE,SWAP_RESTORABLE,
PHYSICAL_PROTECTION,FULL_COPY,TAPE_BACKUP_PENDING ( 2.780 GB of 2.794 GB )

#BACKUP C01___A0FX791RPU SUCCESSFUL -
TARGET_SET=1,REMOTELY_MOUNTABLE,REPETITIVELY_RESTORABLE,SWAP_RESTORABLE,
PHYSICAL_PROTECTION,FULL_COPY,MOUNTING ( 4.000 GB of 4.000 GB )
```

Note: The db2acsutil query status command will not show all information that is shown by the `inquire_detail` command. That is because db2acsutil is a tool delivered by DB2 which only knows a subset of all possible states that can be set by IBM Tivoli Storage FlashCopy Manager.

Tivoli Storage FlashCopy Manager cloning commands

You can use the IBM Tivoli Storage FlashCopy Manager command line interface (fcmcli) to create and manage clones of DB2, native Oracle, and SAP with Oracle databases. Cloning of custom applications is currently unavailable.



The values for the `function-clause` parameter are described in the following sections.

function-clause: FlashCopy cloning operations

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy cloning operations:

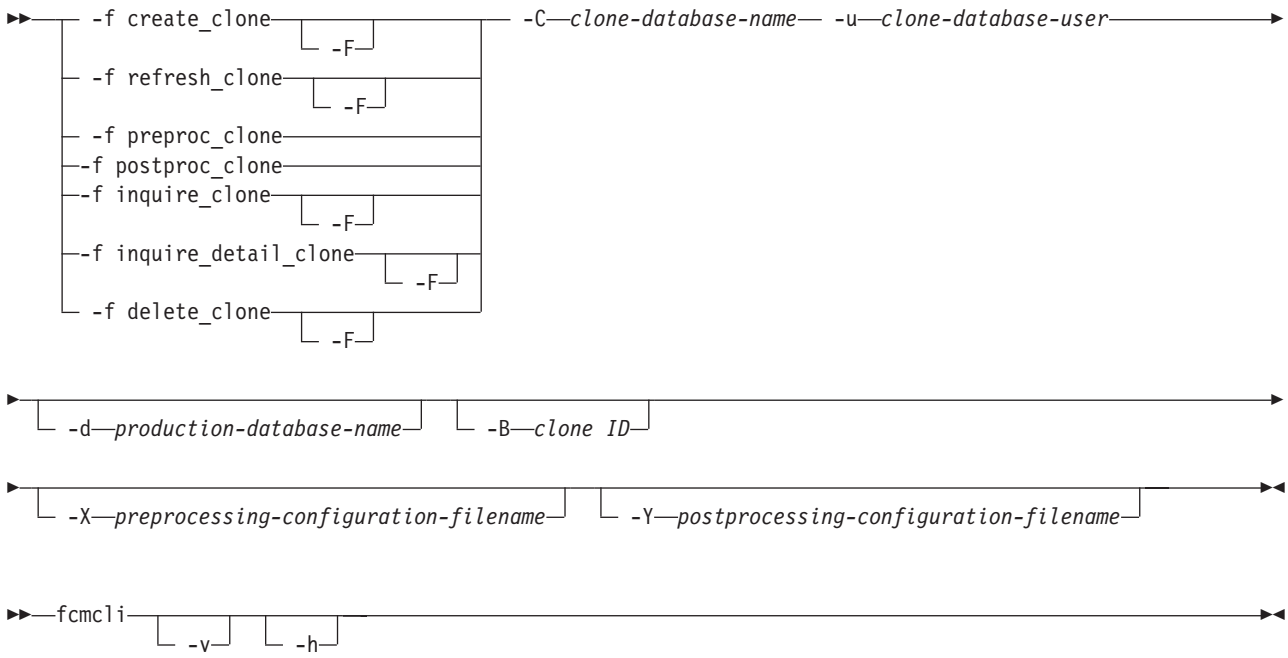


Table 25. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command

Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_DIR>/profile

Table 25. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command (continued)

Option	Description	Default
-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>
-i instance-name	Instance name to apply to the command. Required for '-F' option.	No limitation.
-B	The Backup ID as displayed by `fcmcli -f inquire [_detail]` or `db2acsutil`.	None.

Table 26. Cloning options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command

Option	Description	Default
-C clone database name	Specifies the name of the cloned database residing on the clone system. Specify a valid DB2 or Oracle database name for the *clone database name* value. The *clone database name* can be the name of the production database or a different name. When a name that is the same as the production database name is used, the cloned database is not renamed.	This command line option must be specified for all cloning functions.
-d production database name	Specify the name of the production database on the production system.	The command line option -d <production database name> is optional for Oracle. For DB2, it depends on the number of database entries in the database directory. If the DB2 database directory contains more than one (or no) entry, the command line option -d <production database name> is required to be specified.

Table 26. Cloning options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command (continued)

Option	Description	Default
-F	Specify the force parameter with these functions: • delete_clone: The force command line option causes the clone to be unmounted, marked as deleted, and also deletes the FlashCopy relationships. Without the force command line option, the delete_clone function only unmounts the clone and marks it as deleted in the FlashCopy Manager repository. • create_clone, refresh_clone: The force command line option deletes all backup versions that are older than the clone targets that are reused for the new or refreshed clone. Without the force command line option, the new or refreshed clone fails if there are backup versions older than the clone targets that are reused for the new or refreshed clone. This command line option is valid with the create_clone and refresh_clone functions on SAN Volume Controller 5.1 only.	This command line option is optional.
-u clone instance owner user name	Specify the user name of the clone instance owner. This command line option is required when the following functions are issued: • create_clone • refresh_clone • preproc_clone • postproc_clone	
-X preprocessing configuration file	Specify the name of the configuration file to be used with the preprocessing script. The preprocessing configuration file must reside on the clone server.	This parameter is optional.
-Y postprocessing configuration file	Specify the name of the configuration file to be used with the postprocessing script. The preprocessing configuration file must reside on the clone server.	This parameter is optional.

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. The return code is 1 if one or more minor issues occurred which are not critical but should be checked to prevent major issues later. Return code 2 indicates that an error occurred during the command execution.

The following sections describe the details of the various functions specified with the '-f' option of the IBM Tivoli Storage FlashCopy Manager command **fcmcli**.

Issue cloning-related parameters on the production system as the production database instance owner. The cloning parameters must be issued from the `INST_DIR/acs` directory where the IBM Tivoli Storage FlashCopy Manager production files reside. The fcmcli command identifies the name of the production database in the following order:

1. For Oracle databases, the value of the ORACLE_SID environment variable is used to identify the production database name. For DB2 databases, the DB2 database directory is used. If only one entry exists in the database directory, then this entry is used to identify the production database name.
2. The `-d` *`production database name`* command-line option is queried. If this option is specified, this value overwrites the value identified in Step 1. Also, this value is used to identify the production database name. The command-line option `-d` is optional for Oracle. Its use with DB2 depends on the number of database entries in the database directory. If more than one entry is in the DB2 database directory, then the `-d` option is required.

-f create_clone

This command creates a clone database.

The following actions occur when a clone database is created:

1. A consistent online FlashCopy backup of the production database (including online log files) is created.
2. The FlashCopy backup is mounted on the clone system. The following actions occur during this mount operation:
   - The physical devices on the clone server operating system (used as target volumes during the FlashCopy backup) are configured.
   - The volume groups on the physical devices are imported.
   - These file systems on the imported volume groups are mounted when the clone database is created:
     - database file systems
     - all additional file systems involved in a FlashCopy operation
3. The database on the clone system is recovered.
4. The database is renamed to match the name of the clone database that resides on the clone system.
5. The clone database is started on the clone system.
6. (Optional) Postprocessing scripts are run against the new clone database.

If the clone database on the clone system exists, it must be shut down and unmounted when issuing this function. An error message and return code 2 are issued if the clone database is not shut down and unmounted.This example shows the syntax as database instance owner on the production system:

```
./fcmcli -f create_clone -u <clone instance owner user name>
-C <clone database name> [-F]
```

-f inquire_clone

This command queries a clone database for the list all available backups.

This command is of special interest in FlashCopy Manager cloning operations. The following parameters are also required in order to perform the -f inquire_clone operation:

```
-d database-name
-C <clone db name>
```

-f inquire_detail_clone

This command queries the backup repository and list all available backups.

This command works like -f inquire_clone but prints additional information like usability states and background copy progress (if available) for each backup. This command is of special interest in FlashCopy Manager cloning operations. The following parameters are also required in order to run the -f inquire_detail_clone command:

```
-d database-name
-C <clone db name>
```

-f delete_clone

This command unmounts and deletes a clone database that was created with the create_clone or refresh_clone function. Optionally, preprocessing scripts can run against the clone database that is to be deleted.

The impact of the deletion on the snapshot or FlashCopy relations is dependent on the storage system:

- IBM XIV Storage System: The snapshot is not deleted when delete_clone is issued.
- IBM System Storage DS8000 and SAN Volume Controller: The FlashCopy relations are not deleted when delete_clone is issued. Specify the `-F` option to force the deletion of the FlashCopy relations on these storage systems.

The clone database (on the clone system) must be shut down in order to delete the database. An error message and return code 2 are issued if the clone database is not shut down. This example shows the syntax as database instance owner on the production system:

```
./fcmcli -f delete_clone -C <clone database name> [-F]
```

-f preproc_clone

This command runs preprocessing scripts against the clone database (on the clone system) before the clone database is refreshed.

This clone database (on the clone system) must be up and running when issuing this function. An error message and return code 2 are issued if the clone database is unavailable. This example shows the syntax as database instance owner on the production system:

```
./fcmcli -f preproc_clone -u <clone instance owner user ID>
-C <clone database name> -X <preprocessing configuration file>
```

-f postproc_clone

This command runs postprocessing scripts (on the clone system) against the clone database after a clone database is created.

This new clone database (on the clone system) must be up and running when issuing this function. An error message and return code 2 are issued if the clone database is unavailable. This example shows the syntax as database instance owner on the production system:

```
./fcmcli -f postproc_clone -u <clone instance owner user ID>
-C <clone database name> -Y <postprocessing configuration file>
```

-f refresh_clone

This command automatically refreshes an existing clone database.

The following actions occur when a clone database is refreshed:

1. (Optional) Preprocessing scripts are run against the clone database (using the `-X` cloning parameter). An error message and return code 2 are issued if the clone database is unavailable. Ensure that the last preprocessing script shuts down the clone database, otherwise the **refresh_clone** function will fail in the next step.
2. The clone database is unmounted. An error message and return code 2 are issued if the clone database is not shut down. Ensure that the last preprocessing script shuts down the clone database.
3. A new clone database is created.
4. (Optional) Postprocessing scripts are run against the new clone database.

If the `-X` and `-Y` cloning parameters are not specified, then no preprocessing and postprocessing are performed. The **refresh_clone** function requires both the following conditions to be true:

- A clone database must exist and must have been created with the **create_clone** function.
- The clone database must be mounted on the clone system.

Otherwise, an error message and return code 2 are issued. The following example shows the syntax as database instance owner on the production system:

```
./fcmcli -f refresh_clone -u <clone instance owner user ID>
-C <clone database name> [-X <preprocessing configuration file>]
[-Y <postprocessing configuration file>] [-F]
```

Tivoli Storage FlashCopy Manager administrative commands

You can use commands to administer IBM Tivoli Storage FlashCopy Manager.

Administrative commands are available for you to do the following tasks:

- Start, stop, or configure IBM 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

Configuration commands

Use configuration commands to run the setup script, maintain IBM Tivoli Storage FlashCopy Manager passwords, and query the amount of storage space that is used for backups.

Installation setup script

The setup script for each database variant provides several action options which are usually employed internally by the IBM Tivoli Storage FlashCopy Manager installer. It is also used without options to perform the manual IBM Tivoli Storage FlashCopy Manager setup and basic configuration.

Overview

The setup script uses this command syntax:

```
setup_<database>.sh [-a action}
                          -d [<Instance directory>]
```

The following values are possible for the `<database>` parameter in the setup script name:

```
setup_db2.sh
setup_ora.sh
setup_gen.sh
```

See "Setup script values" on page 100 for more information on the script values.

You can use the setup script for the following purposes:

- Activation or upgrade of IBM Tivoli Storage FlashCopy Manager for one instance, as root:

  ```
  setup_<database>.sh –a install –d <INST_DIR>
  ```

- Initial configuration and reconfiguration:

  ```
  setup_<database>.sh
  ```

- Stopping an activated instance:

  ```
  setup_<database>.sh –a stop –d <INST_DIR>
  ```

- Starting an activated instance:

  ```
  setup_<database>.sh –a start –d <INST_DIR>
  ```

- Deinstallation of a stopped instance:

  ```
  setup_<database>.sh –a disable –d <INST_DIR>
  ```

All of these commands can be issued on either the production or backup system. In order to completely stop or disable IBM Tivoli Storage FlashCopy Manager, the appropriate command needs to be issued first on the production system and then on the backup system (in that order). The setup script can be used to install IBM Tivoli Storage FlashCopy Manager on multiple backup nodes from the production system. As a prerequisite, Open Secure Shell (OpenSSH) must be installed on all of the nodes in the backup system. However, NFS shares between the production

system and backup system nodes are not required for this type of remote installation. OpenSSH is the preferred method for IBM Tivoli Storage FlashCopy Manager.

Important: To completely stop or disable IBM Tivoli Storage FlashCopy Manager, issue the appropriate command first on the production system and then on the backup system.

The script must be run from the database instance-specific installation directory:

- (DB2) `<Instance owner $HOME directory>/sqllib/acs/`
- (Oracle) `<Instance owner $HOME directory>/acs/`

The default action (`setup`) is performed and the instance is configured.

For IBM Tivoli Storage FlashCopy Manager for Custom Applications, there is no database instance-specific directory. In this case, the script must be run from the backup user's `$HOME` directory. 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. It creates a new profile or modifies an existing one and updates `/etc/inittab` according to the current profile (production system) or user preference (backup system). Updates to inittab require starting and stopping IBM Tivoli Storage FlashCopy Manager as intermediate steps. This call cannot stop IBM Tivoli Storage FlashCopy Manager on the backup system if it is still running on the production system and the binaries in the instance-specific installation directory are NFS-shared between the production and backup systems. If IBM Tivoli Storage FlashCopy Manager cannot be stopped you will need to stop IBM Tivoli Storage FlashCopy Manager on the production system before executing the script with the `-a install` option.

Setting or modifying passwords with the setup script

You can set or modify passwords by issuing the setup script without the `-a action` option. For example:

```
setup_<database>.sh
```

Running the setup script without the `-a action` option proceeds through several tasks that are similar to the tasks described in Chapter 3, "Installing IBM Tivoli Storage FlashCopy Manager," on page 45.

When this command is issued, the profile wizard launches for you to edit the profile, and later you are prompted to set or modify passwords. This is the recommended method as passwords are verified and can also be updated on the backup systems. To update passwords on the backup system, specify YES at the following prompt:

```
Do you want to update the BS installation on backup system? [Y/N]
```

Setup script values

These values are available for `setup_<database>.sh`:

setup_db2.sh
Configures IBM Tivoli Storage FlashCopy Manager.

setup_ora.sh
Configures IBM Tivoli Storage FlashCopy Manager for Oracle or IBM Tivoli Storage FlashCopy Manager for *SAP® with Oracle*.

setup_gen.sh
Configures IBM Tivoli Storage FlashCopy Manager for Custom Applications.

These values are available for `action`:

disable

This call can be issued as the root or instance owner. It stops IBM Tivoli Storage FlashCopy Manager and removes all entries from /etc/inittab. In order to reactivate IBM Tivoli Storage FlashCopy Manager, you need to call the script without parameters.

Note that this call cannot stop IBM Tivoli Storage FlashCopy Manager on the backup system if it is still running on the production system and the binaries in the instance-specific installation directory are NFS-shared between the production and backup systems. If IBM Tivoli Storage FlashCopy Manager cannot be stopped you need to stop IBM Tivoli Storage FlashCopy Manager on the production system before executing `setup_<database>.sh –a install`.

install

This call needs to be issued with the root user ID. It performs the following:

1. Stops IBM Tivoli Storage FlashCopy Manager (`setup_<database>.sh –a stop`)
2. Copies all binary files from the IBM Tivoli Storage FlashCopy Manager installation directory to the instance-specific installation directory (INST_DIR)
3. Sets the appropriate access rights for the binary files
4. Restarts IBM Tivoli Storage FlashCopy Manager (`setup_<database>.sh –a start`)

The steps to start and stop IBM Tivoli Storage FlashCopy Manager are skipped if IBM Tivoli Storage FlashCopy Manager has not yet been configured.

This call cannot stop IBM Tivoli Storage FlashCopy Manager on the backup system if it is still running on the production system and the binary files in the instance-specific installation directory are NFS-shared between the two systems. If IBM Tivoli Storage FlashCopy Manager cannot be stopped you need to stop IBM Tivoli Storage FlashCopy Manager on the production system before executing `setup_<database>.sh –a install`.

start

This call can be issued as the root or instance owner. It starts a previously installed and configured version of IBM Tivoli Storage FlashCopy Manager. This call creates different entries in /etc/inittab 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 IBM Tivoli Storage FlashCopy Manager that is currently running. This call updates /etc/inittab and checks that IBM Tivoli Storage FlashCopy Manager has been stopped successfully (a write lock can be acquired for the .lock file that is located in the instance-specific install directory).

This call will fail on the backup system in environments where the instance-specific installation directory is shared between the production and backup systems, if IBM Tivoli Storage FlashCopy Manager is still running on the production system. In order to stop IBM Tivoli Storage FlashCopy Manager in those environments successfully, you need to first stop IBM Tivoli Storage FlashCopy Manager on the production system.

The instance directory name ('-d' option) is required for all explicit actions. It is not required for the default setup function.

Password administration

You can use the `fcmcli -f password` command to change IBM Tivoli Storage FlashCopy Manager passwords.

Tip: To ensure that the Backup Servers (BS) are also updated by SSH (if applicable), use the setup scripts for password modification.

Use the following syntax to change the passwords for intercommunication between IBM Tivoli Storage FlashCopy Manager components, and communication to Oracle and DB2 databases and to storage devices.

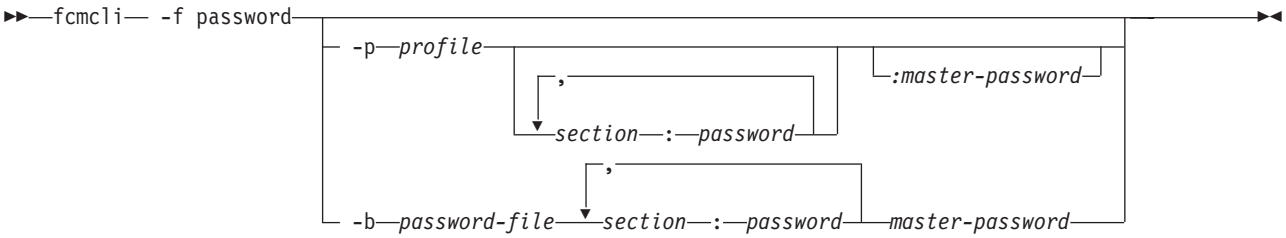


Table 27. `fcmcli` command options for changing passwords.

Option	Description	Default	Overrides Profile Parameter
-f password	Set or change passwords. **Note:** If you want to guarantee that the backup servers are updated as well (if OpenSSH is used), do not call fcmcli -f password directly. Instead, set or change passwords using the setup scripts.		

Table 27. `fcmcli` command options for changing passwords. (continued)

Option	Description	Default	Overrides Profile Parameter
-p profile	Full path and name of the profile being used. In interactive mode, the command searches the profile for the ORACLE, DEVICE_CLASS, and DB2STANDBY sections and then queries for the respective passwords. When the password file name is not specified, the command reads the respective file name from the GLOBAL section of the profile.	The profile in the current working path is used.	
-b password-file	The password file to be created or updated.	The /shared/acsd.pwd located in the directory specified by the ACS_DIR parameter as defined in the GLOBAL section. This information is read from one of these profiles: • When -p is not specified, 'profile' is used. • When -p is specified, the profile specified is used.	(No corresponding profile parameter.)
section:password	Name of the ORACLE, DEVICE_CLASS, or DB2STANDBY sections in the profile and respective passwords for value specified in the ORACLE, DEVICE_CLASS, or DB2STANDBY sections.	See note.	
:<masterpassword>	Master password used to authenticate a library or agent to the Management Agent (acsd).	See note.	

Note: When no password is specified on the command line, the wizard interactively asks for this information:
- The password for the ORACLE section in the specified profile.
- The passwords for the disk storage subsystems that are referred to by the DEVICE_CLASS sections in the specified profile.
- The master password.
- The password for the DB2STANDBY section in the specified profile.

When the profile contains multiple DEVICE_CLASS sections that refer to the same physical disk storage subsystem, the password is queried only once by combining these DEVICE_CLASS sections.

This interactive mode is the preferred method for setting the password. The interactive method has the advantage of password verification by doing a test connection to the storage device.

Related concepts

"IBM Tivoli Storage FlashCopy Manager profile description" on page 117

Query Managed Capacity (fcmcli -f used_capacity)

Use this command to periodically check the amount of storage space used for backups and to verify compliance with the licensed capacity amount.

This command lists all source volumes protected by IBM Tivoli Storage FlashCopy Manager for which a backup (FlashCopy® or snapshot) was created. If a volume contains multiple backups, that volume is counted only 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 source volume ID, the size (capacity) of each source volume, and the total managed capacity of all source volumes.

The **fcmcli -f used_capacity** syntax is as follows:

```
fcmcli -f used_capacity -p profile [-c]
```

-p Specify the name of the IBM Tivoli Storage FlashCopy Manager profile associated with the backups that reside on the volume.

-c Specify this option to display the output as comma separated values.

Example output

This command displays all source volumes for the profile that resides in `db2/S01/acs`:

```
fcmcli -f used_capacity -p /db2/S01/acs/profile
```

Output:

```
FFM0000I managed capacity for repository /db2/S01/acs/repo

FFM0000I volume ID: A0FR6HJ83C  capacity:  2 GB
FFM0000I volume ID: A0FR6HENQ1  capacity:  2 GB
FFM0000I volume ID: A0FR6HAV80  capacity:  2 GB

FFM0000I total managed capacity 6 GB
```

This command displays all volumes for the profile that resides in `db2/S01/acs` as comma separated values:

```
fcmcli -f used_capacity -p /db2/S01/acs/profile -c
```

Output:

```
A0FR6HJ83C,2147483648
A0FR6HENQ1,2147483648
A0FR6HAV80,2147483648
*TOTAL*,6442450944
```

Background daemons

For IBM Tivoli Storage FlashCopy Manager to work properly, some background daemon processes are required to be up and running. 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)

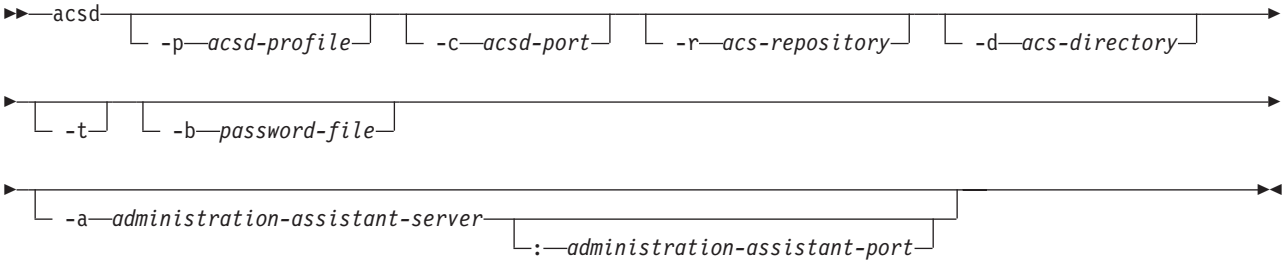
The Management Agent (acsd) coordinates the snapshot backup operation.

The Management Agent is started as a background daemon (see "Background daemons") so you are not required to start it manually.

The Management Agent (acsd) controls the backup flow and mediates between the other agents. The Management Agent also 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:



Syntax for obtaining version or help information:

Table 28. 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 used by the management agent. The Management Agent uses the 'GLOBAL' and 'acsd' sections of the profile.	<INST_DIR>/profile	

Table 28. Options for Starting the Management Agent (acsd) as a Daemon Process (continued)

Option	Description	Default	Overrides Profile Parameter
-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 IBM Tivoli Storage FlashCopy Manager directory	<ACS_DIR>	
-t	Turn trace on	Trace off	TRACE
-b password-file	File in which the IBM 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 specified in the acsd-profile or the corresponding default values. The **shared** and **logs** directories will be automatically created in ACS_DIR. If no parameters are entered, acsd starts with the default profile and using default parameter values where applicable, or it issues an error message if this profile does not exist.

(DB2) When a user installs DB2 and creates a DB2 instance, the Management Agent (acsd) will be copied to <DB2 instance directory>/acs. To activate IBM Tivoli Storage FlashCopy Manager, the user must start the setup script as the DB2 instance owner from this same directory. This script will create two entries in /etc/inittab. The Management Agent (acsd) will thereby be started automatically from /etc/inittab without any command line arguments. In this case the default values will be used for configuring the Management Agent (acsd). The default values can be overridden by providing a profile. By default, this is located in the directory `<DB2 instance directory>/acs`.

When acsd is started for the first time, or with a new ACS_DIR parameter, it will

- create the subdirectories 'shared' and 'logs'
- create a password file pwd.acsd in the 'shared' subdirectory
- generate a master password.

As long as 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.

Related concepts

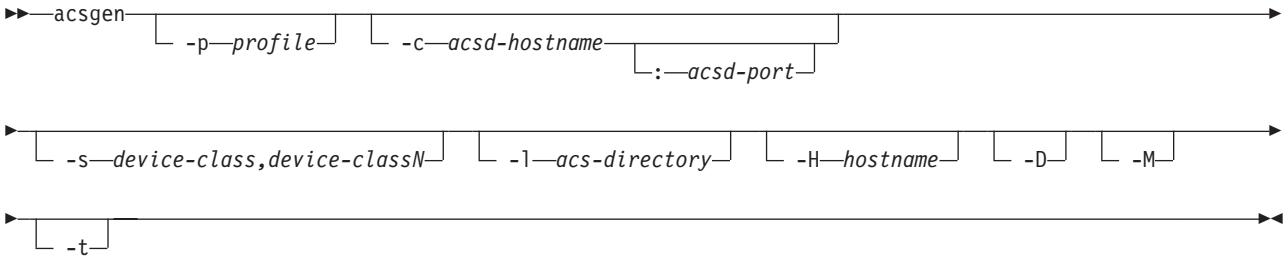
"IBM Tivoli Storage FlashCopy Manager profile description" on page 117

Generic Device Agent (acsgen)

The Generic Device Agent (acsgen) is the component that uses appropriate adapters to start snapshot commands on snapshot-compatible devices.

The Generic Device Agent is started as a background daemon (see "Background daemons" on page 105) so you are not required to start it manually.

If you must deviate from the standard installation, the Generic Device Agent (acsgen) offers the following command options for customization:



Syntax for obtaining version or help information:

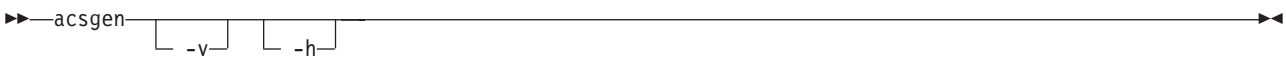


Table 29. Options for Starting the Generic Device Agent (acsgen)

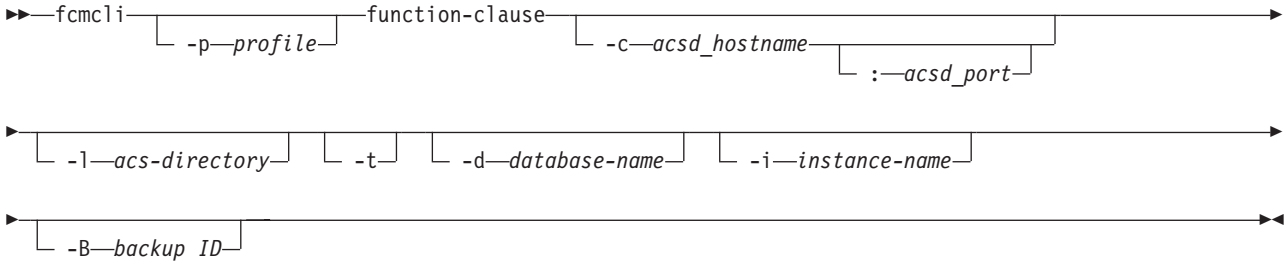
Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_DIR>/profile
-c acsd-hostname	Name of the server where the management agent (acsd) is running	localhost
acsd-port	TCP/IP port number or service name on which the management agent (acsd) is listening	57328
-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

Table 29. Options for Starting the Generic Device Agent (acsgen) (continued)

Option	Description	Default
-l acs-directory	Directory where the 'logs' and 'shared' directories can be found.	<ACS_DIR>
-D	Start as daemon The '-a' option defines which usability states the device agent responds to. Valid only when started from /etc/inittab.	Run and terminate
-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 machine host name that is displayed by the `hostname` command.
-t	Turn trace on	<TRACE>
-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 these situations exist: • an offloaded backup to Tivoli Storage Manager is requested; • database files reside on JFS file systems; • database files reside on AIX LVM mirrored volumes; • the database was not suspended. A mount verifies the consistency of the associated file systems.	Start as "monitoring agent".
-v	Display version and help information	None.
-h	Display help information only	None.

Mounting and unmounting snapshots on a secondary system

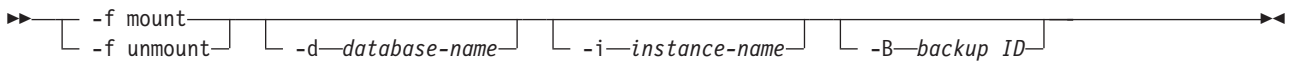
FlashCopy Manager commands are available to mount or unmount a snapshot backup on a secondary system.



The values for the `function-clause` parameter are described in the following sections.

function-clause: FlashCopy administrative operations

The following functions are supported by the fcmcli command option -f 'function' for mount and unmount:



The following functions are supported by the fcmcli command option -f 'function' for forced unmount:

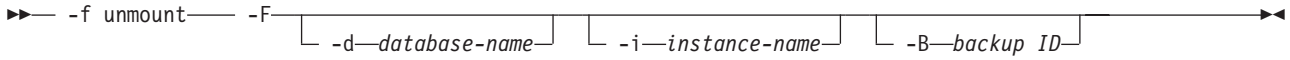


Table 30. Options for the IBM Tivoli Storage FlashCopy Manager 'fcmcli' command

Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_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 mount	Mount snapshot target set	
-f unmount	Unmount snapshot target set	
-d database-name	Database name. Required for '-F' option.	No limitation
-i instance-name	Instance name to apply to the command. Required for '-F' option.	No limitation.
-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 • -d database-name • -i instance-name • -B backup-id parameters.	None.
-t	Start with trace on.	Trace off
-v	Display version.	
-h	Display help text.	
-B	The Backup ID as displayed by `fcmcli -f inquire [_detail]` or `db2acsutil`.	None.

-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* section" on page 148 for details).
2. Import the volume groups from the target volumes.
3. Mount all file systems within the volume groups.

The mount is performed 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 additional options (filter arguments) such as

```
-i instance-name
-d database-name
-B backup-id
```

a specific snapshot backup can be selected for mounting on the offload system.

(DB2) In a DPF environment with multiple partitions, IBM Tivoli Storage FlashCopy Manager always mounts all partitions associated with a snapshot backup operation.

To reflect whether a snapshot backup is currently being mounted or is already mounted, the usability states MOUNTING and MOUNTED, respectively, will be set for those backups in the snapshot backup repository. These two state values prevent a duplicate mount request for a backup that is currently being mounted, or is already mounted, on the backup system. If multiple snapshot backups of a database are candidates to be mounted, IBM Tivoli Storage FlashCopy Manager always 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.

Normal mode: The unmount itself is performed 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. The following steps will be done internally:

1. Unmount the filesystems belonging to the target volumes
2. Export the assigned volume group
3. Remove the devices (vpath/hdisk) from the offload system

By specifying additional options (filter arguments) such as

```
-i instance-name
-d database-name
-B backup-id
```

a specific snapshot backup can be selected for unmounting from the offload system.

(DB2) In a DPF environment with multiple partitions, IBM Tivoli Storage FlashCopy Manager always unmounts all partitions associated with a snapshot backup.

If the unmount does not succeed due to problems on the device agent side, the usability state of the backup will remain MOUNTED in the snapshot backup repository. Thus, after resolving the problems on the backup system (in some cases the only way might be a manual intervention), the fcmcli 'unmount' has to be issued again to finalize the unmount of the filesystems and update the usability state of the backup in the snapshot backup repository accordingly. If an off-loaded tape backup is currently running (usability state TAPE_BACKUP_IN_PROGRESS is set), those backups will not be picked by IBM Tivoli Storage FlashCopy Manager for unmounting.

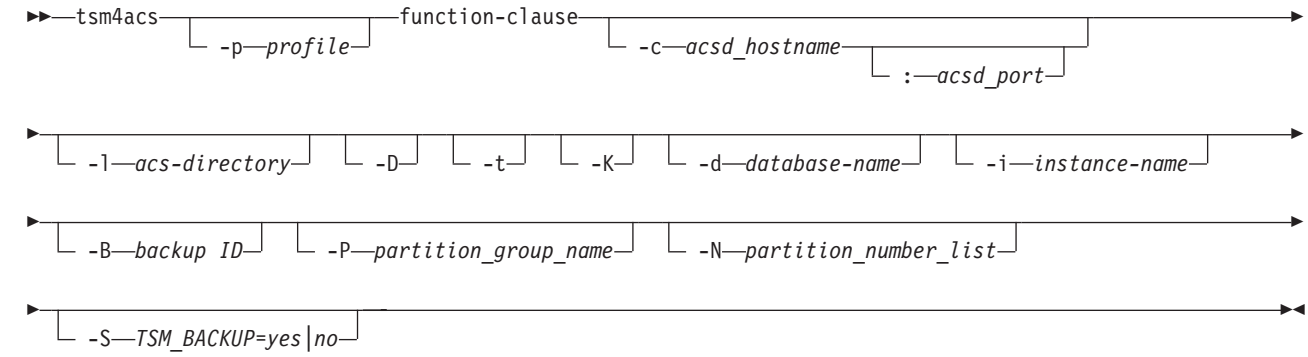
Force mode: Unexpected system failures in combination with offloaded tape backups can potentially lead to an incorrect state of the backup reflected in the snapshot backup repository (TAPE_BACKUP_IN_PROGRESS still set). Therefore, a special built-in 'force' option (-F) for the fcmcli 'unmount' function is provided to return the system to a usable state. Besides the normal unmount function, 'unmount force' is able to pick backups currently 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 '-d', '-i', and '-B' options must be specified to uniquely identify the backup 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.

Offload Agent (tsm4acs)

The offload agent is a daemon that accesses a certain set of functionality associated with the IBM Tivoli Storage FlashCopy Manager package. This functionality includes backup to Tivoli Storage Manager and functions for managing Tivoli Storage Manager backups.

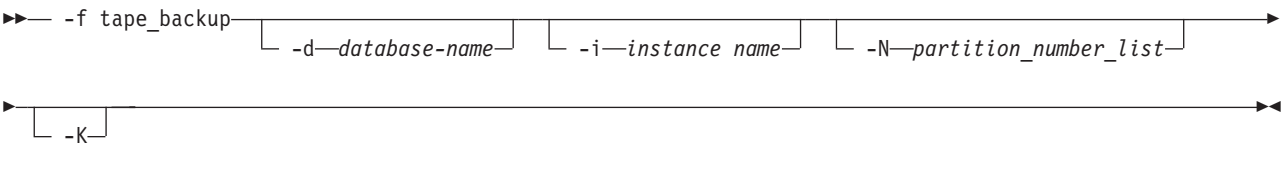


The values for the `function-clause` parameter are described in the following sections.

function-clause: FlashCopy offload operations

In a DB2 environment, the installation of IBM Tivoli Storage FlashCopy Manager enables the offload functionality that otherwise is not available for the built-in snapshot backup functionality that is shipped with DB2.

The following functions are supported by the tsm4acs command option -f 'function':



The function 'update_status' is supported by the tsm4acs command:

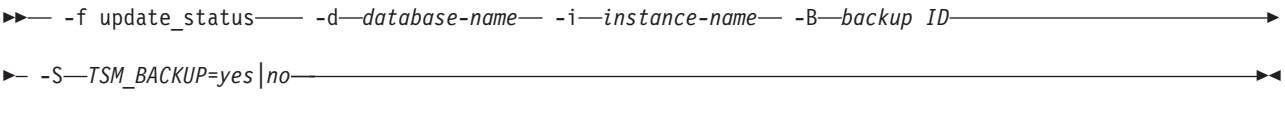


Table 31. Options for the IBM Tivoli Storage FlashCopy Manager 'tsm4acs' command

Option	Description	Default
-p profile	Full profile name. The device agent uses the • GLOBAL • CLIENT • DEVICE_CLASS • OFFLOAD • ORACLE sections of the profile.	<INST_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 tape_backup	Back up a snapshot target set to Tivoli Storage Manager.	
-f update_status	Update the usability state after a snapshot backup operation completes to one of the following: • Offload a snapshot backup to Tivoli Storage Manager (TSM_BACKUP=yes). • Do not offload a snapshot backup to Tivoli Storage Manager (TSM_BACKUP=no) if it was scheduled to offload. These parameters are also required when using -f update_status: • -d database-name • -i instance-name • -T snapshot-id • -S TSM_BACKUP=yes|no	
-d database-name	Database name. Required for '-F' option.	No limitation

Table 31. Options for the IBM Tivoli Storage FlashCopy Manager 'tsm4acs' command (continued)

Option	Description	Default
-N partition | partition list	A single number or list of numbers (separated by a comma) denoting the partitions to be directed by the specified function.	All partitions are directed (when not specified).
-i instance-name	Instance name to apply to the command. Required for '-F' option.	No limitation.
-D	Run as daemon process. Valid only when started from /etc/inittab.	Run and terminate.
-K	In a multi-partition environment, the partitions remain mounted as long as all participating partitions are offloaded to Tivoli Storage Manager successfully. The offload agent will unmount all partitions after the last partition is successfully offloaded.	Off. The unmount operation is part of every Tivoli Storage Manager backup operation.
-t	Start with trace on.	Trace off
-v	Display version.	
-h	Display help text.	
-S	TSM_BACKUP=yes|no Use this option to inform IBM Tivoli Storage FlashCopy Manager that a Tivoli Storage Manager backup is no longer required or that a Tivoli Storage Manager backup is currently requested. This option is only valid with the update_status function.	
-B	The Backup ID as displayed by `fcmcli -f inquire [_detail]` or `db2acsutil`.	None.
-P	The name of a partition group as specified in the profile with the PARTITION_GROUP parameter.	None.

The tsm4acs process connects to the Management Agent (acsd) process and performs the function specified with the '-f' option. After executing the appropriate operation, tsm4acs notifies acsd, which then updates the snapshot backup repository accordingly. When started as a daemon (-D option), as is the case for the standard /etc/inittab entry, tsm4acs will perform offloaded tape backup operations. This will result in a synchronous tape backup of all snapshot backups. As soon as a new snapshot is started with TSM_BACKUP YES, the offload agent will start to back it up to tape when it becomes available for mounting on a backup system (REMOTELY_MOUNTABLE).

The return code of the Offload Agent will be 0 if it finishes the request without an error or if there were no candidates for the request. Further, the return code will be 1 if one or more minor issues occurred which are not critical but should be checked to prevent major issues later. Return code 2 indicates that an error occurred during the command execution.

The following sections describe the details of the various functions specified with the '-f' option of the IBM Tivoli Storage FlashCopy Manager command tsm4acs.

-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 srever

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 IBM 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 offloaded backup to tape, enter the command:

```
tsm4acs -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. tsm4acs will always back up the oldest snapshot eligible for transfer to Tivoli Storage Manager.

(DB2) Offloaded tape backups will not be registered in the DB2 history on the production system. They will be reflected in the DB2 history on the offload system as long as the assigned volumes have not been overwritten. See also “DB2 backup history file overview” on page 66.

By specifying the -D option for the offload agent, it will act 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 once. If the first attempt fails for some reason, the snapshot backup is marked accordingly and will not be picked a second time by the tsm4acs daemon for offloading to tape. Such a backup must be offloaded to tape manually by issuing:

```
tsm4acs -f tape_backup <filter arguments>
```

If multiple snapshot backups of a database are candidates for offloading to tape, the IBM 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, IBM 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. See Table 35 on page 126 for more details.

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 fcmcli with the 'mount' function or by a forced mount request (see “Forced mount” on page 9 for more information). If all necessary file systems were already mounted, this step will be skipped (see “-f mount” on page 110).
2. Update the usability state to TAPE_BACKUP_IN_PROGRESS for all partitions having 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. For all participating partitions, reset the usability state TAPE_BACKUP_IN_PROGRESS.
5. Unmount the filesystems from the offload system (see “-f unmount” on page 110).

As long as the usability state for a partition is TAPE_BACKUP_IN_PROGRESS, any request to restart the offload of that partition to tape will be refused.

If a backup to Tivoli Storage Manager fails, FlashCopy Manager can retry the backup operation.

(DB2) In DPF environments, offloaded backups can be performed only when the snapshot was created on all partitions. If the Offload Agent retries a backup operation, it only backs up those partitions that have not already been backed up successfully.

-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.

In order 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
```

Chapter 6. Tivoli Storage FlashCopy Manager configuration files

Configuration files are defined by the user with all the information IBM Tivoli Storage FlashCopy Manager needs to successfully perform its functions.

IBM Tivoli Storage FlashCopy Manager uses the following configuration files:

- Profile
- Target volumes file(s)
- Password file
- (SAP® with Oracle) SAP Backint configuration file
- (SAP® with Oracle) SAP® BR*Tools configuration file
- (Native Oracle) Tivoli Storage Manager options files

IBM Tivoli Storage FlashCopy Manager profile description

IBM Tivoli Storage FlashCopy Manager relies on a profile in order to operate properly.

The profile needs to be available on all database nodes, on the machine where the Management Agent (acsd) is running, and on the backup servers when saving snapshot backups to Tivoli Storage Manager. The profile only uses the GLOBAL section on the backup server.

The IBM Tivoli Storage FlashCopy Manager profile is created or updated using the setup script. The standard profile is named 'profile' and is recommended to be defined as follows:

```
<ACS_DIR>/profile
```

The location where the profile is defined must meet these requirements:

- The profile directory must not be part of any snapshot operation.
- (DB2) The profile directory can be NFS exported and NFS shared on all DB2 DPF partitions.

See Chapter 3, “Installing IBM Tivoli Storage FlashCopy Manager,” on page 45 for more information about defining ACS_DIR.

The IBM Tivoli Storage FlashCopy Manager profile is typically used with only one database name. The profile is identified by the value of the option -p of the IBM Tivoli Storage FlashCopy Manager executable files and for DB2 databases by the PROFILE vendor option. The elements of the profile are not case sensitive. By convention, section and parameter names are shown in uppercase.

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Tivoli Storage FlashCopy Manager profile sections

Each section of the Tivoli Storage FlashCopy Manager profile file contains information unique to that section.

The profile is structured into these named sections:

- GLOBAL
- ACSD
- CLIENT
- DEVICE_CLASS *device*
- OFFLOAD
- OFFLOAD_DB2STANDBY
- ORACLE
- CLONING
- DB2STANDBY

The DEVICE_CLASS section can occur multiple times, each provided with an arbitrary but unique instance name *device*. The names are changeable and determined by using the DEVICE_CLASS profile parameter specified within the CLIENT or the CLONING section. Each section has a unique set of specific parameters.

GLOBAL section

The GLOBAL section contains information that is required and used by all IBM Tivoli Storage FlashCopy Manager components and is therefore required on all database nodes as well as by the management, device, and offload agents. Any component of IBM Tivoli Storage FlashCopy Manager evaluates this section only once (during startup). Therefore, changes within this section require IBM Tivoli Storage FlashCopy Manager to be restarted before they become effective. Depending on the environment, it might be necessary to install IBM Tivoli Storage FlashCopy Manager on multiple machines. Such an environment might be when the database is distributed across multiple application hosts or when using a backup server to transfer snapshot backups to Tivoli Storage Manager. Even in those environments there is always only one active Management Agent, whose location is specified using the ACSD parameter in this section. The GLOBAL section is also used to specify the location for logging, tracing, and password files. The profile only uses the GLOBAL section on the backup server.

ACSD section

The ACSD section contains information that is used exclusively by the Management Agent (acsd). This section includes the ACS_REPOSITORY parameter, which specifies the directory where the Management Agent stores its backup repository. This repository is the most important collection of IBM Tivoli Storage FlashCopy Manager data. If the repository is lost, any previously created backup will not be able to be restored.

CLIENT section

The CLIENT section contains all parameters relating to backup operations, such as SAP or native 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. Most of the parameters in the CLIENT section can be overridden by options.

Tip: For SAP® with Oracle: When configuring offloaded backups, the profile does not contain a CLIENT section. Instead, the corresponding information from the CLIENT section is located in the `.utl` file. For more information, see "IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)" on page 135.

DEVICE_CLASS *device* **section**

The DEVICE_CLASS section contains parameters related to the storage system. 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 that can be used to create a snapshot backup and as such depends heavily on the specific storage subsystem. You can specify multiple DEVICE_CLASS sections within one profile and assign arbitrary but unique names of your choosing to these sections. By specifying the DEVICE_CLASS parameter within the CLIENT or CLONING section, the corresponding DEVICE_CLASS section will be activated for use during this particular operation. The value of DEVICE_CLASS is recorded in the IBM Tivoli Storage FlashCopy Manager repository in order to identify the appropriate DEVICE_CLASS section that is used during restore. For each of the DEVICE_CLASS sections, a password is required and can be set by issuing the setup script without the `-a action` option. For example:

```
setup_<database>.sh
```

These passwords are used by IBM Tivoli Storage FlashCopy Manager to authenticate to the storage subsystem represented by the associated DEVICE_CLASS section. See also "Management Agent (acsd)" on page 105.

Tip: A DEVICE_CLASS cannot be referred by the CLIENT and the CLONING sections at the same time.

OFFLOAD section

The OFFLOAD section contains information on how a snapshot is transferred to Tivoli Storage Manager. It is used by the Offload Agent (tsm4acs) and the offload related functionality of fcmcli. See the FlashCopy offload operations in Chapter 5, "IBM Tivoli Storage FlashCopy Manager commands and scripts," on page 73 for more details.

To configure IBM Tivoli Storage FlashCopy Manager in a way that protects both active and standby nodes of a DB2 HADR environment, you must have two OFFLOAD sections in the profile. The two sections are named differently--OFFLOAD and OFFLOAD_DB2STANDBY.

When the Offload Agent is started, it connects to the Management Agent and queries for snapshot backups that have been backed up with profile parameter) TSM_BACKUP (for SAP with Oracle TSM_BACKUP_FROM_SNAPSHOT) set to YES. If such a backup is found, the Offload Agent mounts this snapshot and initiates a Tivoli Storage Manager backup using the following application:

- (Native DB2) the DB2 built-in Tivoli Storage Manager agent
- (SAP with Oracle or DB2) IBM Tivoli Storage Manager for Enterprise Resource Planning (Tivoli Storage Manager for ERP)
- (Native Oracle) Oracle RMAN and Data Protection for Oracle.
- (IBM Tivoli Storage FlashCopy Manager for Custom Applications) Tivoli Storage Manager backup-archive client

The OFFLOAD section is optional unless one of these conditions exists:

- (SAP® with Oracle) Tivoli Storage Manager for ERP is used for offload tape backup (at least the PROFILE parameter must be present).
- One or more of the default values must be overridden.

ORACLE section
(Oracle) The ORACLE section contains the parameters describing the native Oracle database. The ORACLE section is not needed for SAP® with Oracle configurations.

CLONING section
The CLONING section contains the parameters used for cloning operations. The CLONING section is ignored for all other operations. 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.

DB2STANDBY section
(DB2) The DB2STANDBY section is used when backing up the standby node of a DB2 high-availability disaster recovery (HADR) environment. Although IBM Tivoli Storage FlashCopy Manager also evaluates all parameters specified within the CLIENT section during HADR operations, some parameters specified in the DB2STANDBY section override the corresponding parameters specified in the CLIENT section. See the parameters in the "DB2STANDBY section" on page 163 for details.

OFFLOAD_DB2STANDBY section
The OFFLOAD_DB2STANDBY has the same semantics as the OFFLOAD section, except that it is evaluated whenever an offloaded backup from a DB2 HADR secondary occurs (instead of the DB2 HADR primary).

Tip: Typically, you also need an OFFLOAD section in your profile to protect your databases when DB2 HADR primary and secondary have switched roles.

Example

All parameters belonging to a section are enclosed by a section-begin statement (>>> *sectionname*) and a section-end statement (<<< *sectionname*). The name is optional on the section-end statement. Comments can be used at any place within the profile; they are introduced by '#' and apply to the remainder of the line. Tab characters are permitted. The basic structure for the file sections is as follows:

```
# 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 device2
parametername1 value1
parametername2 value1 value2
  ....
<<<
# OFFLOAD section
>>> OFFLOAD
parametername1 value1
parametername2 value1 value2
  ....
<<<
# ORACLE section
>>> ORACLE
parametername1 value1
parametername2 value1 value2
  ....
<<<
# CLONING section
>>> CLONING
parametername1 value1
parametername2 value1 value2
  ....
<<<
# DB2STANDBY section
>>> DB2STANDBY
parametername1 value1
parametername2 value1 value2
  ....
<<<
```

The following example is a sample profile for DB2 including cloning and backup of a standby node of a DB2 high-availability disaster recovery (HADR) environment.

```
>>> GLOBAL
ACS_DIR /db2/AS1/acs
ACSD auntmathilda 54331
# TRACE NO
<<<

>>> ACSD
ACS_REPOSITORY /db2/AS1/acs/acsrepository
# ADMIN_ASSISTANT levi 5126
# REPOSITORY_LABEL TSM
<<<
```

```
>>> CLIENT
# BACKUPIDPREFIX DB2___
APPLICATION_TYPE SAP
# PARTITION_GROUP
TSM_BACKUP YES
# MAX_VERSIONS ADAPTIVE
# LVM_FREEZE_THAW AUTO
# NEGATIVE_LIST no_check
# TIMEOUT_FLASH 120
# GLOBAL_SYSTEM_IDENTIFIER
# DEVICE_CLASS STANDARD
<<<

>>> OFFLOAD
BACKUP_METHOD DB2
OPTIONS @/db2/AS1/dbs/vendor.env.%DB2NODE
# PARALLELISM AUTO
# NUM_SESSIONS 1
# NUM_BUFFERS AUTO
# BUFFER_SIZE AUTO
<<<

>>> DB2STANDBY
DB2_PRODUCTIVE_SERVER akuma DB2_db2as1_svc
DB2_ALIAS AS1
PRE_FLASH_CMD /db2/AS1/acs/db2_pre_flash_script.cmd
POST_FLASH_CMD /db2/AS1/acs/db2_post_flash_script.cmd
DB2_USERNAME db2as1
DB2_AUTH_TYPE SERVER
<<<

>>> OFFLOAD_DB2STANDBY
BACKUP_METHOD TSM_CLIENT
# MODE FULL
ASNODENAME AS1TEST
# DSM_DIR
# DSM_CONFIG
# VIRTUALFSNAME fcm
<<<

>>> CLONING
DEVICE_CLASS CLONE1 USE_FOR_CLONING AS2
<<<

>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE DS8000
COPYSERVICES_PRIMARY_SERVERNAME uncletitus
# COPYSERVICES_SECONDARY_SERVERNAME
COPYSERVICES_USERNAME tsmuser
# COPYSERVICES_COMMPROTOCOL HTTPS
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE
# COPYSERVICES_SERVERPORT 5989
FLASHCOPY_TYPE NOCOPY
# COPYSERVICES_TIMEOUT 6
# RESTORE_FORCE NO
# STORAGE_SYSTEM_ID
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE /db2/AS1/acs/acsvolumes/fct.file
<<<

>>> DEVICE_CLASS CLONE1
COPYSERVICES_HARDWARE_TYPE DS8000
COPYSERVICES_PRIMARY_SERVERNAME uncletitus
# COPYSERVICES_SECONDARY_SERVERNAME
COPYSERVICES_USERNAME tsmuser
# COPYSERVICES_COMMPROTOCOL HTTPS
```

```
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE
# COPYSERVICES_SERVERPORT 5989
# FLASHCOPY_TYPE COPY
# COPYSERVICES_TIMEOUT 6
# RESTORE_FORCE NO
# STORAGE_SYSTEM_ID
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE /db2/AS1/acs/acsvolumes/fct.file.cloning
CLONE_DATABASE YES
<<<
```

Overriding IBM Tivoli Storage FlashCopy Manager profile parameters

Overwrite IBM Tivoli Storage FlashCopy Manager profile parameters for DB2 and for SAP with Oracle by using vendor options. See Chapter 5, "IBM Tivoli Storage FlashCopy Manager commands and scripts," on page 73 for details.

Modifying the GLOBAL or ACSD sections of the IBM Tivoli Storage FlashCopy Manager profile

Changes to the profile take effect immediately and do not require restarting IBM Tivoli Storage FlashCopy Manager except when the GLOBAL or ACSD sections are modified.

However, changes to the GLOBAL section of the profile do require the following procedure:

1. Issue this command to stop IBM Tivoli Storage FlashCopy Manager on all machines where it is currently installed:

   ```
   setup_<database>.sh –a stop
   ```

2. Update the parameters in the GLOBAL or ACSD sections.
3. Issue this command to start IBM Tivoli Storage FlashCopy Manager on all machines that were previously stopped:

   ```
   setup_<database>.sh –a start
   ```

IBM Tivoli Storage FlashCopy Manager profile parameters

Use the IBM Tivoli Storage FlashCopy Manager profile parameters to configure IBM Tivoli Storage FlashCopy Manager. The profile parameters are organized into different sections in the IBM Tivoli Storage FlashCopy Manager profile. Tables that summarize the profile parameters are provided.

See "Profile parameter notes" on page 168 for additional information about the profile parameters.

Table 32. IBM Tivoli Storage FlashCopy Manager profile sections

Profile parameter section	Page
GLOBAL section	"GLOBAL section" on page 124
ACSD section	"ACSD section" on page 125
CLIENT section	"CLIENT section" on page 125
IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)	"IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)" on page 135

Table 32. IBM Tivoli Storage FlashCopy Manager profile sections (continued)

Profile parameter section	Page
SAP® BR*Tools configuration profile (.sap)	"SAP® BR*Tools configuration profile (.sap)" on page 140
ORACLE section	"ORACLE section" on page 142
CLONING section	"CLONING section" on page 145
DEVICE_CLASS device section	"DEVICE_CLASS *device* section" on page 148
OFFLOAD section	"OFFLOAD section" on page 155
DB2STANDBY section	"DB2STANDBY section" on page 163
OFFLOAD_DB2STANDBY section	"OFFLOAD_DB2STANDBY section" on page 168

Related concepts

"IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183

Related reference

"Key files and directories" on page 194

GLOBAL section

The profile parameters in the GLOBAL section contain basic configuration information, such as on which port FlashCopy Manager is listening, and where it is writing its logs to. The parameters are independent of the storage device or application.

Table 33. IBM Tivoli Storage FlashCopy Manager profile parameters - GLOBAL section

Parameter		
Name	**Value**	**Default value**
ACS_DIR	Path of the IBM Tivoli Storage FlashCopy Manager directory. See note 1.	Required
ACSD	*hostname port* Hostname and port (separated by space) of the system on which the Management Agent is running. This parameter must be identical on all systems where IBM Tivoli Storage FlashCopy Manager is installed for a given database instance. However, each instance can be managed by an individual Management Agent.	localhost 57328
TRACE	**YES** Enable tracing **NO** Disable tracing For more information, see "Log and trace files summary" on page 234. TRACE can also be specified in the backint profile.	NO

Related reference

"Profile parameter notes" on page 168

ACSD section

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

Table 34. IBM Tivoli Storage FlashCopy Manager profile parameters - ACSD section

Parameter		
Name	**Value**	**Default value**
ACS_REPOSITORY	Path to the ACS repository directory. See Note 2.	This parameter must be specified by the user.
ADMIN_ASSISTANT	*<server> <port>* Server and port on which the Tivoli Storage Manager for ERP Administration Assistant server component is listening. **NO** Do not send data to the Administration Assistant. See note 3. Applies only to SAP environments.	NO
REPOSITORY_LABEL	A prefix that is added to each volume name on the IBM XIV® Storage System. A maximum of three characters is allowed in one of these ranges:`[a-z][A-Z][0-9]` See note 4.	TSM

Related reference

"Profile parameter notes" on page 168

CLIENT section

The CLIENT section contains parameters that relate to the database applications. The parameters do not depend on the storage device. This section is required for all database applications except for SAP with Oracle if IBM Tivoli Storage FlashCopy Manager is used with IBM Tivoli Storage Manager for Enterprise Resource Planning.

In this case, the parameters of the CLIENT section must be included directly within the IBM Tivoli Storage Manager for Enterprise Resource Planning configuration file (.utl file) so they are moved out of the Tivoli Storage FlashCopy Manager profile. These parameters are designated with the "+" in the SAP with Oracle column. See "IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)" on page 135 for more information.

Note: Additional DEVICE_CLASS sections are usually added to the Tivoli Storage FlashCopy Manager profile automatically by the profile wizard whenever you add additional instances of the DEVICE_CLASS parameter to the CLIENT section. When you use 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. You must manually edit the profile with a text editor to add additional DEVICE_CLASS sections. This situation is the only instance when you must edit the profile.

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
x	x		x	APPLICATION_TYPE	Environment (native or SAP® application) **DB2** Treat as a generic (native) DB2 system. **ORACLE** Treat as a generic (native) Oracle system. **SAP** An SAP® application that uses DB2 as the underlying database. **SAP_ORACLE** An SAP® application that uses Oracle as the underlying database **GENERIC** A Tivoli Storage Manager application uses the underlying database. See note 30.	This parameter is preset depending on the setup script variant used.
x	x	+	x	TSM_BACKUP **Note:** This parameter is called TSM_BACKUP in the FlashCopy Manager profile. It is called TSM_BACKUP_FROM_ SNAPSHOT in the SAP with Oracle .utl file (see Table 36 on page 136).	**YES** Create a Tivoli Storage Manager backup from this snapshot. Reuse of the target set is allowed if the Tivoli Storage Manager backup operation does not complete successfully. **MANDATE** In contrast to YES, do not reuse the target set until the Tivoli Storage Manager backup completes. See note 18 for complete parameter definitions.	NO

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
x	x	+	x	TSM_BACKUP (continued) **Note:** This parameter is called TSM_BACKUP in the profile. It is called TSM_BACKUP_FROM_ SNAPSHOT in the SAP with Oracle .utl file (see Table 36 on page 136).	**LATEST** When a snapshot backup was performed with TSM_BACKUP LATEST and the off-loaded backup to Tivoli Storage Manager has either not started or has failed, any new snapshot backup with option TSM_BACKUP set to LATEST, YES, or MANDATE, removes the backup request to Tivoli Storage Manager from the previous backup. This prevents backup requests to Tivoli Storage Manager from queuing if they could not be completed in time. **NO** Keep the snapshot backup and do not use it as a source for a subsequent tape backup operation. See note 18 for complete parameter definitions.	NO

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
x	x	+	x	TSM_BACKUP (continued) **Note:** This parameter is called TSM_BACKUP in the FlashCopy Manager profile. It is called TSM_BACKUP_FROM_ SNAPSHOT in the SAP with Oracle .utl file (see Table 36 on page 136).	**TSM_ONLY** The backup is automatically marked for deletion during the unmount operation once the Tivoli Storage Manager backup has completed. This occurs regardless of whether the backup was successful or not. **USE_FOR** *list of device classes* This attribute can be combined with any of these options to limit its application to snapshots performed with particular device classes as specified in the profile. Any number of device classes that are listed must be separated by spaces. See note 18 for complete parameter definitions.	NO
x	x	+	x	MAX_VERSIONS **Note:** This parameter is called MAX_VERSIONS in the profile. It is called MAX_SNAPSHOT_ VERSIONS in the SAP with Oracle .utl file (see Table 36 on page 136).	**ADAPTIVE** The maximum number varies depending on the available space. IBM Tivoli Storage FlashCopy Manager re-uses the oldest target set as the target for the current backup. *n* Maximum number of snapshot versions to be maintained. When this limit is reached, the oldest version is deleted.	ADAPTIVE
x	x	+	x	LVM_FREEZE_THAW	Determines when to enable the freeze and thaw actions. See note 11.	

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
x	x	+	x	DEVICE_CLASS	<*list of device classes*> [<*conditions*>] One of the device classes listed is used during backup in the DEVICE_CLASS statement for which the condition is true. The condition statement is optional and has this syntax: [USE_AT <*days of week*>] [FROM <*time*> TO <*time*>] (partioned DB2 databases) [ON_DBPARTITIONNUMS] <*list of partitions*> See note 9 for complete information.	STANDARD
x	x		x	NEGATIVE_LIST	**NO_CHECK** Does not check for additional files. **WARN** Issues a warning (processing continues). **ERROR** Issues an error (processing ends). *filename* The file *filename* contains fully qualified names of files and directories. See note 13.	This parameter must be specified by the user.
	x	+		TARGET_DATABASE_SUSPEND	YES, NO, OFFLINE This value specifies whether to suspend activity on the target database until the FlashCopy operation completes. Enter one of the following values: *yes*, *no*, or *offline*. A *yes* value is recommended when transaction processing activity is high. An *offline* value specifies that all backups must be offline. If SAP® requests an offline backup, this parameter is ignored. See note 17.	This parameter must be specified by the user.

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
	x			VOLUME_MGR	ASM | LVM If ASM is selected, the existing option LVM_FREEZE_THAW will be ignored and not queried by the wizard since there is no file system. If LVM is specified, the ASM-related options in the device section will be ignored and not queried by the wizard.	LVM
x				PARTITION_GROUP	Specify all partitions that share the same volume group in a multi-partition database environment. *<group name>* Identifier for the partition group. *<db2 node> [<db2 node>] [...]* DB2 node name. Multiple entries must be separated by a space. See note 21.	
x	x	x	x	TIMEOUT_FLASH	Specify 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 issued. See note 22.	120 seconds
x	x	x	x	TIMEOUT_<PHASE>	Specify the maximum time (in seconds) that the database agent waits for a response to the management agent call during the <phase> phase. If the database agent does not receive a response within the specified time, an error message is issued. See note 23 for the phases that you can specify.	3600 seconds

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
x	x	x	x	GLOBAL_SYSTEM_IDENTIFIER	Specify a string that used in the IBM Tivoli Storage Manager for Enterprise Resource Planning Administration Assistant that uniquely identifies a DB2 or Oracle database in the system landscape. This parameter only valid when the ADMIN_ASSISTANT parameter is specified in the ACSD section of the profile.	DB2_<DBname> or ORA_<DBname>
			x	PRE_FLASH_CMD	command string You can specify this parameter when the APPLICATION_TYPE parameter specifies `GENERIC`. This parameter identifies the command script or executable file that is used to quiesce the application immediately before the snapshot operation begins. When the value of this parameter contains command arguments, place the value between double quotation marks ("). This parameter is optional in the profile, or it can be specified on the command line. If specified on the command line, it overrides the corresponding parameter in the profile.	

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
			x	POST_FLASH_CMD	command string You can specify this parameter when the APPLICATION_TYPE parameter specifies `GENERIC`. This parameter identifies the command script or executable file that is used to resume the application immediately after snapshot creation. When the value of this parameter contains command arguments, place the value between double quotation marks ("). This parameter is optional in the profile, or it can be specified on the command line. If specified on the command line, it overrides the corresponding parameter in the profile.	

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
			x	INFILE	file You can specify this parameter when the APPLICATION_TYPE parameter specifies `GENERIC`. This parameter identifies the file that contains a list of all objects to be processed. The file must comply with these requirements: • Each line specifies only one file or directory to be backed up. • A directory (including all subdirectories) is processed recursively. Links are followed when the directory is expanded. • When a link to a file is specified, 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 a command-line entry. If INFILE is not specified in the profile, it must be specified on the command line.	
x	x	x	x	BACKUPPREFIXID	string Specify a string that will be added in front of the backup ID that is generated by FlashCopy Manager. This parameter can be used to separate the backups within the same repository so that other clients are not able to query, restore or delete these backups. The string can contain letters, digits, or the '_' (underscore) and must be exactly 6 characters long.	

Table 35. IBM Tivoli Storage FlashCopy Manager profile parameters - CLIENT section (continued)

Database Environment				Parameter		
DB2	**Native Oracle[1]**	**SAP® with Oracle[2,3]**	**Custom application**	**Name**	**Value**	**Default value**
Note: 1. For native Oracle environments, an additional ORACLE section is required in the profile. 2. If you are using FlashCopy Manager with IBM Tivoli Storage Manager for Enterprise Resource Planning to protect SAP with Oracle, put the parameters of the CLIENT section directly into the IBM Tivoli Storage Manager for Enterprise Resource Planning configuration file (.utl file). See "IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)" on page 135. 3. For SAP with Oracle, you also need to update the BRTOOLS configuration file (.sap file). See "SAP® BR*Tools configuration profile (.sap)" on page 140.						

Related reference

"Profile parameter notes" on page 168

IBM Tivoli Storage FlashCopy Manager backint profile (.utl file)

The descriptions of the IBM Tivoli Storage FlashCopy Manager backint profile are provided.

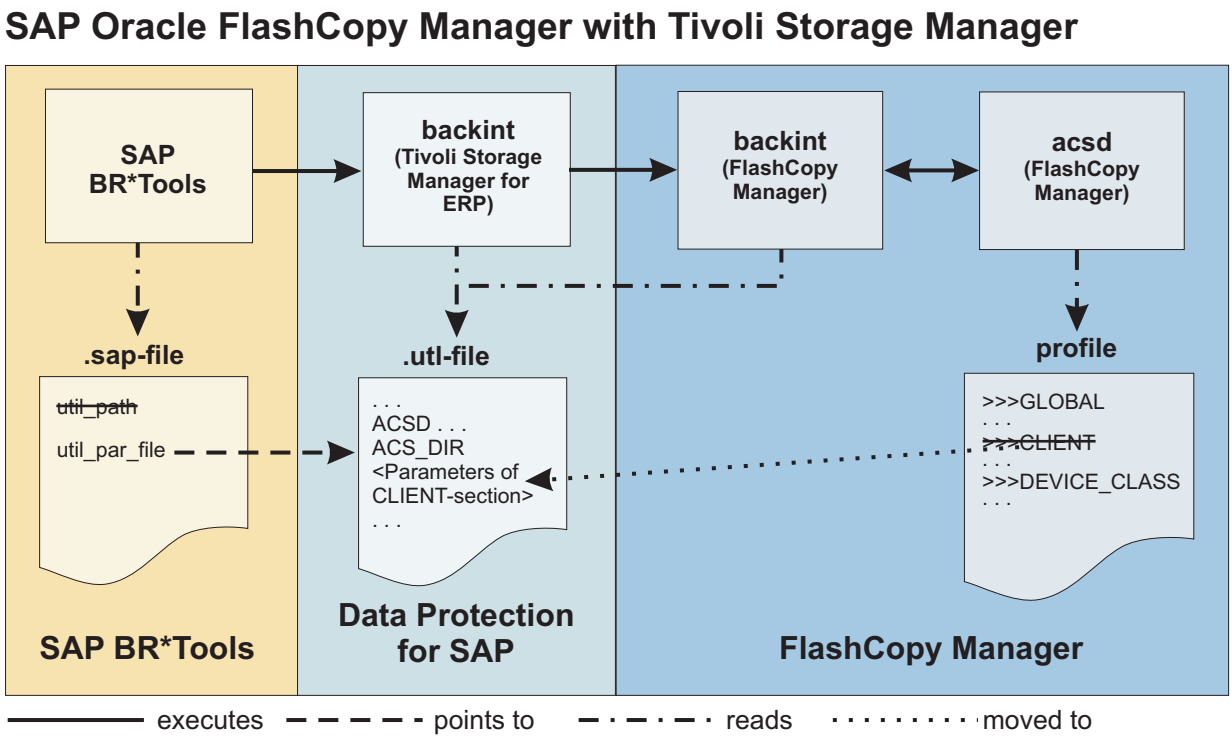


Figure 9. Illustration of SAP with Oracle FlashCopy Manager with Tivoli Storage Manager

If IBM Tivoli Storage FlashCopy Manager is used with IBM Tivoli Storage Manager for Enterprise Resource Planning to protect an SAP system running on top of an Oracle database, the parameters that are typically specified in the CLIENT section can be put directly into the IBM Tivoli Storage Manager for Enterprise Resource Planning configuration file (.utl file) (see Table 36 on page 136). Note that for that purpose there is no need to create a new IBM Tivoli Storage Manager for Enterprise Resource Planning configuration file (.utl file). Instead you can update an existing .utl file for that purpose.

Note: Additional DEVICE_CLASS sections are usually added to the Tivoli Storage FlashCopy Manager profile automatically by the profile wizard whenever you add additional instances of the DEVICE_CLASS parameter to the CLIENT section. When you use 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. You must manually edit the profile with a text editor to add additional DEVICE_CLASS sections. This situation is the only instance when you must edit the profile.

This file can contain the following parameters.

Table 36. IBM Tivoli Storage FlashCopy Manager parameters in the SAP with Oracle client configuration file (.utl)*

Parameter		
Name	**Value**	**Default value**
TSM_BACKUP_FROM_SNAPSHOT	**YES** Create a Tivoli Storage Manager backup from this snapshot. Reuse of the target set is allowed if the Tivoli Storage Manager backup operation does not complete successfully. **MANDATE** In contrast to YES, do not reuse the target set until the Tivoli Storage Manager backup completes. See note 18 for complete parameter definitions.	NO
TSM_BACKUP_FROM_SNAPSHOT (continued)	**LATEST** When a snapshot backup was performed with TSM_BACKUP LATEST and the offloaded backup to Tivoli Storage Manager has either not started or has failed, any new snapshot backup with option TSM_BACKUP set to LATEST, YES, or MANDATE, removes the backup request to Tivoli Storage Manager from the previous backup. This prevents backup requests to Tivoli Storage Manager from queuing if they could not be completed in time. **NO** Keep the snapshot backup and do not use it as a source for a subsequent tape backup operation. See note 18 for complete parameter definitions.	NO
TSM_BACKUP_FROM_SNAPSHOT (continued)	**TSM_ONLY** The backup is automatically marked for deletion during the unmount operation once the Tivoli Storage Manager backup has completed. This occurs regardless of whether the backup was successful or not. **USE_FOR** *list of device classes* This attribute can be combined with any of these options to limit its application to snapshots performed with particular device classes as specified in the profile. Any number of device classes that are listed must be separated by spaces. See note 18 for complete parameter definitions.	NO

Table 36. IBM Tivoli Storage FlashCopy Manager parameters in the SAP with Oracle client configuration file (.utl) (continued)*

Parameter		
Name	**Value**	**Default value**
MAX_SNAPSHOT_VERSIONS	**ADAPTIVE** The maximum number varies depending on the available space. IBM Tivoli Storage FlashCopy Manager reuses the oldest target set as the target for the current backup. *n* Maximum number of snapshot versions to be maintained. When this limit is reached, the oldest version is deleted.	ADAPTIVE
LVM_FREEZE_THAW	Determines when to enable the freeze and thaw actions. See note 11.	
DEVICE_CLASS	<*list of device classes*> [<*conditions*>] One of the device classes listed is used during backup in the DEVICE_CLASS statement for which the condition is true. The condition statement is optional and has this syntax: [USE_AT <*days of week*>] [FROM <*time*> TO <*time*>] (partioned DB2 databases) [ON_DBPARTITIONNUMS] <*list of partitions*> See note 9 for complete information.	STANDARD
TARGET_DATABASE_SUSPEND	YES, NO, OFFLINE This value specifies whether to suspend activity on the target database until the FlashCopy operation completes. Enter one of the following values: *yes*, *no*, or *offline*. A *yes* value is recommended when transaction processing activity is high. An *offline* value specifies that all backups must be offline. If SAP® requests an offline backup, this parameter is ignored. See note 17.	This parameter must be specified by the user.
ALLOW_FULL_FILE_BACKUP	YES, NO This value specifies whether to allow a full file backup into the repository. Due to the performance impact, be cautious when setting this parameter to YES. A full database backup into the repository is not recommended. **Note:** This parameter is not available for editing when using the configuration wizard.	NO

Table 36. IBM Tivoli Storage FlashCopy Manager parameters in the SAP with Oracle client configuration file (.utl) (continued)*

Parameter		
Name	**Value**	**Default value**
TIMEOUT_FLASH	Specify 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 issued. See note 22.	120 seconds
TIMEOUT_<PHASE>	Specify the maximum time (in seconds) that the database agent waits for a response to the management agent call during the <phase> phase. If the database agent does not receive a response within the specified time, an error message is issued. See note 23.	3600 seconds
GLOBAL_SYSTEM_IDENTIFIER	Specify a string that used in the IBM Tivoli Storage Manager for Enterprise Resource Planning Administration Assistant that uniquely identifies an Oracle database in the system landscape. This parameter only valid when the ADMIN_ASSISTANT parameter is specified in the ACSD section of the profile.	ORA_<DBname>
ACS_DIR	Path of the IBM Tivoli Storage FlashCopy Manager directory. See note 1.	Required
ACSD	*hostname port* Hostname and port (separated by space) of the system on which the Management Agent is running. This parameter must be identical on all systems where IBM Tivoli Storage FlashCopy Manager is installed for a given database instance. However, each instance can be managed by an individual Management Agent.	localhost 57328
BACKUPIDPREFIX	string Specify a string that will be added in front of the backup ID that is generated by FlashCopy Manager. This parameter can be used to separate the backups within the same repository so that other clients are not able to query, restore or delete these backups. The string can contain letters, digits, or the '_' (underscore) and must be exactly 6 characters long. **Note:** This parameter has the same meening as the corresponding parameter in the TSM for Enterprise Resource Planning *.utl file and we recommend to use the same value	

Table 36. IBM Tivoli Storage FlashCopy Manager parameters in the SAP with Oracle client configuration file (.utl) (continued)*

Parameter		
Name	**Value**	**Default value**
TRACE, TRACEFILE	Activates tracing. Wait for instructions from support when setting those values	

Note: If you are using IBM Tivoli Storage Manager for Enterprise Resource Planning, the parameters contained in the Tivoli Storage FlashCopy Manager client configuration file can be put directly into the IBM Tivoli Storage Manager for Enterprise Resource Planning configuration file (IBM Tivoli Storage Manager for Enterprise Resource Planning .utl file).

Related reference

"Profile parameter notes" on page 168

SAP® BR*Tools configuration profile (.sap)

This configuration profile is located in the $ORACLE_HOME/dbs directory.

The .sap profile is described in detail in the *SAP® database guide for Oracle* that is provided by SAP®, and you might already have an existing .sap file in your environment. This guide serves is a reference for all profile parameters that are valid in the .sap profile.

The following list contains parameters that will most likely need to be added or updated in your existing .sap file.

This configuration refers to the following keywords within that profile:

backup_type
Identifies the default type of the database backup. This parameter is only used by brbackup (default is `offline`).

backup_dev_type
Determines the backup medium that is used (the default is tape). In order to create a snapshot backup using IBM Tivoli Storage FlashCopy Manager, this parameter must be set to util_vol or to util_vol_online. (Recommendation: Minimize the time during which the database is degraded.)

util_par_file
If you are running FlashCopy Manager with IBM Tivoli Storage Manager for Enterprise Resource Planning, set this parameter to the fully qualified path of the IBM Tivoli Storage Manager for Enterprise Resource Planning profile (.utl file). This way FlashCopy Manager uses the configuration that was added to the IBM Tivoli Storage Manager for Enterprise Resource Planning configuration file (.utl file).

If you are running FlashCopy Manager in an environment where IBM Tivoli Storage Manager for Enterprise Resource Planning is not configured, set this parameter to the fully qualified path of the FlashCopy Manager profile. This way FlashCopy Manager uses the configuration that was added to the CLIENT section of the FlashCopy Manager profile.

util_path
Specifies the path to the backint executable.

If you are running FlashCopy Manager with IBM Tivoli Storage Manager for Enterprise Resource Planning, you do not need to set this parameter.

If you are running FlashCopy Manager in an environment where IBM Tivoli Storage Manager for Enterprise Resource Planning is not available, set this parameter to the INST_DIR (<Instance owner $HOME directory>/acs/>).

util_vol_unit
Specifies the smallest unit that can be backed up with a snapshot or clone,

and also determines restore granularity. The possible values are `sap_data` (finest restore granularity), `all_data`, and `all_dbf` (not recommended).

Note: SAP requires that the setting of this parameter correctly describes the disk layout of your database.

Use `sap_data` if your disk layout consists of:

- At least one volume group for each sapdata directory
- At least one volume group for each origlog directory
- At least one volume group for each mirrlog directory

For `sap_data`, there must be exactly one volume group for each sapdata directory, exactly one volume group for each origlog directory, and exactly one volume group for each mirrlog directory. If one of the sapdata, origlog, or mirrlog directories contains more than one volume group, there is a fourth parameter value `disk_vol` that must be used. The parameters `disk_vol` and `all_dbf` are not recommended by SAP because they contradict the SAP recommendation about the separation of data files and redo log files. The default value set by SAP is `sap_data`.

Use `all_data` if your disk layout consists of:

- At least one volume group for sapdata
- At least one volume group for origlog
- At least one volume group for mirrlog

util_vol_access
Specifies the accessibility of snapshot backup volumes

- none (required on the production system)
- copy (not supported)
- mount (required on the backup system if SAP® BR*Tools installed on the backup system)
- both (not supported)

util_vol_nlist = (<nfile_name1>, <nfile_name2>, ...) | no_check
This parameter defines a list of non-database files or directories that are located on the database disk volumes but do not need to appear in the list of files to back up in the input file. These files are automatically included in the backup, but are never reported in the BACKINT interface messages, especially not in the #ERRFILE message. During a restore, these files (and possibly fixed files) might be overwritten without prior warning.

no_check deactivates the BACKINT check of the backup volumes. This check makes sure that the backup volumes do not contain either non-database files or database files that belong to a database other than the database to be backed up. When no_check is set, the user takes responsibility for making sure that the database volumes (directories sapdata, origlog, and mirrlog) only contain database files of the database to be backed up. Or, if the database volumes contain either non- database files or database files from a database other than the database to be backed up, the user accepts that such files can be overwritten without warning.

util_options = <additional_backint_options>
This parameter defines additional BACKINT options that BR*Tools places after the standard command-line options when calling the BACKINT program. With this parameter, the FlashCopy Manager backint options '-O <TSM_BACKUP_FROM_SNAPSHOT value> and '-S <device class>' can be

specified. See “BR*TOOLS - User interface for Oracle in SAP environments” on page 83 for more information about these backint options.

Example:

```
util_options = "-O yes -S STANDARD"
```

ORACLE section

The ORACLE section is an extension to the CLIENT section for ORACLE environments. The parameters do not depend on the storage device.

Table 37. IBM Tivoli Storage FlashCopy Manager profile parameters - ORACLE section

Parameter		
Name	**Value**	**Default value**
CATALOG_DATABASE_ CONNECT_STRING	Recovery catalog connect string This value specifies the connect string of the Recovery Catalog database to be used to catalog backup information. This value must correspond to the value defined in the $ORACLE_HOME/network/admin/ tnsnames.ora file.	This parameter must be specified by the user.
CATALOG_DATABASE_ USERNAME	User name This value specifies a user name that has Oracle system database administrator privileges on the Recovery Catalog database.	This parameter must be specified by the user.
TARGET_DATABASE_PARAMETER_FILE	Target database parameter file This value specifies the fully resolved path and file name of the Oracle parameter file (init<SID>.ora by default) for the target database. Note that this file must be a text-based Oracle parameter file (PFILE) and not an Oracle server file.	The default value is ${ORACLE_HOME}/dbs/ init${ORACLE_SID}.ora
DATABASE_BACKUP_SCRIPT_FILE	Name of the RMAN backup script that contains the Data Protection for Oracle environment variables. See note 8.	This parameter must be specified by the user.
DATABASE_CONTROL_FILE_RESTORE	YES, NO Specify whether to restore Oracle control files after snapshot restore processing completes. A *no* value will not restore Oracle control files and the user will do the full recovery up to the current image of the Oracle database using existing control files residing in the system. A *yes* value restores Oracle control files and the user will do the incomplete recovery up to the point when the control files were backed up.	NO

Table 37. IBM Tivoli Storage FlashCopy Manager profile parameters - ORACLE section (continued)

Parameter		
Name	**Value**	**Default value**
ASM_INSTANCE_USER	User name Specify the user name of the ASM instance owner. Use this parameter when the target database and the ASM instance are running under different user IDs. The ASM instance must have sysdba, sysasm, or sysadm permission. AUTO When this parameter is set to AUTO, the database user who is running the process is used.	AUTO
ASM_INSTANCE_ID	SID of the ASM instance It is not really recommended by Oracle but possible to have a SID for the ASM instance other than '+ASM'. In such environments, this profile parameter can be used to specify the ASM instance SID.	+ASM
ASM_ROLE	sysdba | sysasm Specify the role that should be used when connecting to the ASM instance. The 'sysdba' role must be specified when using Oracle 10g. Specify 'sysasm' when using Oracle 11g,	sysdba

Related reference

"Profile parameter notes" on page 168

CLONING section

The CLONING section of the IBM Tivoli Storage FlashCopy Manager profile contains parameters used for cloning operations. The parameters are independent of the storage device or application.

Table 38. IBM Tivoli Storage FlashCopy Manager profile parameters - CLONING section

Database Environment			Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Name**	**Value**	**Default value**
x	x	x	DEVICE_CLASS	*device class* Identify the device class to use when cloning a database. **USE_FOR_CLONING** *list of clone database names* *conditions* ON_DBPARTITIONNUMS *<list of partitions>* This parameter is required. See note 24.	
x	x	x	FLASH_DIR_LIST	**[ON DBPARTITIONNUM** *list of partitions***]** *fully qualified file name* Specify this parameter to include file systems (in the FlashCopy operation) that are not a part of the database files. See note 25.	No filename specified
	x	x	OVERWRITE_ DATABASE_ PARAMETER_FILE	**YES** Copy the database configuration file from the production system to the clone system. **NO** Do not copy the database configuration file from the production system to the clone system. See note 26.	YES
	x	x	TARGET_DATABASE_ PARAMETER_FILE	Production target database parameter file. Specify the name of the Oracle parameter file for the production database. See note 27.	${ORACLE_HOME}/dbs/init${ORACLE_SID}.ora
x	x	x	DATABASE_SCHEMA	Specify the correct production database schema. See note 28.	See note 28.
x	x	x	NEGATIVE_LIST	See the description of this parameter in the CLIENT section.	See the default of this parameter in the CLIENT section.
x	x	x	LVM_FREEZE_THAW	See the description of this parameter in the CLIENT section.	See the default of this parameter in the CLIENT section.

Table 38. IBM Tivoli Storage FlashCopy Manager profile parameters - CLONING section (continued)

Database Environment			Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Name**	**Value**	**Default value**
x	x	x	TIMEOUT_PARTITION	See the description of the TIMEOUT_<PHASE> parameter in note 23.	See the default of this parameter in note 23.
x	x	x	TIMEOUT_PREPARE	See the description of the TIMEOUT_<PHASE> parameter in note 23.	See the default of this parameter in note 23.
x	x	x	TIMEOUT_FLASH	See the description of this parameter in note 22.	See the default of this parameter in note 22.
x	x	x	TIMEOUT_VERIFY	See the description of the TIMEOUT_<PHASE> parameter in note 23.	See the default of this parameter in note 23.
x	x	x	TIMEOUT_CLOSE	See the description of this parameter in note 23.	See the default of this parameter in note 23.
x	x	x	TIMEOUT_FLASHRESTORE	See the description of the TIMEOUT_<PHASE> parameter in note 23.	See the default of this parameter in note 23.
x	x	x	TIMEOUT_COMPLETERESTORE	See the description of the TIMEOUT_<PHASE> parameter in note 23.	See the default of this parameter in note 23.
x	x	x	GLOBAL_SYSTEM_IDENTIFIER	See the description of this parameter in the CLIENT section.	See the default of this parameter in the CLIENT section.

Related reference

"Profile parameter notes" on page 168

DEVICE_CLASS *device* section

The IBM Tivoli Storage FlashCopy Manager profile contains one or more DEVICE_CLASS sections. Those sections are intended to configure IBM Tivoli Storage FlashCopy Manager for use with a particular storage device. The parameters do not depend on the application that is protected.

Note: Additional DEVICE_CLASS sections are usually added to the Tivoli Storage FlashCopy Manager profile automatically by the profile wizard whenever you add additional instances of the DEVICE_CLASS parameter to the CLIENT section. When you use 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. You must manually edit the profile with a text editor to add additional DEVICE_CLASS sections. This situation is the only instance when you must edit the profile.

Table 39. IBM Tivoli Storage FlashCopy Manager profile parameters - DEVICE_CLASS section

Device Applicability			Parameter		
DS	**SVC**	**XIV®**	**Name**	**Value**	**Default value**
x	x	x	COPYSERVICES_ HARDWARE_TYPE	Storage system on which the database resides: **DS8000** IBM DS8100 IBM DS8300 **SVC** IBM SAN Volume Controller **XIV** IBM XIV® Storage System Only one system can be specified.	This parameter is required.
x	x	x	CLONE_DATABASE	**YES** Use the device class for cloning. **NO** Do not use the device class for cloning. See note 29.	This parameter is not explicitly set by the user. It is preset by the wizard according to whether the device class is used by a CLIENT or a CLONING section.
x	x		COPYSERVICES_ PRIMARY_ SERVERNAME	*server name or address* Defines the TCP/IP address of the host running the CIM Agent for DS Open API (which can manage the primary and secondary Copy Services servers of the DS8000 cluster), the SAN Volume Controller master console, or embedded CIM Agent.	localhost
x			COPYSERVICES_ SECONDARY_ SERVERNAME	Specify the name of the backup Copy Services server located within a snapshot devices cluster. You can specify either the numeric IP address or the DNS name of the server. The default value is *none*. On DS, this parameter is only with the proxy CIM Agent.	'none'
		x	COPYSERVICES_ SERVERNAME	Specify the hostname of the IBM XIV® Storage System. This parameter is only valid when COPYSERVICES_HARDWARE_ TYPE specifies XIV.	'none'

Table 39. IBM Tivoli Storage FlashCopy Manager profile parameters - DEVICE_CLASS section (continued)

Device Applicability			Parameter		
DS	**SVC**	**XIV®**	**Name**	**Value**	**Default value**
x	x	x	COPYSERVICES_USERNAME	User name for: *cim user* CIM Agent for DS Open API (which can manage the primary and secondary Copy Services servers of the DS8000 cluster. *svc user* SAN Volume Controller master console or cluster *XIV user* Username to log in to the XIV system.	superuser
		x	PATH_TO_XCLI	Specify 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.	None
x	x		COPYSERVICES_ SERVERPORT	*server port* Defines the port number on the host running the CIM Agent for DS Open API (which can manage the primary and secondary Copy Services servers of the DS8000 cluster, the SAN Volume Controller master console, or embedded CIM Agent.	See Note 6.
x	x		COPYSERVICES_TIMEOUT	*timeout* Maximum length of time (in minutes) the CIM Client will wait for the response to a call issued to the CIMOM (CIM Agent) If the CIM Client does not receive a response within this time, an error message is issued.	6
x	x		COPYSERVICES_ COMMPROTOCOL	Protocol to be used for communication with the CIM Agent. **HTTP** Communication in non-secure mode **HTTPS** Communication in secure mode	HTTPS

Table 39. IBM Tivoli Storage FlashCopy Manager profile parameters - DEVICE_CLASS section (continued)

Device Applicability			Parameter		
DS	**SVC**	**XIV®**	**Name**	**Value**	**Default value**
x	x		COPYSERVICES_ CERTIFICATEFILE	See note 5.	NO_CERTIFICATE
x	x		FLASHCOPY_TYPE (See note 10.)	Specifies whether the storage subsystem performs a bitwise copy of data from one logical volume to another. **COPY** Directs the storage system to perform a bit-level copy of the data from one physical volume to another. This value is recommended under the following conditions: • You intend to perform a fast (snapshot) restore of a backed-up database • A copy of the database data on the target volume is desired.	COPY
x	x		FLASHCOPY_TYPE (cont'd)	**INCR** Similar to COPY. It differs from COPY by the fact that it only copies those tracks that were modified since the previous incremental FlashCopy was created.	COPY
x	x		FLASHCOPY_TYPE (cont'd)	**NOCOPY** Directs the storage system to perform a bit-level copy of a track when and if data is modified after the FlashCopy request. This technique is typically referred as copy-on- write	COPY
x	x	x	STORAGE_SYSTEM_ID	Specify the storage system ID of the cluster to which the DS8000, IBM XIV®, or SAN Volume Controller storage system refers in an AIX Logical Volume Manager mirrored environment. See the Note 21 and "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183.	None.

Table 39. IBM Tivoli Storage FlashCopy Manager profile parameters - DEVICE_CLASS section (continued)

Device Applicability			Parameter		
DS	**SVC**	**XIV®**	**Name**	**Value**	**Default value**
x	x		TARGET_SETS	Specify the target volumes to be used in the FlashCopy operation using one of these values: • VOLUMES_DIR • VOLUMES_FILE • <list of target set names> (SAN Volume Controller only) – TARGET_NAMING <string with wildcards %SOURCE and %TARGETSET> See the Note 20 and "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183.	This parameter is specified by the user.
x	x		VOLUMES_DIR	Fully qualified path of the volumes directory, in which the FlashCopy target volumes file(s) must reside. See the Note 20 and "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183.	This parameter is specified by the user.
x	x		VOLUMES_FILE	Specify the name of the target volumes file (.fct). See the Note 20 and "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183.	This parameter is specified by the user.

Table 39. IBM Tivoli Storage FlashCopy Manager profile parameters - DEVICE_CLASS section (continued)

Device Applicability			Parameter		
DS	**SVC**	**XIV®**	**Name**	**Value**	**Default value**
x	x		TARGET_NAMING <string with wildcards %SOURCE and %TARGETSET>	Specify the naming convention for target volumes. Whenever a backup volume is required at backup time, FlashCopy Manager has already determined the name of the target set for the current operation and the name of the source volume to be backed up. The name of the target volume storing the backup is the name specified once the strings %SOURCE and %TARGETSET are replaced with the respective values in the current operation.	This parameter is specified by the user.
	x		SVC_COPY_RATE	*priority* Specifies the priority that the SAN Volume Controller gives to the FlashCopy background process for the current backup or restore. Enter a value from 0-100. See note 16.	50
	x		SVC_CLEAN_RATE	Specify the cleaning rate for the FlashCopy mapping. Enter a value from 1 to 100.	
x			RESTORE_FORCE	YES, NO (See note 15.)	NO
		x	USE_WRITABLE_SNAPSHOTS	YES | NO | AUTO Specify whether writable snapshots should be used. Writable snapshots are required in LVM mirrored environments. The AUTO setting automatically selects the recommended value based upon your environment.	AUTO
		x	USE_CONSISTENCY_GROUPS	YES | NO Specify whether consistency groups should be used. The use of consistency groups decreases the time needed for the FlashCopy operation. A YES setting is required in ASM environments.	YES
x	x	x	BACKUP_HOST_NAME	Specify the name of the backup host as configured in the storage subsystem that is used during offloaded tape backups only. See note 32 for more details.	

Table 39. IBM Tivoli Storage FlashCopy Manager profile parameters - DEVICE_CLASS section (continued)

Device Applicability			Parameter		
DS	**SVC**	**XIV®**	**Name**	**Value**	**Default value**
		x	GRACE_PERIOD	Specify the period of time (in hours) to retain snapshots after they have been created that are not contained in the snapshot repository or not contained on the IBM XIV® Storage System. A 0 value reconciles all snapshots. This parameter is only valid when COPYSERVICES_HARDWARE_ TYPE specifies XIV.	24 hours
x	x	x	RECON_INTERVAL	Specify the interval (in hours) to perform reconciliation for the storage system.	12 hours

Related reference

"Profile parameter notes" on page 168

OFFLOAD section

The OFFLOAD section contains information that is related to Tivoli Storage Manager backups from a snapshot.

File names that are specified in this section typically point to files that reside on a backup server. The offload section is optional and can exist for DB2 (non-SAP, SAP), ORACLE (non-SAP, SAP), and custom applications. The parameters do not depend on the storage device.

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
x	x	x	x	BACKUP_METHOD	The value depends on the type of database environment you are in: • DB2 (SAP, non-SAP) - DB2 • Oracle (non-SAP) - ORACLE • Oracle (SAP) - BACKINT • Custom application - TSM_CLIENT **Note:** This parameter is preset by the wizard based on the database environment.	Required TSM_CLIENT must be specified when APPLICATION_TYPE equals GENERIC. See note 31.

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section (continued)

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
			x	MODE	This parameter determines which of the following Tivoli Storage Manager Backup Archive client backup functions to use when creating a Tivoli Storage Manager off-loaded backup: **ARCHIVE** Creates an archive backup of all files and directories that are specified in the backup request. Directories are processed recursively. **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 used to create the snapshot. This option can be used to define rules that create a weekly full backup and daily incremental backups. **Note:** You can use the USE_FOR option to define multiple MODE statements within the OFFLOAD section. See note 31.	FULL

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section (continued)

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
			x	ASNODENAME	nodename This 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.	This parameter is required.
			x	VIRTUALFSNAME	name This parameter identifies the virtual file space name of a backup group. It is available when the MODE parameter specifies a value of FULL or DIFF. VIRTUALFSNAME is optional.	`fcm`
			x	DSM_DIR	This optional parameter identifies the path used for the DSM_DIR environment variable. For UNIX and Linux, specify the path where the executable file dsmc, the resource files, and the dsm.sys file reside.	Empty string.
			x	DMS_OPT	This optional parameter identifies the path and file name of the Tivoli Storage Manager client options file (dsm.opt).	Empty string.
			x	DSM_LOG	This optional parameter identifies the path used for the Tivoli Storage Manager client error log file (dsmerror.log).	Empty string.

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section (continued)

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
x				OPTIONS	**<options string>** Specifies options to be used for this Tivoli Storage Manager backup operation. The string is passed directly to the backup utility. **@filename** Specifies that the options to be used for the Tivoli Storage Manager backup operation are contained in a file located on the backup server. The string will be passed directly to the backup utility. See note 14.	Empty string.
	x			OVERWRITE_ DATABASE_ PARAMETER_ FILE	**YES** Replace the database configuration file on the backup system with the version defined on the production system, to ensure they are identical. **NO** Do not copy the production-system database configuration file to the backup system.	YES
	x			DATABASE_ BACKUP_ INCREMENTAL_ LEVEL	n Level of backup to be performed. You can enter any numerical value. See note 7.	0
x				PARALLELISM	**n** Number of table spaces that can be read in parallel by the backup utility. **AUTO** DB2 calculates an optimum value.	AUTO

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section (continued)

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
x				NUM_SESSIONS	**n** Number of I/O sessions to be created between DB2 and Tivoli Storage Manager.	1
x				NUM_BUFFERS	**n** Number of buffers to be used by DB2. **AUTO** DB2 will calculate the optimum value for this parameter.	AUTO
x				BUFFER_SIZE	**n** The value of this parameter specifies the size, in 4 KB pages, of the buffer used by DB2 when building the backup image. The minimum value is 8 pages. **AUTO** DB2 calculates the optimum value if backup was started automatically.	AUTO
x				PARALLEL_BACKUP	**YES** The Tivoli Storage Manager backup of all participating partitions will run in parallel. **NO** The Tivoli Storage Manager backups of all participating partitions will run sequentially. Before setting this parameter to YES, check the release notes for the requirements to be observed.	NO
		x		PROFILE	Name of the external SAP Backint profile	This parameter is required.

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section (continued)

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
	x			ASM_INSTANCE_USER	User name Specify the user name of the ASM instance owner. Use this parameter when the target database and the ASM instance are running under different user IDs. The ASM instance must have sysdba, sysasm, or sysadm permission. AUTO When this parameter is set to AUTO, the database user who is running the process is used. This parameter is used for the backup server. If it is not specified for the OFFLOAD section, the value of this parameter (as specified in the ORACLE section) is used for the backup server.	
	x			ASM_INSTANCE_ID	SID of the ASM instance It is not really recommended by Oracle but possible to have a SID for the ASM instance other than '+ASM'. In such environments, this profile parameter can be used to specify the ASM instance SID. This parameter is used for the backup server. If it is not specified for the OFFLOAD section, the value of this parameter (as specified in the ORACLE section) is used for the backup server.	

Table 40. IBM Tivoli Storage FlashCopy Manager profile parameters - OFFLOAD section (continued)

Database Environment				Parameter		
DB2	**Native Oracle**	**SAP® with Oracle**	**Custom application**	**Name**	**Value**	**Default value**
	x			ASM_ROLE	sysdba | sysasm Specify the role that should be used when connecting to the ASM instance. The 'sysdba' role must be specified when using Oracle 10g. Specify 'sysasm' when using Oracle 11g, This parameter is used for the backup server. If it is not specified for the OFFLOAD section, the value of this parameter (as specified in the ORACLE section) is used for the backup server.	

Related reference

"Profile parameter notes" on page 168

DB2STANDBY section

The DB2STANDBY section is the same as the CLIENT section, except when it is configured for a DB2 database that acts as a DB2 HADR secondary. After takeover, when the database is active, the CLIENT section is used. The parameters do not depend on the storage device.

Table 41. IBM Tivoli Storage FlashCopy Manager profile parameters - DB2STANDBY section

Parameter		
Name	**Value**	**Default value**
PRE_FLASH_CMD	command string This parameter identifies the command script or executable file that is used to quiesce the DB2 standby or DB2 HADR secondary immediately before the snapshot operation begins. When the value of this parameter contains command arguments, place the value between double quotation marks ("). This parameter is required in the profile or it needs to be specified in the command line. If specified on the command line, it overrides the corresponding parameter in the profile.	
POST_FLASH_CMD	command string This parameter identifies the command script or executable file that is used to resume the DB2 standby or DB2 HADR secondary immediately after snapshot creation. When the value of this parameter contains command arguments, place the value between double quotation marks ("). This parameter is required in the profile or it needs to be specified in the command line. If specified on the command line, it overrides the corresponding parameter in the profile.	
DB2_PRODUCTION_SERVER	This parameter contains two values: **host name or TCP/IP name** Specify the TCP/IP name or hostname of the DB2 server where the HADR primary server is running (production system). **TCP/IP port** The TCP/IP port on which the DB2 production database instance is listening for remote connections (DB2 database manager configuration parameter SVCENAME) Both values must be separated by a space and both values are required to be specified.	This parameter is required.

Table 41. IBM Tivoli Storage FlashCopy Manager profile parameters - DB2STANDBY section (continued)

Parameter		
Name	**Value**	**Default value**
DB2_ALIAS	alias name Specify the alias name of the DB2 database running on the HADR primary server.	This parameter is required.
DB2_USERNAME	DB2 user Specify the DB2 user that is used to connect from the HADR standby server to the DB2 database running on the HADR primary server.	The user name of the user who started the tsm4acs operation.
DB2_AUTH_TYPE	SERVER, CLIENT, SERVER_ENCRYPT, DATA_ENCRYPT, GSSPLUGIN Specify the value of the DB2 instance AUTHENTICATION parameter on the DB2 HADR primary server. This parameter is optional. The valid values are: **SERVER** Authentication of the user name and password takes place at the server. **CLIENT** Authentication of the user name and password takes place at the client. **SERVER_ENCRYPT** Specifies that authentication takes place on the node containing the target database, and that the authentication password is to be encrypted. **DATA_ENCRYPT** Specifies that authentication takes place on the node containing the target database, and that connections must use data encryption. **GSSPLUGIN** Specifies that authentication takes place using an external GSS API-based plug-in security mechanism.	SERVER_ENCRYPT

Table 41. IBM Tivoli Storage FlashCopy Manager profile parameters - DB2STANDBY section (continued)

Parameter		
Name	**Value**	**Default value**
TSM_BACKUP	When the DB2 system acts as DB2 standby server or as HADR secondary, this parameter is evaluated instead of the parameter specified in the CLIENT section. In that case, FlashCopy Manager evaluates the OFFLOAD DB2STANDBY section instead of the OFFLOAD section to create a Tivoli Storage Manager backup from the snapshot. This parameter accepts the following values: • YES • MANDATE • LATEST • NO • TSM_ONLY • USE_FOR *list of device classes* See note 18 for complete parameter definitions.	No
MAX_VERSIONS	This parameter is evaluated instead of the parameter specified in the CLIENT section when the DB2 system acts as DB2 standby server or as HADR secondary. This parameter contains the following values: **ADAPTIVE** The maximum number varies depending on the available space. IBM Tivoli Storage FlashCopy Manager re-uses the oldest target set as the target for the current backup. *n* Maximum number of snapshot versions to be maintained. When this limit is reached, the oldest version is deleted.	ADAPTIVE

Table 41. IBM Tivoli Storage FlashCopy Manager profile parameters - DB2STANDBY section (continued)

Parameter		
Name	**Value**	**Default value**
DEVICE_CLASS	This parameter is evaluated instead of the parameter specified in the CLIENT section when the DB2 system acts as DB2 standby server or as HADR secondary. This parameter contains the following values: <*list of device classes*> [<*conditions*>] One of the device classes listed is used during backup in the DEVICE_CLASS statement for which the condition is true. The condition statement is optional and has this syntax: [USE_AT <*days of week*>] [FROM <*time*> TO <*time*>] (partioned DB2 databases) [ON_DBPARTITIONNUMS] <*list of partitions*> See note 9 for complete information.	STANDARD

Related reference

"Profile parameter notes"

OFFLOAD_DB2STANDBY section

The OFFLOAD_DB2STANDBY section has the same semantics as the OFFLOAD section, except that it is evaluated whenever an offloaded backup from a DB2 HADR secondary occurs instead of the DB2 HADR primary.

The parameters in the OFFLOAD_DB2STANDBY section are the same as the OFFLOAD section, except for the addition of the parameters that are marked for custom applications. The parameters do not depend on the storage device.

Related reference

"OFFLOAD section" on page 155

Profile parameter notes

Additional information about the IBM Tivoli Storage FlashCopy Manager profile parameters are provided.

1. ACS_DIR

The IBM Tivoli Storage FlashCopy Manager directory contains the following subdirectories:

- Subdirectory `logs` contains all log and trace information that IBM Tivoli Storage FlashCopy Manager generates. If you want all of your client nodes to store log and trace information within a single directory, you can use an NFS share for this subdirectory.
- Subdirectory `shared` is used for information that needs to be shared among all IBM Tivoli Storage FlashCopy Manager components. You can either use an NFS filesystem to share this information across multiple servers or transfer a copy of this subdirectory to all systems on which IBM Tivoli Storage FlashCopy Manager is installed.

  The `shared` subdirectory currently contains only the password file (pwd.acsd). This file maintains passwords for all devices specified within the profile (see the device section) and a *master password*, which is used from all components in order to authenticate when connecting to the Management Agent. See "IBM Tivoli Storage FlashCopy Manager password file" on page 183.

  Note: By mapping ACS_DIR (or either of the subdirectories `logs` and `shared`) on an NFS share that is accessible to all IBM Tivoli Storage FlashCopy Manager components, you gain centralized access to all logs and eliminate the need to distribute the password file. However, remote configuration using SSH from the production system is the preferred method, not NFS sharing.

2. ACS_REPOSITORY

Specifies the directory in which the IBM Tivoli Storage FlashCopy Manager repository resides. The IBM Tivoli Storage FlashCopy Manager repository is critical for restore. It must be placed in a secure location. If the repository is lost, all backups are effectively deleted. The directory referenced by ACS_REPOSITORY cannot be in a filesystem that is participating in the snapshot backup. Otherwise, IBM Tivoli Storage FlashCopy Manager might fail. It is recommended that the IBM Tivoli

Storage FlashCopy Manager repository not be in the main IBM Tivoli Storage FlashCopy Manager directory (ACS_DIR). A preferred location is a subdirectory of <ACS_DIR>:

```
<ACS_DIR>/acsrepository
```

Note: The path to ACS_REPOSITORY must exist prior to the initial configuration, but the directory itself must not exist. The setup wizard will indicate an error if this directory already exists but does not contain a valid repository. Alternatively, the directory might already exist and contain a valid repository.

3. ADMIN_ASSISTANT

If this parameter is defined, IBM Tivoli Storage FlashCopy Manager will send backup and restore information to the Administration Assistant if Tivoli Storage Manager for ERP and the Administration Assistant component are installed. <server> and <port> are separated by a space. This parameter is ignored in non-SAP environments.

4. REPOSITORY_LABEL

Specify a prefix that will be added to each snapshot name on the storage device. A maximum of three characters is allowed and must be specified in one of these ranges:

```
[a-z]
[A-Z]
[0-9]
```

This optional parameter is only used with IBM XIV® Storage Systems. The default value is `TSM`.

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

5. COPYSERVICES_CERTIFICATEFILE

If COPYSERVICES_ COMMPROTOCOL is set (or defaults) to `HTTPS`:

certificate file name
Name of a certificate file created for secure communication between the CIM Client and the CIM Agent.

NO_CERTIFICATE
Select null trust provider mode.

By default, the CIM Agent for DS8000, which is preinstalled on the HMC, requires communication in secure mode. In this case, clients such as IBM Tivoli Storage FlashCopy Manager need to connect using HTTPS instead of HTTP. This requires that the CIM Client must first obtain the public key used for encryption from the 'truststore' certificate in the CIM Agent and then authenticate using the user name and password.

To enable the HTTPS protocol, the IBM Tivoli Storage FlashCopy Manager profile parameter COPYSERVICES_COMMPROTOCOL must specify HTTPS (default value). In this case, parameter COPYSERVICES_CERTIFICATEFILE can define a certificate file name, and IBM Tivoli Storage FlashCopy Manager exports the certificate using this file.

The CIM Agent also provides another communication mode known as *null trust provider*. In this case, 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 filename. To enable this mode, the value of COPYSERVICES_CERTIFICATEFILE must be NO_CERTIFICATE. This mode is recommended only if the production and backup systems, as well as the storage system, are protected by a firewall. If NO_CERTIFICATE is in effect, the cimom.properties parameter `DigestAuthentication` must be set to 'false'.

6. COPYSERVICES_SERVERPORT

The default port number depends on the settings of COPYSERVICES_HARDWARE_TYPE and COPYSERVICES_COMMPROTOCOL:

COPYSERVICES_HARDWARE_TYPE	COPYSERVICES_COMMPROTOCOL	Default Port
DS8000	HTTPS	5989
	HTTP	5988
SVC (4.3.0 or later)	HTTPS	5989
	HTTP	5988

7. DATABASE_BACKUP_INCREMENTAL_LEVEL

The following conditions apply:

- A *0* value performs a full backup. This is the default.
  - A full backup must be performed before an incremental backup can be performed.
- A numerical value greater than *0* performs an incremental backup.
  - Incremental backups are progressive. For example, a level *0* backup must be performed before a level *1* backup can occur. A level *1* backup must be performed before a level 2 backup can occur and so on.

8. DATABASE_BACKUP_SCRIPT_FILE

The script must:

1. contain commands that are valid for the backup system database (applicable on a database with datafile copies),
2. contain the Data Protection for Oracle environment variable TDPO_OPTFILE.

   Specify the fully qualified path name to the tdpo.opt options file with the TDPO_OPTFILE environment variable.
3. have the allocate channel command and the ENV parameter on the same line. For example:

   ```
   allocate channel t1 type 'sbt_tape' parms 'ENV=(TDPO_OPTFILE=..)';
   ```
4. have the database command specified on a line separate from the backup command. For example:

   ```
   backup
   (database);
   ```

9. DEVICE_CLASS

During backup, IBM Tivoli Storage FlashCopy Manager will use one of the device classes listed in the *list of device classes* of the DEVICE_CLASS statement for which the *conditions* evaluates to true. If multiple *conditions* statements evaluate to true the operation will fail. The device classes listed in the *list of device classes* (separated by spaces) IBM Tivoli Storage FlashCopy Manager will be used 'cyclically'. To be more precise, IBM Tivoli Storage FlashCopy Manager use the device class that follows the device class, which was used most recently, for the next backup operation. If the last device class in the list was used during the most recent backup or no device class in the list was ever used for a backup, IBM Tivoli Storage

FlashCopy Manager will use the first device class in the list. The value of the DEVICE_CLASS parameter has this syntax:

list of device classes **[***conditions***]**
One of the device classes listed is used during backup in the DEVICE_CLASS statement for which the condition is true. The condition statement is optional and has this syntax:

```
[USE_AT days of week] [FROM time TO time]
(partioned DB2 databases) [ON_DBPARTITIONNUMS list of partitions]
```

Multiple sections representing different devices are possible. Any such section can be selected using the DEVICE_CLASS profile parameter or vendor option. At restore time, IBM Tivoli Storage FlashCopy Manager always uses the same DEVICE_CLASS value that was used during the backup.

10. FLASHCOPY_TYPE

- This parameter applies generically to any snapshot device. The values INCR and NOCOPY apply only to FlashCopy devices.
- COPY, INCR, or NOCOPY (SAN Volume Controller 5.1 or later) is required if the customer plans to run a snapshot restore.
- INCR is recommended if Tivoli Storage Manager backups are desired from disk copies, which are created with less burden on the storage system than for the COPY option. This value is also recommended under the following conditions:
  - You intend to perform a snapshot restore of the backed-up database.
  - You intend to schedule more frequent backups for your database.

  For IBM System Storage 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 one target set is specified.
- NOCOPY is recommended under the following conditions:
  - A complete copy of the source volumes on which the database files reside to the target volumes is not desired.
  - Backup time constraints are a concern

A successful backup of the database to the Tivoli Storage Manager server is possible even if the parameter is set to NOCOPY. For SAN Volume Controller, SVC_COPY_RATE is forced to 0 when FLASHCOPY_TYPE is specified as NOCOPY or INCR.

11. LVM_FREEZE_THAW

YES
Enable freeze prior to snapshot and thaw afterwards. For AIX, the value YES is valid only if all filesystems involved in the backup are JFS2 filesystems. This parameter is ignored when Oracle data files reside on raw logical volumes.

NO
Do not perform a freeze. In order to set this parameter to NO, a licensed version of IBM Tivoli Storage FlashCopy Manager is needed and a backup server is required for mounting the snapshot to ensure filesystem consistency.

The value NO is required if at least one JFS filesystem is involved.

AUTO
If TARGET_DATABASE_SUSPEND is YES, treat as LVM_FREEZE_THAW YES.

See also “Interdependency of LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND” on page 182.

12. MAX_VERSIONS

ADAPTIVE
The maximum number varies depending on the available space. IBM Tivoli Storage FlashCopy Manager re-uses the oldest target set as the target for the current backup.

n Maximum number of snapshot versions to be maintained. When this limit is reached, the oldest version is deleted.

(DB2 with Tivoli Storage Manager for Advanced Copy Services) Accepts only the values '1' and '2' for this parameter when the Tivoli Storage Manager for Advanced Copy Services product is used and not the fully licensed version of IBM Tivoli Storage FlashCopy Manager.

13. NEGATIVE_LIST
Depending on the storage device, IBM Tivoli Storage FlashCopy Manager performs backup and restore operations with volume-group granularity. The parameter NEGATIVE_LIST is used to control processing when non-database files are stored within the same file systems involved in the backup or restore operation. This parameter is required.

NO_CHECK
Does not check for additional files and the operation ignores any additional files that are discovered.

Attention: Be aware that during restore processing, this setting will result in all files that reside in one of the file systems or volume groups (that are the subject of the restore) being overwritten.

WARN
Issues a warning for each file discovered on the volume that is not part of the FlashCopy operation (processing continues). In case of a restore, the additional files found on the file systems to restore will be overwritten by the restore operation.

ERROR
Issues an error for each file discovered on the volume that is not part of the FlashCopy operation (processing ends).

In an Oracle ASM environment, the output that displays when a file is discovered is shown here:

```
#ERRFILE +<asm_file> <-> + <asm_link>
```

or

```
#ERRFILE +<asm_link> <-> + <asm_file>
```

Both the <asm_file> and <asm_link> expressions identify the same entity. To allow this additional file in the FlashCopy operation, add the appropriate <asm_file> or <asm_link> expression to the negative-list file.

filename
When files exist that are not part of the database tablespace files but are to be included in the FlashCopy operation, specify the fully qualified names of these files and directories (one entry per line) in this negative-list file (filename). Processing continues even when these files are discovered. When other files are discovered that are not contained in this negative-list file, processing ends. Note that any directory listed in the negative-list file is processed recursively; for example, it allows all files within the directory (and any subdirectory) to be processed during a backup or restore request.

This parameter is not available for SAP® with Oracle because a similar mechanism is provided directly by the SAP® BR*Tools. Refer to the SAP® documentation for this purpose.

14. OPTIONS

(DB2) A file specification must be a fully qualified file name. If IBM Tivoli Storage Manager for Enterprise Resource Planning is being used, the IBM Tivoli Storage Manager for Enterprise Resource Planning DB2 vendor options file (vendor.env) must be specified.

(DB2) To be able to set up individual partitions in a DPF environment in a different manner, the placeholder string %DB2NODE can be embedded in the options string. At runtime, it will be replaced with the appropriate partition number for which the backup was issued. This placeholder can be part of the vendor options file entry, thus allowing different configuration files depending on the partition. For example, if there are two partitions

```
OPTIONS @/db2/T01/tdpr3/vendor_%DB2NODE.env
```

refers to the two files

```
/db2/T01/tdpr3/vendor_0.env
/db2/T01/tdpr3/vendor_1.env
```

The first file will be used for partition 0, the second for partition 1.Specifying this parameter overrides the value specified by the VENDOROPT database configuration parameter.

15. RESTORE_FORCE

In the case of a re-run of a snapshot restore, message FMM0200E is issued if the background copy process in the storage device of the previous snapshot restore is still running and RESTORE_FORCE is not set to YES. There are two options:

- wait until the background copy process terminates
- specify RESTORE_FORCE YES in the profile and re-run the snapshot restore. This will withdraw all existing source/target relations and create new ones, resulting in a full copy.

  Note: If you set RESTORE_FORCE to YES in a specific situation, but do not want it to apply to all restores, you should consider doing so in a temporary profile.

16. SVC_COPY_RATE

The value represents a priority that can range between 0 and 100. A value

of 100 is the highest but has the greatest impact on the responsiveness of the storage system. A value of 0 suppresses the background copy process and forces FLASHCOPY_TYPE to NOCOPY.

17. TARGET_DATABASE_SUSPEND

This value specifies whether to suspend activity on the target database until the FlashCopy operation completes. Enter one of the following values:

YES
Suspend the target database until the FlashCopy operation completes. This value is recommended when the level of transaction processing is high.

NO
Do not suspend the target database.

OFFLINE
All backups must be offline. If SAP requests an offline backup, this parameter is ignored.

The values YES and NO imply an 'online' backup type. When performing a backup with OFFLINE specified, the target database on the production system must be in a "startup mount" state at the time that acsora or acsutil is issued. Otherwise recovery must be performed to restore the database. See also “Interdependency of LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND” on page 182.

18. TSM_BACKUP / TSM_BACKUP_FROM_SNAPSHOTS

To create a Tivoli Storage Manager backup from a snapshot, install IBM Tivoli Storage FlashCopy Manager on a backup server. The Offload Agent can be run to trigger a TSM backup from any snapshot created with TSM_BACKUP set to YES, MANDATE, or LATEST.

If FlashCopy Manager is used with IBM Tivoli Storage Manager for Enterprise Resource Planning, this parameter is moved to the `.utl` file under the new name "TSM_BACKUP_FROM_SNAPSHOTS" for SAP with Oracle environments.

YES
Create a Tivoli Storage Manager backup from this snapshot. Reuse of the target set is allowed if the Tivoli Storage Manager backup operation does not complete successfully.

MANDATE
In contrast to YES, do not reuse the target set until the Tivoli Storage Manager backup completes.

LATEST
When a snapshot backup was performed with TSM_BACKUP LATEST and the off-loaded backup to Tivoli Storage Manager has either not started or has failed, any new snapshot backup with option TSM_BACKUP set to LATEST, YES, or MANDATE, removes the backup request to Tivoli Storage Manager from the previous backup. This prevents backup requests to Tivoli Storage Manager from queuing if they could not be completed in time.

NO
Keep the snapshot backup and do not use it as a source for a subsequent tape backup operation.

TSM_ONLY
The backup is automatically marked for deletion during the unmount operation once the Tivoli Storage Manager backup has completed. This occurs regardless of whether the backup was successful or not.

USE_FOR *list of device classes*
This attribute can be combined with any of these options to limit its application to snapshots performed with particular device classes as specified in the profile. Any number of device classes that are listed must be separated by spaces.

Note: (DB2) The ability to create a Tivoli Storage Manager backup from a snapshot requires a IBM Tivoli Storage FlashCopy Manager license.

19. TARGET_SETS
Specify the target volumes to be used in the FlashCopy operation using one of these values:

VOLUMES_DIR
Specify a directory that contains all target volumes files (.fct). If you migrated data from Tivoli Storage Manager for Advanced Copy Services to IBM Tivoli Storage FlashCopy Manager, the VOLUMES_DIR parameter remains effective. However, the VOLUMES_FILE parameter is the preferred method for specifying the target volumes file.

VOLUMES_FILE
Specify the name of the target volumes file (.fct).

list of target set names **(SAN Volume Controller only)**
Specify a list of target set names, for example `TARGET_SETS 1 2 3`. In order to define the naming convention for the target volumes, specify the TARGET_NAMING parameter.

TARGET_NAMING <string with wildcards %SOURCE and %TARGETSET>
Defines the naming convention for target volumes. Whenever a backup volume is required at backup time, IBM Tivoli Storage FlashCopy Manager has already determined the name of the target set for the current operation and the name of the source volume to be backed up. The name of the target volume storing the backup is the name specified once the strings `%SOURCE and %TARGETSET` are replaced with the respective values in the current operation.

20. STORAGE_SYSTEM_ID
Specify the storage system ID of the cluster to which the DS8000, IBM XIV®, or SAN Volume Controller storage system refers in a Logical Volume Manager mirrored environment.

For SAN Volume Controller, the system ID refers to the SAN Volume Controller Cluster ID.

This parameter must be specified in the DEVICE_CLASS section of the profile when either of these parameter values exist:

- TARGET_SETS VOLUMES_FILE
- TARGET_SETS VOLUMES_DIR
- TARGET_SETS *list of target set names* (SAN Volume Controller only)

This parameter must also be specified in the target volumes file (.fct) when this parameter value exists:

- TARGET_SETS VOLUMES_DIR

Note: This parameter might be needed for ASM. See "A note on LVM mirroring and ASM failure group environments" on page 36 for more information.

21. PARTITION_GROUP

This parameter is used in multi-partition DB2 environments, when multiple partitions reside on the same volume group (volume sharing). Use it to specify all partitions that share the same volume group. This parameter can be specified multiple times. When PARTITION_GROUP is used, the VOLUMES_FILE parameter must be used to specify the .fct file. The VOLUMES_DIR parameter cannot be used with PARTITION_GROUP. You can specify:

<group name>
Specify an identifier for the partition group.

<db2 node>
Specify the DB2 node name. When multiple entries are specified, each entry must be separated by a space.

This is an example of a PARTITION_GROUP entry:

```
>>> CLIENT
...
PARTITION_GROUP ONE 0 1
PARTITION_GROUP TWO 2 3
...
<<<
```

See "Target set definition file for multi-partition DB2 databases" on page 31 for an example of an .fct file in this environment.

22. TIMEOUT_FLASH

Specify 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 issued. This parameter allows the maximum time to be specified for which that database is allowed to be suspended. This also implies the maximum time for which JFS2 file systems are allowed to be frozen. If the timeout is reached, then the file systems thaw, the database is resumed, and the backup operation ends with an error. If the parameter LVM_FREEZE_THAW is set to AUTO or YES, then the minimal allowed value for TIMEOUT_FLASH is 5 seconds. Otherwise the minimal value is 1 second.

23. TIMEOUT_<PHASE>

Specify the maximum time (in seconds) that the database agent waits for a response to the management agent call during the <phase> phase. If the database agent does not receive a response within the specified time, the backup or restore operation ends and an error message is issued. The default value is 3600 seconds.

You can specify one of these phase values for a FlashCopy backup (for example, TIMEOUT_PREPARE):

- PARTITION
- PREPARE
- FLASH (see separate description of this parameter)

- VERIFY
- CLOSE

You can specify one of these phase values for a FlashCopy restore (for example, TIMEOUT_FLASHRESTORE):

- PREPARERESTORE
- FLASHRESTORE
- COMPLETERESTORE
- CLOSE

24. DEVICE_CLASS *device class* **USE_FOR_CLONING** *list of clone database names* **[***conditions***]**

Specify this parameter in the CLONING section of the profile to identify the device class to use when cloning a database.

The USE_FOR_CLONING statement is required. The *conditions* statement is optional and uses this syntax:

```
(partioned DB2 databases)
[ON_DBPARTITIONNUMS <list of partitions>]
```

25. FLASH_DIR_LIST [ON DBPARTITIONNUM *list of partitions***]** *fully qualified file name*

Specify this parameter in the CLONING section of the profile to include file systems in the FlashCopy operation that are not a part of the database files. You must include these files in certain circumstances. For example, when cloning a SAP® Advanced Business Application Programming and Java system, the Java instance is not part of the database files. As a result, a clone of the Java instance must be created along with the clone of the database. Use the FLASH_DIR_LIST parameter in this situation to include the Java instance directories and therefore, simplify the cloning process.

Specify a fully qualified directory name and file name. Inside the file, specify one fully qualified file or directory on each line. FlashCopy Manager uses the FlashCopy function to flash copy the complete volume groups in which the specified files or directories reside.

In DB2 Data Partitioning Feature environments that contain multiple partitions, a different file name for each partition can be specified. In this situation, you must specify the ON DBPARTITIONNUM parameter because different file names are specified for different partitions. Each partition number must be separated by a space.The default value is an empty list. This value prevents additional files or directories from participating in the FlashCopy operation.

26. OVERWRITE_ DATABASE_PARAMETER_FILE YES|NO

Important: Use with Oracle databases only. This parameter also exists in the OFFLOAD section of the profile and specifies whether the database configuration file on the backup server is overwritten with the file from the production server. However, the parameter value in the OFFLOAD section is not applicable to cloning operations and is ignored.

Specify this parameter in the CLONING section of the profile to copy the database configuration file from the production system to the clone system. Tivoli Storage FlashCopy Manager requires two database configuration files to be available in the clone instance on the clone system. The default database configuration file name is `${ORACLE_HOME}/dbs/init${ORACLE_SID}.ora`.

In a scenario where the production system is ${ORACLE_SID}=P01 and the clone system is ${ORACLE_SID}=C01, these database configuration files are required:

```
/oracle/C01/102_64/dbs/initP01.ora
/oracle/C01/102_64/dbs/initC01.ora
```

The initP01.ora file is used during the cloning process to recover the database (used in the FlashCopy operation) on the clone system. The initC01.ora file is used to rename and start the clone database.

Specify one of these values:

YES Copy the database configuration file from the production system to the clone system. The following process occurs:

- The clone database configuration file initP01.ora is copied on the clone system. The existing file (/oracle/C01/102_64/dbs/initP01.ora) is overwritten.
- The clone database configuration file /oracle/C01/102_64/dbs/initP01.ora is copied to /oracle/C01/102_64/dbs/initC01.ora. The existing file (/oracle/C01/102_64/dbs/initC01.ora) is overwritten. All occurrences of P01 in this file are renamed C01.

NO Do not copy the database configuration file from the production system to the clone system. This value requires that the database configuration files /oracle/C01/102_64/dbs/initP01.ora and /oracle/C01/102_64/dbs/initC01.ora are available on the clone system. You must verify that these files are available and are valid.

Tip: If the name of the database configuration file on the production database is not the default file name (${ORACLE_HOME}/dbs/init${ORACLE_SID}.ora), use the TARGET_DATABASE_PARAMETER_FILE parameter (in the CLONING section) to specify the correct name. In this situation, the clone database configuration file name is created by replacing the ${ORACLE_SID} value of the production database with the name of the clone database.

27. TARGET_DATABASE_PARAMETER_FILE *production target database parameter file*

Important: Use with Oracle databases only. This parameter also exists in the ORACLE section of the profile and specifies the database configuration file name. However, the parameter value in the ORACLE section is not applicable to cloning operations and is ignored.

Specify this parameter in the CLONING section of the profile to identify the name of the Oracle parameter file for the production database. Enter the fully resolved path and file name of the Oracle parameter file (*initSID*.ora by default) for the production database. This file must be a text-based Oracle parameter file (PFILE) and not an Oracle server file. The default value is ${ORACLE_HOME}/dbs/init${ORACLE_SID}.ora. If the production database is configured to use an Oracle server file, this parameter is ignored.

28. DATABASE_SCHEMA *production database schema*

The database schema does not change when a clone database is created from the production database. As a result, the clone database uses the same database schema as the production database. Use the DATABASE_SCHEMA profile parameter to specify the correct database schema.

DATABASE_SCHEMA is required for non-SAP databases. There is no default database schema value.

DATABASE_SCHEMA is optional for SAP databases. The default database schema value is determined by the following environment variables if these environment variables are set on the production database instance owner environment:

```
(DB2)    dbs_db6_schema
(Oracle) dbs_ora_schema
```

If these environment variables are not set, the default database schema value is SAPR3. When DATABASE_SCHEMA is used (for an SAP database), the specified database schema value overrides all default database schema values.

DATABASE_SCHEMA is only evaluated when the following conditions exist:

- A processing script is used with the preproc_clone or postproc_clone command.
- The refresh_clone command is issued with the -X or -Y cloning parameter.
- The create_clone command is issued with the -Y cloning parameter.

29. CLONE_DATABASE YES|NO

This parameter is preset by the profile wizard. Specify this cloning profile parameter in the DEVICE_CLASS device section of the profile. Specify the value YES with this parameter to assign a device class for use with cloning. Specify one of these values:

YES Use the device class for cloning. When this parameter specifies YES, the device class is considered 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 this parameter specifies NO, any cloning request fails with an error message and return code 2.

This example shows a CLONE_DATABASE 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
# GRACE_PERIOD 24
# USE_WRITABLE_SNAPSHOTS AUTO
USE_CONSISTENCY_GROUPS NO
BACKUP_HOST_NAME acsback5
<<<
```

30. APPLICATION_TYPE

When this parameter specifies GENERIC, the following optional settings are available and can be specified in the CLIENT section of the profile:

INFILE *file*

This parameter identifies the file that contains a list of all objects to be processed. The file must comply with these requirements:

- Each line specifies only one file or directory to be backed up.
- A directory and all subdirectories are processed recursively. Symbolic links are followed when the directory is expanded.
- When a symbolic link to a file is specified, IBM Tivoli Storage FlashCopy Manager protects the file system where the file is located. However, the file system where the symbolic link is located is disregarded.

You can override the INFILE parameter by entering a command on the command line. If you do not specify INFILE in the profile, you must specify it on the command line.

The fcmcli functions `inquire`, `inquireDetails`, and `delete` do not recognize the INFILE parameter. The function `restore` accepts INFILE as an optional parameter.

PRE_FLASH_CMD *file*
This optional parameter identifies the command script or executable file used to quiesce the application immediately before the snapshot operation begins. You can override the PRE_FLASH_CMD parameter by entering a command on the command line. When the value of the PRE_FLASH_CMD parameter contains command arguments, place the value between double quotation marks (").

POST_FLASH_CMD *file*
This optional parameter identifies the command script or executable file used to resume the application immediately after the snapshot operation completes. You can override the POST_FLASH_CMD parameter by entering a command on the command line. When the value of the POST_FLASH_CMD parameter contains command arguments, place the value between double quotation marks (").

31. BACKUP_METHOD
This parameter is preset by the profile wizard based on the application environment. For custom application environments (APPLICATION_TYPE=GENERIC), the BACKUP_METHOD is set to TSM_CLIENT. The following optional settings can be specified in the OFFLOAD section of the profile:

MODE
This parameter determines which of the following Tivoli Storage Manager Backup Archive client backup functions to use when creating a Tivoli Storage Manager offloaded backup:

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 IBM Tivoli Storage FlashCopy Manager does not need to resend all data upon a failure during an archive operation. Only the remainder of the data is sent after the failure.

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 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.

ASNODENAME *nodename*
This parameter identifies the node name of the system where data is stored during a Tivoli Storage Manager offloaded backup. This parameter is required only for custom applications.

In IBM Tivoli Storage FlashCopy Manager, backups are always made from an offload system, but are restored directly to the production system. For a custom application configuration, the ASNODENAME parameter defines a dedicated node that contains the data of the custom application (in this case, the production system). IBM Tivoli Storage FlashCopy Manager uses the Offload Agent (tsm4acs) to create offloaded backups to the Tivoli Storage Manager server from the offload system. The parameter ASNODENAME ensures that this data is backed up such that it can be restored directly to production using the dsmc command. This command depends on the choice of the profile parameters MODE and VIRTUALFSNAME of the OFFLOAD section and the value of the parameter BACKUPIDPREFIX from the CLIENT section.

Note: You must specify the PASSWORDACCESS GENERATE option in the client system options file on the offload system and production system.

VIRTUALFSNAME *name*
This parameter identifies the virtual file space name of a backup group. It is available when the MODE parameter specifies a value of FULL or DIFF. VIRTUALFSNAME is optional and the default value is `fcm`.

DSM_DIR
This optional parameter identifies the path used for the DSM_DIR environment variable. For UNIX and Linux, specify the path where the executable file `dsmc`, the resource files, and the `dsm.sys` file reside.

DSM_OPT
This optional parameter identifies the path used for the Tivoli Storage Manager client options file. The default value is the path of the Tivoli Storage Manager client installation directory.

32. BACKUP_HOST_NAME
Specify the name of the backup host that is used during offloaded tape backups only. The possible values of the BACKUP_HOST_NAME parameter depend on the storage subsystem and its usage.

Table 42. BACKUP_HOST_NAME values in the DEVICE_CLASS device section of the profile

Storage subsystem type	BACKUP_HOST_NAME value in device section of the profile	Comments
XIV, SVC, DS8000	NONE	Use this value if you do not have a backup server.
XIV	<backup_server_hostname>	Use this value if you have a backup server. Enter the host name of the backup server as configured on the XIV storage subsystem.
SVC	PREASSIGNED_VOLUMES	Use this value if you have a backup server and you use static volume mapping. This configuration means your FlashCopy target set disks are already mapped to the backup server and remains unchanged during all FCM operations.
SVC	<backup_server_hostname>	Use this value if you have a backup server and you want to use dynamic volume mapping. This configuration means the target set disks are automatically assigned to and removed from a host if required by the FCM operation. Use this value if you have a backup server. Enter the host name of the backup server as configured in the SAN Volume Controller.
DS8000	PREASSIGNED_VOLUMES	Use this value if you have a backup server.

Related concepts

"IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183

Related reference

"Key files and directories" on page 194

Interdependency of LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND

The LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND profile parameters are interdependent.

These two IBM 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. This parameter is ignored when Oracle data files reside on raw logical volumes.

The following table summarizes the actions taken depending on the values of the two parameters:

Table 43. 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

IBM Tivoli Storage FlashCopy Manager password file

IBM Tivoli Storage FlashCopy Manager requires a password file in order to access the storage subsystem where the database volumes are stored.

This password file also contains a *master password*, which is required by the Management Agent to authenticate the database nodes and the Offload Agent. It is possible to share a single password file between all systems by placing it into an NFS mounted file system that is available to all servers on which IBM Tivoli Storage FlashCopy Manager is installed. Separate password file instances can also be used for different database nodes, for the Management Agent, and for the (optional) Offload Agent. Separate password file instances for the Management Agent requires access to the password for the storage subsystem. For the Offload Agent, the master password is required on all systems.

A password file can be created during the initial setup of IBM Tivoli Storage FlashCopy Manager using the setup script, which also updates /etc/inittab appropriately. The password file is stored as

```
<ACS_DIR>/shared/pwd.acsd
```

where <ACS_DIR> is the value of the ACS_DIR parameter in the profile.

IBM Tivoli Storage FlashCopy Manager target volumes file

The target volumes file (`.fct`) identifies the target volumes to be used for a FlashCopy backup.

During a FlashCopy backup on IBM System Storage DS8000 or SAN Volume Controller, a set of target volumes (the target set) are required for each set of source volumes that are to be copied. More than one target set can be defined for use in different FlashCopy backups. The volumes in each target set that are used in a backup must be specified in a similar way in a separate target set topic. These target sets are specified in a target volumes file, the `.fct` file. The target set section name begins with the prefix VOLUMES_SET_ (if VOLUMES_DIR is used) or TARGET_SET (if VOLUMES_FILE is used) and is appended with a target set *target*

set name, which differentiates the various target set sections. The target set name can be any alphanumeric value. Note that target set definitions are not required on XIV®.

In each topic section in the target volumes file, use one TARGET_VOLUME parameter for each target volume to be used 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 are permitted before the first target set section only and are indicated by a "#" character in the first column of each line. Tab characters are permitted.

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.

When VOLUMES_DIR is specified in the profile, the target volumes file conforms to this naming convention:

```
<dbm-instance>.<database-name>.<device-class>.<partition-num>.fct
```

- <dbm-instance>: DB2 instance name
- <database-name>: DB2 database alias
- <device-class>: Device class specified in the profile or as a vendor option
- <partition-num>: 'NODEnnnn' where 'nnnn" is the partition number (leading zeroes)

The target volumes file name is case sensitive. For example:

```
keon14.A01.STANDARD.NODE0000.fct
```

Managing target volumes by storage system

Different methods of target volume mapping are available based on the available storage system as shown in the following table:

Table 44. Managing target volume LUNs by storage system

IBM System Storage DS8000	SAN Volume Controller	XIV®
Manual target LUN creation using target volumes file (.fct) with VOLUMES_FILE or VOLUMES_DIR parameter	Manual target LUN creation using target volumes file (.fct) with VOLUMES_FILE or VOLUMES_DIR parameter or Naming convention using TARGET_NAMING parameter	Automatic target LUN creation *without* using target volumes file (.fct)

On DS8000 and SAN Volume Controller storage systems, use the TARGET_SETS parameter to specify the target volumes file (VOLUMES_FILE) or a directory that contains multiple target volumes files (VOLUMES_DIR). The VOLUMES_FILE can be used to share a target volume file between multiple device classes by restricting a target set to a specific DEVICE_CLASS. On a partitioned DB2 environment, use the VOLUMES_FILE parameter to create target set definitions for specific PARTITION sections. This setting is required when two partitions are accessing the same TARGET_SET during a single backup operation.

To further simplify target mapping on SAN Volume Controller, the TARGET_NAMING parameter allows a naming convention to be specified for the target volumes. This enables IBM Tivoli Storage FlashCopy Manager to map source volumes to suitable target volumes without requiring the storage administrator to manually list all targets in the target volumes file.

IBM Tivoli Storage FlashCopy Manager uses the following criteria to associate a target volume to a source volume:

- The source volume and target volume must be located in the same storage system.
- The source volume and target volume must have the same size.

IBM Tivoli Storage FlashCopy Manager selects a target volume to be validated as a suitable target volume for the given source volume depending on the value of the parameter TARGET_SETS:

- SAN Volume Controller only: The TARGET_NAMING parameter naming convention specified:

  The following sample explains the usage of the naming convention specified by the TARGET_SETS and TARGET_NAMING parameters:

  – Assuming the source volumes are named `A01pro_1` and `A01pro_2`
  – Assuming the TARGET_SETS profile parameter has a value of 1
  – Assuming the TARGET_NAMING parameter value as %SOURCE_t %TARGETSET

  Using this target naming definition, the source volume `A01pro_1`, with target set named 1, results in target volume `A01pro_1_t1`, and source volume `A01pro_2` results in the target volume `A01pro_2_t1`.
- VOLUMES_FILE and VOLUMES_DIR:

  In both cases a target volumes file (.fct) must be specified.

  As a minimum, a list of target volumes must be specified in the target volumes file. The source volumes and the size are both optional. If no source is specified,

then IBM Tivoli Storage FlashCopy Manager first checks for each of the specified target volumes, if a FlashCopy relation exists between these target volumes and one of the source volumes. If a FlashCopy relation exists, it is reused for the next FlashCopy backup. If no FlashCopy relation exists to one of the source volumes, a new relation between one source volume and this target is created with the next FlashCopy backup. In the latter case, the created source-target pairs are unpredictable because they depend on the order of the target volumes listed in the target volumes file and also on the order of the source volumes as they occur in the operating system.

If you want predefined source-target pairs, you must either specify the dedicated source volume for each of the target volumes in the target volumes file, or all FlashCopy relations must already exist in the storage system before the start of the FlashCopy backup.

This example shows the syntax of target volumes files specified by the VOLUMES_DIR parameter:

```
>>> VOLUMES_SET_<name>
STORAGE_SYSTEM_ID <id of the storage cluster>
TARGET_VOLUME <target> [<source>] [<size>]
[...]
<<<

[...]
```

This example shows the syntax of target volumes files 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>]
   [...]
   <<<
   [...]

<<<

[...]
```

In SAP on DB2 multi-partition environments (especially when migrating from Tivoli Storage Manager for Advanced Copy Services 5.4), some (or all) database files of the DB2 partitions of one production server can be allocated in the same volume groups and on the same source volumes on the storage system. This is referred to as volume sharing. IBM Tivoli Storage FlashCopy Manager supports volume when the TARGET_SETS profile parameter is set to VOLUMES_FILE and the PARTITION_GROUP parameter is specified in the DEVICE_CLASS. This is an example of such a configuration:

```
<ACS_DIR>/profile:
...
>>> DEVICE_CLASS STANDARD
...
PARTITION_GROUP GROUP_A 0 1
PARTITION_GROUP GROUP_B 2 3
...
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE <ACS_DIR>/acsvolumes/volumes_file.fct
<<<

<ACS_DIR>/acsvolumes/volumes_file.fct:
>>> TARGET_SET 1
>>> PARTITION GROUP_A
TARGET_VOLUME J01acs_td_0
TARGET_VOLUME J01acs_tl_0
TARGET_VOLUME J01acs_td_1
TARGET_VOLUME J01acs_tl_1
...
<<< PARTITION GROUP_A

>>> PARTITION GROUP_B
TARGET_VOLUME J01acs_td_2
TARGET_VOLUME J01acs_tl_2
TARGET_VOLUME J01acs_td_3
TARGET_VOLUME J01acs_tl_3
...
<<< PARTITION GROUP_B
<<< TARGET_SET 1

>>> TARGET_SET 2

...
<<< TARGET_SET 2
```

If you migrated data from Tivoli Storage Manager for Advanced Copy Services 5.5 (or later) to IBM Tivoli Storage FlashCopy Manager, the VOLUMES_DIR parameter remains effective. However, specifying TARGET_SETS VOLUMES_FILE and setting the VOLUMES_FILE parameter is the preferred method for specifying the target volumes file.

To further simplify target mapping on SAN Volume Controller, the TARGET_SETS parameter allows a naming convention to be specified for your target volumes. This enables IBM Tivoli Storage FlashCopy Manager to map source volumes to suitable target volumes without requiring the storage administrator to manually list all targets in the target volumes file.

In an AIX LVM mirroring environment, the storage system ID of the cluster to which the DS8000 or SAN Volume Controller storage system refers must be specified in the target volumes file with the STORAGE_SYSTEM_ID parameter. However, when either TARGET_SETS VOLUMES_FILE or TARGET_SETS *list of target set names* is specified, the STORAGE_SYSTEM_ID parameter must be specified in the DEVICE_CLASS.

Related reference

"IBM Tivoli Storage FlashCopy Manager profile parameters" on page 123

"Target volume parameter settings (DS8000 configuration)" on page 188

"Target volume parameter settings (SAN Volume Controller configuration)" on page 189

Target volume parameter settings (DS8000 configuration)

Each target volume planned for use must be specified by its serial number.

A snapshot backup operation looks for either a source volume and target volume correlation, or a target-volume-only specification.

Table 45. Parameters of the 'VOLUMES_SET_x' Topic (DS8000)

Parameter Name	Value

TARGET_VOLUME
<target volume serial number>
<source volume serial number>
<source volume size>
	A target set definition file contains a list of target volumes that are organized into target sets. IBM Tivoli Storage FlashCopy Manager attempts to match source volumes to suitable targets within a target set during backup. To determine source target relations in advance, specify a source serial number with a target serial number in the target set definition file. In this situation, the relation between the source and target is required and backup processing fails if one of the targets is unavailable for the specified source.
	
	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.
	`TARGET_VOLUME 75924811001 75924811011 Size=2.0_GB`
	
	The source serial number and the size can be omitted completely or dashes can be entered in both fields as placeholders, as shown in the following example:
	`TARGET_VOLUME 75924811001 - -`
	
	The dashes will be ignored. Note the target volume requirements for a FlashCopy:
	• The size must be the same as that of the source volume
	• The source and target volumes that are listed in one TARGET_SET must be in the same storage subsystem
	
	Note: Do not change the order of the parameters (target volume serial number, source volume serial number, size of source volume).
	
	See “Managing target volumes by storage system” on page 184 for detailed information about the criteria that are used to associate a target volume to a source volume.

The FLASHCOPY_TYPE parameter is only valid for DS8000 and SAN Volume Controller. If it becomes necessary to make any of these changes:

- 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 IBM Tivoli Storage FlashCopy Manager snapshot backups” on page 91 with the force option.

Related reference

“Example target volumes file (DS8000 configuration)” on page 215

Target volume parameter settings (SAN Volume Controller configuration)

Each target volume planned for use must be specified by its virtual disk name.

A snapshot backup operation looks for either a source volume and target volume correlation, or a target-volume-only specification.

Table 46. Parameters of the 'VOLUMES_SET_x' Topic (SAN Volume Controller)

Parameter Name	Value

TARGET_VOLUME
<target volume virtual disk name>
<source volume virtual disk name>
<source volume size>
	A target set definition file contains a list of target volumes that are organized into target sets. IBM Tivoli Storage FlashCopy Manager attempts to match source volumes to suitable targets within a target set during backup. To determine source target relations in advance, specify a source virtual disk name with a target virtual disk name in the target set definition file. In this situation, the relation between the source and target is required and backup processing fails if one of the targets is unavailable for the specified source.
	
	This example shows a configuration where the SAN Volume Controller source volume with virtual disk name svdfsrc4 must be used in a FlashCopy with the target volume with virtual disk name svdftgt4.
	`TARGET_VOLUME svdftgt4 svdfsrc4 Size=2.0_GB`
	
	The source virtual disk name and the size can be omitted completely or dashes can be entered in both fields as placeholders, as shown in the following example:
	`TARGET_VOLUME svdftgt4 - -`
	
	The dashes will be ignored. Note the target volume requirements for a FlashCopy:
	• the size must be the same as that of the source volume
	• the source and target volumes that are listed in one TARGET_SET must be in the same SAN Volume Controller cluster.
	
	Note: Do not change the order of the parameters (target volume name, source volume name, size of source volume).
	
	See “Managing target volumes by storage system” on page 184 for detailed information about the criteria that are used to associate a target volume to a source volume.

The FLASHCOPY_TYPE parameter is only valid for DS8000 and SAN Volume Controller. If it becomes necessary to make any of these changes:

- 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 IBM Tivoli Storage FlashCopy Manager snapshot backups” on page 91 with the force option.

Note: SAN Volume Controller 5.1 (or later): IBM Tivoli Storage FlashCopy Manager only allows the deletion of FlashCopy mappings that are not dependent on other FlashCopy mappings. As a result, 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, then the background

operation that actually deletes the mappings is delayed until all older backups are also deleted or are reused by a new backup request.

Example:

This is a typical SE 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

"Example target volumes file (SAN Volume Controller configuration)" on page 218

Target set handling for cloning

Cloning operations require specific settings for target sets.

The TARGET_SETS profile parameter identifies the target volumes to be used in the FlashCopy operation. This parameter must be specified in the device class section of the profile. You can specify one of these values with cloning operations:

VOLUMES_FILE *name of the target volumes file (.fct)*
Specify the name of the target volumes file (.fct). The USE_FOR_CLONING *list of clone database names* statement identifies the correct target set to use for a specific clone database name. When more than one clone database name is specified in the list, the referenced target set is used for all specified clone database names. In this situation, the target set must only be used by those clone databases identified in the list. The USE_FOR_CLONING list of clone database names must be specified in the target volumes file.

TARGET_NAMING *string with wildcards %SOURCE* **USE_FOR_CLONING** *list of clone database names*
Available for SAN Volume Controller only. Specify the naming convention for target volumes. Whenever a backup volume is required at backup time, IBM Tivoli Storage FlashCopy Manager has already determined the name of the target set for the current operation and the name of the source volume to be backed up. The name of the volume storing the backup is the name specified when the string `%SOURCE` is replaced with the respective value in the current operation. The required USE_FOR_CLONING *list of clone database names* statement identifies the correct target set to use for a specific clone database name. When more than one clone database name is specified in the list, the referenced target set is used for all specified clone database names. In this situation, the target set must only be used by those clone databases identified in the list. The USE_FOR_CLONING list of clone database names must be

specified with the TARGET_NAMING parameter itself. It is possible to have multiple TARGET_NAMING entries in the device class where each represents a different clone database name.

Restriction: SAN Volume Controller 5.1: When a new backup is started on a target volume that is not the oldest in the chain, SAN Volume Controller stops all mappings to older target volumes. When a restore is requested from a target volume that is not the youngest in the chain, SAN Volume Controller stops all mappings to newer target volumes. When a mapping to a target volume stops in either of these situations, this target volume immediately goes offline if any of these conditions exist:

- The target volume is a space efficient volume.
- The mapping was for an incremental copy that was ongoing.
- The mapping was for a full copy that was ongoing.

As a result, the target volumes for the production database to be cloned, and the target volumes for the FlashCopy backup of the same database, must not reside on the same SAN Volume Controller cluster. If you are cloning databases in an AIX Logical Volume Mirroring (LVM) environment, use FlashCopy cloning on one of the SAN Volume Controller clusters and FlashCopy backup on the other SAN Volume Controller cluster. Do not to use space efficient target volumes for cloning.

Target volumes file (.fct) cloning examples

The target volumes file (specified by the VOLUMES_FILE parameter) must have the following syntax (for multi-partition DB2):

```
>>> TARGET_SET target set name
 DEVICE_CLASS <device classes> USE_FOR_CLONING <list of clone database names>
   # this parameter is mandatory for FlashCopy Cloning and allows to
   # restrict the use of this target set to a specific device class
   # and to a specific clone database name or a list of clone database names
 >>> PARTITION name of partition
   # e.g. NODE0000 for partition 0 or NODE0001 for partition 1, ...
   # or the name of a PARTITION_GROUP
  TARGET_VOLUME target [source] [size]
 [...]
 <<<
 [...]
<<<
[...]
```

The target volumes file (specified by the VOLUMES_FILE parameter) must have the following syntax (single partition DB2 and Oracle):

```
>>> TARGET_SET target set name
 DEVICE_CLASS <device classes> USE_FOR_CLONING <list of clone database names>
   # this parameter is mandatory for FlashCopy Cloning and allows to
   # restrict the use of this target set to a specific device class
   # and to a specific clone database name
 TARGET_VOLUME target [source] [size]
 [...]
<<<
[...]
```

Tivoli Storage Manager option files for native Oracle

Tivoli Storage Manager provides these options to assist with setting up the native Oracle environment.

Tivoli Storage Manager option files used by Data Protection for Oracle

Be aware of the names and locations of these Tivoli Storage Manager option files when using Data Protection for Oracle.

- Client system options (dsm.sys)
- Client user options (dsm.opt)
- Data Protection for Oracle options (tdpo.opt)
- RMAN backup script

Files for IBM Tivoli Storage FlashCopy Manager

Be aware of the names and locations of these IBM Tivoli Storage FlashCopy Manager option files.

- Client system options (dsm.sys)
- IBM Tivoli Storage FlashCopy Manager profile (<ACS_DIR>/profile

Configuration files used for cloning

Information is provided about configuration files for use with FlashCopy cloning.

Tivoli Storage FlashCopy Manager uses preprocessing and postprocessing configuration files during cloning operations (for example `/oracle/P01/acs/preprocessing.ini`). The functions that are provided by the processing scripts depend on the cloning environment where they are issued. All processing configuration files and the scripts that are defined in the configuration files must meet the following requirements:

- They must exist on the clone system.
- They must have a minimum permission of read and execute access for the clone database instance owner. The preprocessing and postprocessing scripts must have a minimum permission of read and execute access for the user who owns the scripts and who is the operator of the scripts. Furthermore, if the scripts are intended to be run by any user registered on the system, the scripts must be owned by the root user and the must have a minimum permission of read and execute for the User, Group, and World user group.
- They must have a minimum permission of read access for the production database instance owner.

Attention: A write access level for the World user group must not be granted. Such access might cause a security exposure.

When you add processing configuration files, place each script on a separate line as shown in this example:

```
/oracle/P01/acs/scripts/PreProcessing_stopsap.sh
/oracle/P01/acs/scripts/PreProcessing_stopdb.sh
```

Both processing configuration files support embedded user comments. A comment line in the configuration file is denoted by the number sign character (#). The scripts must be specified with fully qualified file names. Each line of the processing

configuration file represents one processing script. The Tivoli Storage FlashCopy Manager Offload Agent (tsm4acs) uses these arguments and their values when calling the scripts:

DBNAME_PROD
The database name on the production system.

DBNAME_CLONE
The database name on the cloning system.

DBHOST_PROD
The host name of the production system.

DBHOST_CLONE
The host name of the cloning system.

CLONE_TIMESTAMP
The timestamp when the clone was created. This entry is also the time when the production database is suspended and the FlashCopy operation begins. The timestamp format is `YYYYMMDDhhmmss`. During preprocessing, the timestamp identifies when the previous FlashCopy clone was created. During postprocessing, the timestamp identifies when the current FlashCopy clone was created.

SCHEMA
The database schema of the production database as specified by the profile parameter DATABASE_SCHEMA. Depending on SAP Kernel release, this schema is `SAPR3` or `SAPDBname`.

You can use the following processing scripts:

- SQL scripts (DB2 SQL or Oracle SQL) with the extension `.sql`.
- Shell scripts with the extension `.sh`. Shell scripts can be started by a database user who is different from the clone database user. This feature is useful in certain situations. For example, when installing the SAP® license for the cloned SAP® system, start the postprocessing shell script as the SAP® administration user *sid*`adm`:

  ```
  scripts/PostProcessing_saplicense.sh:c01adm
  ```

  By adding `:c01adm` to the script file name, the script runs as user `c01adm` instead of user `orac01` or `db2c01`. This addition requires that the owner of the script to be identical to the user who is intended operator of the script (`c01adm` in this example). The only exception is if a preprocessing or postprocessing script is owned by the 'root' user, which indicates that the script can be executed by any user registered on the system.

The processing scripts that are defined in the processing configuration files are executed sequentially. The return code of each script is validated and have these values:

- RC=0: Processing ended successfully. Continue cloning if it was the last script to be executed or continue with the next script.
- RC=1: Processing ended successfully with warning. Continue cloning if it was the last script to be executed or continue with the next script.
- RC=2: Processing terminated with error. Stop cloning immediately without executing further scripts.

The return code for each script is written to the cloning log files. The output is written to dedicated log files with these file names:

```
clone_preproc.<timestamp>
clone_postproc.<timestamp>
```

Processing example: cloning configuration files

In the following processing example, the production database is named P01, and the clone database is named C01:

```
./fcmcli -f preproc_clone -u db2c01 -C C01 -X /oracle/C01/acs/preprocessing.ini
./fcmcli -f postproc_clone -u db2c01 -C C01 -Y /oracle/C01/acs/postprocessing.ini
```

If a processing script needs additional command-line options, add these options to each line of the configuration file. In this example, the additional command-line argument LC01 is added to the script entry in the configuration file:

```
/oracle/C01/acs/scripts/PostProcessing_startListener.sh LC01
```

IBM Tivoli Storage FlashCopy Manager (fcmcli) calls the processing script with the six above listed default arguments first, and calls the additional command-line options next. In this example, the additional command-line argument LC01 is passed to the PostProcessing_startListener.sh script as the seventh argument:

```
#!/bin/ksh
# FOLLOWING ACTIONS ARE PERFORMED ---------------------------------------------
# start the Oracle Listener

DBNAME_PROD=$1
DBNAME_CLONE=$2
DBHOST_PROD=$3
DBHOST_CLONE=$4
CLONE_TIMESTAMP=$5

# ${SCHEMA} is schema owner (for SAP Kernel > 6.10, for userid other than SAPR3)
SCHEMA=$6
SCHEMA=$(echo ${SCHEMA} | tr [a-z] [A-Z])

# ${LISTENER} is the name of the listener to be started (taken from listener.ora)
LISTENER=$7

lsnrctl start ${LISTENER}
```

If a DB2 SQL script needs additional command-line options, use a shell script as a wrapper with the DB2 SQL commands. Tivoli Storage FlashCopy Manager requires that the DB2 SQL script use a semicolon (;) delimiter. If another delimiter character is specified, use another shell script wrapper that calls the DB2 SQL script with the correct delimiter character in the command-line entry. This example shows a shell script wrapper that specifies the correct delimiter character:

```
#/bin/ksh
DELIMITER=#
db2 -td${DELIMITER} -svf PostProcessing_script1.sql
```

Key files and directories

Certain files and directories are of considerable importance when using IBM Tivoli Storage FlashCopy Manager.

The following tables show the major files and directories involved when using IBM Tivoli Storage FlashCopy Manager in the various database configurations:

Table 47. Key Files and Directories (DB2)

Directory or File	Environment Variable, Vendor Option, Profile Parameter or Option	Default or Recommended Location	Examples and Remarks
DB2 installation directory	DB2DIR	/opt/IBM/db2/<version> or /opt/ibm/db2/<version>	/opt/IBM/db2/V9.5 Applies to a 'root' installation.
Home directory of DB2 database manager instance owner	HOME, INSTHOME	/home/<DB2 instance owner> or /db2/<DB2 instance owner>	/home/db2inst1
DB2 instance directory		$HOME/sqllib	/home/db2inst1/sqllib
IBM Tivoli Storage FlashCopy Manager installation directory		• (AIX): `/usr/tivoli/tsfcm/acs_2.2.0.0` • (Linux): `/opt/tivoli/tsfcm/acs_2.2.0.0` • (Solaris): `/opt/tivoli/tsfcm/acs_2.2.0.0`	/usr/tivoli/tsfcm/*acs_2.2.0.0*
IBM Tivoli Storage FlashCopy Manager working directory	ACS_DIR	Recommended by installer: <DB2 instance owner $HOME directory>/acs	/home/db2inst1/acs
Log/trace directory		<ACS_DIR>/logs	/home/db2inst1/acs/logs See "Log and trace files summary" on page 234.
IBM Tivoli Storage FlashCopy Manager shared directory		<ACS_DIR>/shared	/home/db2inst1/acs/shared
Password file		<ACS_DIR>/shared/pwd.acsd	See "IBM Tivoli Storage FlashCopy Manager password file" on page 183.
Snapshot backup library		libacsdb2.a or libacsdb2.so	
IBM Tivoli Storage FlashCopy Manager license file		<DB2 instance directory>/acs/tsmacs.lic	
Profile	PROFILE -p profile	Recommended by installer: $HOME/acs/profile with link to this file from <DB2 instance directory>/acs/profile	**Profile:** /home/db2inst1/acs/profile **Link:** /home/db2inst1/sqllib/acs/profile –> /home/db2inst1/acs/profile
Target volumes file directory	VOLUMES_DIR	Default: None. Recommended by installer: $HOME/acs/acsvolumes	/home/db2inst1/acs/acsvolumes Recommended not to reside in <DB2 instance directory> See notes.

Table 47. Key Files and Directories (DB2) (continued)

Directory or File	Environment Variable, Vendor Option, Profile Parameter or Option	Default or Recommended Location	Examples and Remarks
Target volumes file	VOLUMES_FILE	Default: None. Recommended not to reside in <DB2 instance directory>	See notes.
IBM Tivoli Storage FlashCopy Manager repository directory	ACS_ REPOSITORY	Default: None. Recommended by installer: $HOME/acs/acsrepository	/home/db2inst1/acs/acsrepository Recommended not to reside in <DB2 instance directory> See notes.
Target volumes file(s)		<VOLUMES_DIR>/<filename>	See notes and "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183.

Note:

1. By convention, the DB2 instance will be created in $HOME of the DB2 instance owner.
2. The directory specified by ACS_REPOSITORY will be created by IBM Tivoli Storage FlashCopy Manager and must not exist at the time of initial configuration. The path to this directory must exist, however.

Table 48. Key Files and Directories (Oracle)

Directory or File	Environment Variable, Vendor Option, Profile Parameter or Option	Default or Recommended Location	Examples and Remarks
Tivoli Storage FlashCopy Manager installation directory		• (AIX): `/usr/tivoli/tsfcm/acs_2.2.0.0` • (Linux): `/opt/tivoli/tsfcm/acs_2.2.0.0` • (Solaris): `/opt/tivoli/tsfcm/acs_2.2.0.0`	/usr/tivoli/tsfcm/*acs_2.2.0.0*
Tivoli Storage FlashCopy Manager working directory	ACS_DIR	Recommended by installer: $HOME/acs, where $HOME is the home directory of the Oracle instance owner ora<SID>, where <SID> is the value of ORACLE_SID.	/oracle/C21/acs
Log/trace directory		<ACS_DIR>/logs	/oracle/C21/acs/acs/logs See "Log and trace files summary" on page 234.
Tivoli Storage FlashCopy Manager shared directory		<ACS_DIR>/shared	/oracle/C21/acs/shared
Password file		<ACS_DIR>/shared/pwd.acsd	See "IBM Tivoli Storage FlashCopy Manager password file" on page 183.
Tivoli Storage FlashCopy Manager license file		<ACS_DIR>/tsmacs.lic	/oracle/C21/acs/tsmacs.lic

Table 48. Key Files and Directories (Oracle) (continued)

Directory or File	Environment Variable, Vendor Option, Profile Parameter or Option	Default or Recommended Location	Examples and Remarks
Profile	PROFILE -p profile	Recommended by installer: $HOME/acs/profile with link to this file from <Oracle instance directory>/acs/profile	Profile: /oracle/C21/acs/profile
SAP® Backint profile		Default: $ORACLE_HOME/dbs/init<DBSID>.utl	/oracle/C21/102_64/dbs/initC21.utl (SAP® with Oracle only)
SAP® BR*Tools profile		Default: $ORACLE_HOME/dbs/init<DBSID>.sap	/oracle/C21/102_64/dbs/initC21.sap (SAP® with Oracle only)
Target volumes file directory	VOLUMES_ DIR	Default: None. Recommended by installer: $HOME/acs/acsvolumes	/oracle/C21/acs/acsvolumes See notes.
Target volumes file	VOLUMES_FILE	Default: None. Recommended not to reside in $HOME/acs/acsvolumes	
Tivoli Storage FlashCopy Manager repository directory	ACS_ REPOSITORY	Default: None. Recommended by installer: $HOME/acs/acsrepository	/oracle/C21/acs/repository See notes.
Target volumes file(s)		<VOLUMES_DIR>/<filename>	See notes and "IBM Tivoli Storage FlashCopy Manager target volumes file" on page 183.
Data Protection for Oracle options file (tdpo.opt)		Default: None. Its location must be specified in the RMAN script that is used to perform the backup.	Native Oracle only See http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/topic/com.ibm.itsmfd.doc/ab5u000444.htm in the *IBM Tivoli Storage Manager for Databases: Data Protection for Oracle for UNIX and Linux Installation and User's Guide* for more information.
Tivoli Storage Manager client system options file (dsm.sys)		Default for AIX: /usr/tivoli/tsm/client/api/bin64/dsm.sys Default for Linux and Solaris: /opt/tivoli/tsm/client/api/bin64/dsm.sys	
Tivoli Storage Manager client user options files (dsm.opt)		Default for AIX: /usr/tivoli/tsm/client/api/bin64/dsm.opt Default for Linus and Solaris: /opt/tivoli/tsm/client/api/bin64/dsm.opt	
Note: The directory specified by ACS_REPOSITORY will be created by IBM Tivoli Storage FlashCopy Manager and must not exist at the time of initial configuration. The path to this directory must exist, however.			

Table 49. Key Files and Directories (Custom Applications)

Directory or File	Environment Variable, Vendor Option, Profile Parameter or Option	Default or Recommended Location	Examples and Remarks
Tivoli Storage FlashCopy Manager installation directory		• (AIX): `/usr/tivoli/tsfcm/acs_2.2.0.0` • (Linux): `/opt/tivoli/tsfcm/acs_2.2.0.0` • (Solaris): `/opt/tivoli/tsfcm/acs_2.2.0.0`	
Tivoli Storage FlashCopy Manager working directory	ACS_DIR	Recommended by configuration wizard: $HOME/acs	
Log/trace directory		<ACS_DIR>/logs	/home/db2inst1/acs/logs See "Log and trace files summary" on page 234.
Profile	-p profile	Recommended by installer: $HOME/acs/profile	
Tivoli Storage FlashCopy Manager repository directory	ACS_ REPOSITORY	Default: None. Recommended by installer: $HOME/acs/acsrepository	
Target volumes file	VOLUMES_FILE	Default: None.	
Tivoli Storage Manager client system options file (dsm.sys)		Default for AIX: /usr/tivoli/tsm/client/ api/bin64/dsm.sys Default for Linux and Solaris: /opt/tivoli/tsm/client/api/bin64/dsm.sys	
Tivoli Storage Manager client user options files (dsm.opt)		Default for AIX: /usr/tivoli/tsm/client/ api/bin64/dsm.opt Default for Linux and Solaris: /opt/tivoli/tsm/client/api/bin64/dsm.opt	
Note: The directory specified by ACS_REPOSITORY will be created by IBM Tivoli Storage FlashCopy Manager and must not exist at the time of initial configuration. The path to this directory must exist, however.			

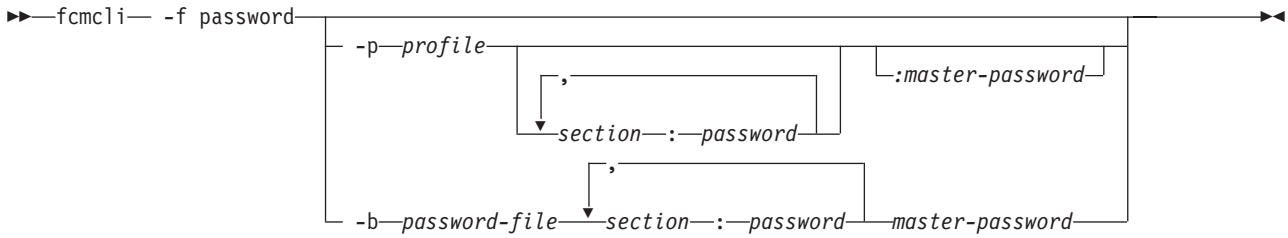
Appendix A. IBM Tivoli Storage FlashCopy Manager command line specification

The syntax of all IBM Tivoli Storage FlashCopy Manager commands are listed.

See Chapter 5, "IBM Tivoli Storage FlashCopy Manager commands and scripts," on page 73 for explanations of the options listed here.

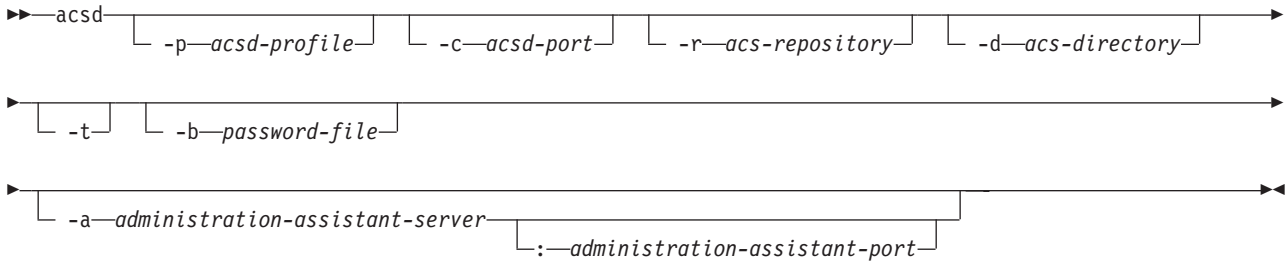
fcmcli -f password

See "Password administration" on page 102 for more information about the fcmcli -f password command.



acsd

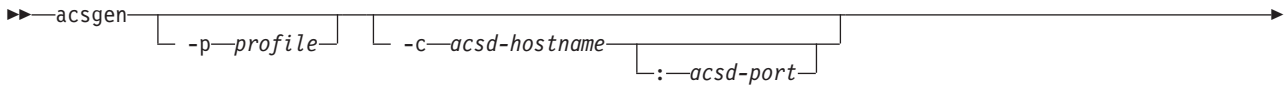
See "Management Agent (acsd)" on page 105 for more information about the acsd command.



Syntax for obtaining version or help information:

acsgen

See "Generic Device Agent (acsgen)" on page 107 for more information about the acsgen command.



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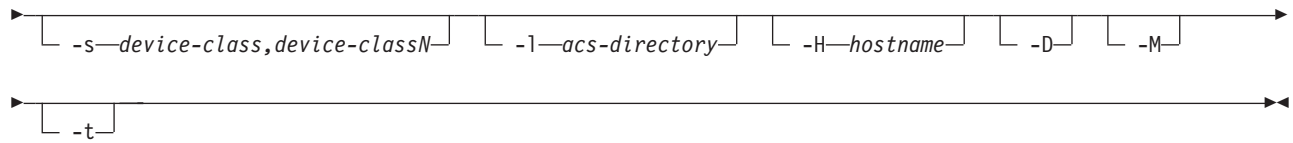


fcmcli -f used_capacity

See “Query Managed Capacity (fcmcli -f used_capacity)” on page 104 for more information about the fcmcli -f used_capacity command.

```
fcmcli -f used_capacity -p profile [-c]
```

acsora

See “acsora - User interface for Oracle in non-SAP environments” on page 81 for more information about the acsora command.

```
acsora [-p profile] -f <function> [-B backupID] [-F]

where <function> is one of:
        backup
        restore
        delete
        inquire
        inquire_detail
```

acsutil

See “acsutil - Snapshot Object Manager for Oracle” on page 85 for more information about the acsutil command.

```
acsutil [-p <profile>]
```

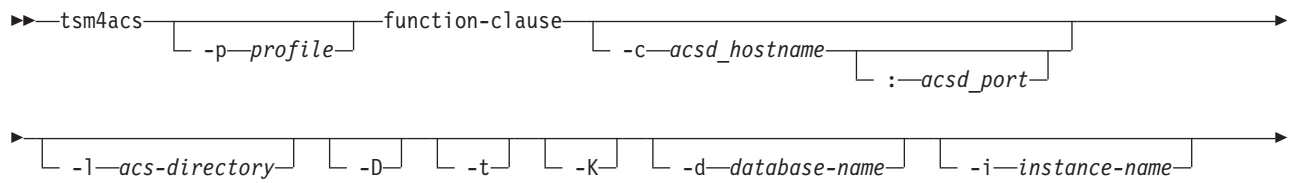
backint

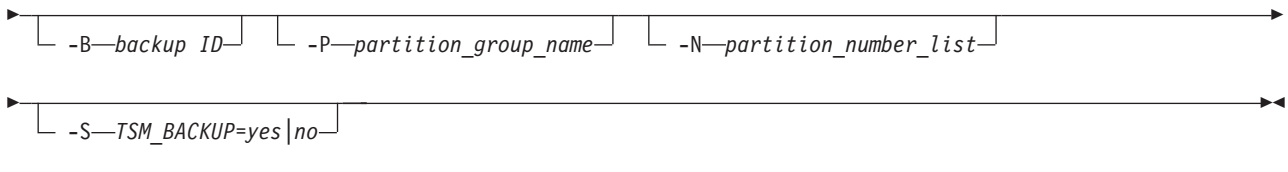
See “BR*TOOLS - User interface for Oracle in SAP environments” on page 83 for more information about the backint command.

```
backint  [-p profile]
         -f <function>
         -t <backup_type>
         [-F]
```

tsm4acs

See “Offload Agent (tsm4acs)” on page 111 for more information about the tsm4acs command.



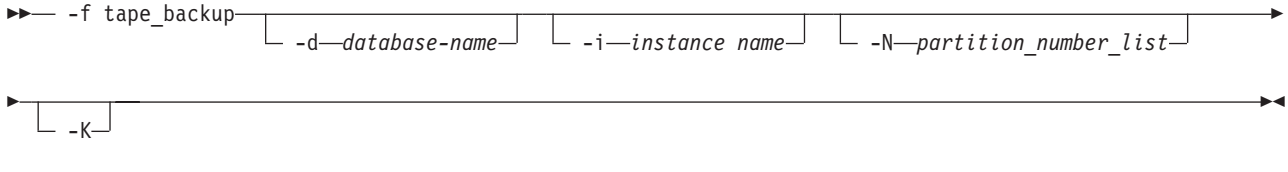


The values for the `function-clause` parameter are described in the following sections.

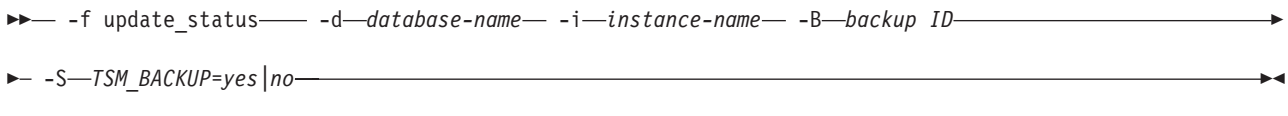
function-clause: FlashCopy offload operations

In a DB2 environment, the installation of IBM Tivoli Storage FlashCopy Manager enables the offload functionality that otherwise is not available for the built-in snapshot backup functionality that is shipped with DB2.

The following functions are supported by the tsm4acs command option -f 'function':



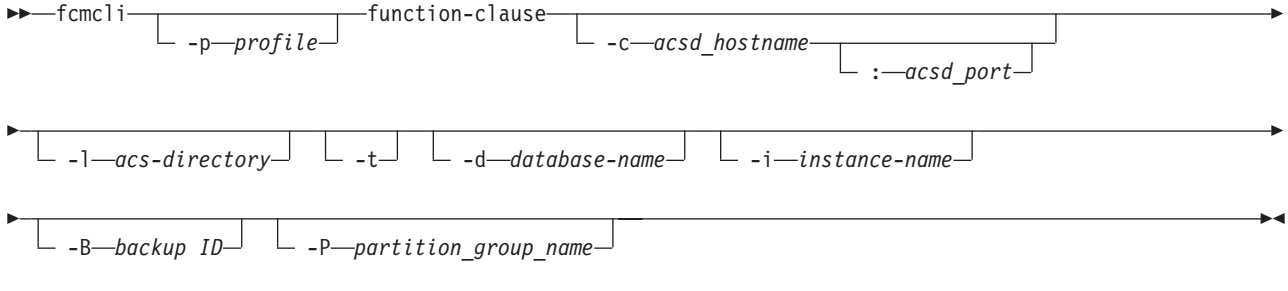
The function 'update_status' is supported by the tsm4acs command:



fcmcli

See the following topics for more information about the fcmcli command:

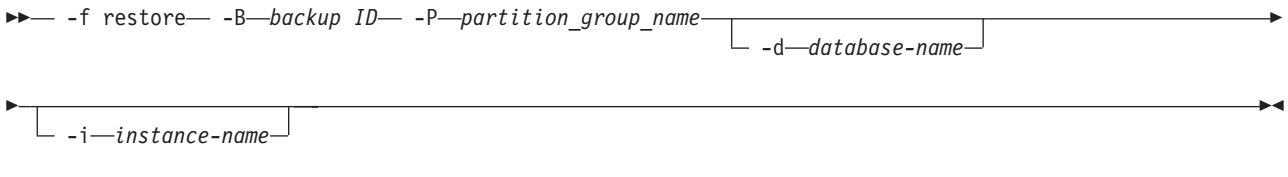
- "Backup and restore commands for DB2" on page 73
- "Backup and restore commands for custom applications" on page 87
- "Tivoli Storage FlashCopy Manager cloning commands" on page 93
- "Mounting and unmounting snapshots on a secondary system" on page 108



The values for the `function-clause` parameter are described in the following sections.

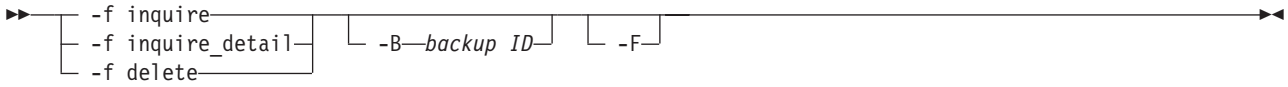
function-clause: FlashCopy operations of DB2 with partition group

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy restores of DB2 with partition group:



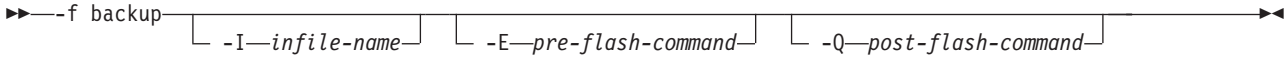
function-clause: FlashCopy operations of DB2 with and without partition group

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy inquire and delete of DB2:

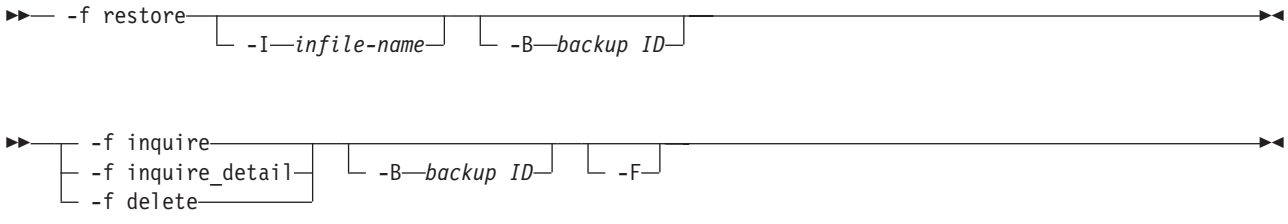


function-clause: FlashCopy operations of custom applications

The following functions are supported by the fcmcli command option -f 'function' for IBM Tivoli Storage FlashCopy Manager for Custom Applications backups of custom applications:

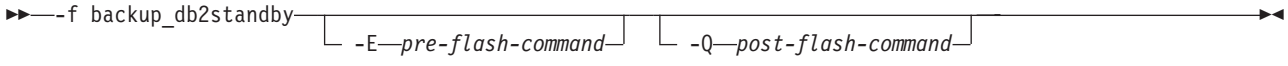


The following functions are supported by the fcmcli command option -f 'function' for FlashCopy restores, inquire, and delete of custom applications:

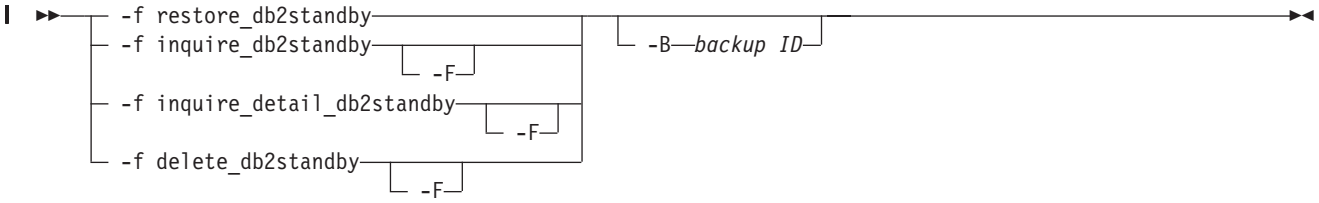


function-clause: FlashCopy operations of DB2 HADR databases

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy backups of DB2 HADR databases:

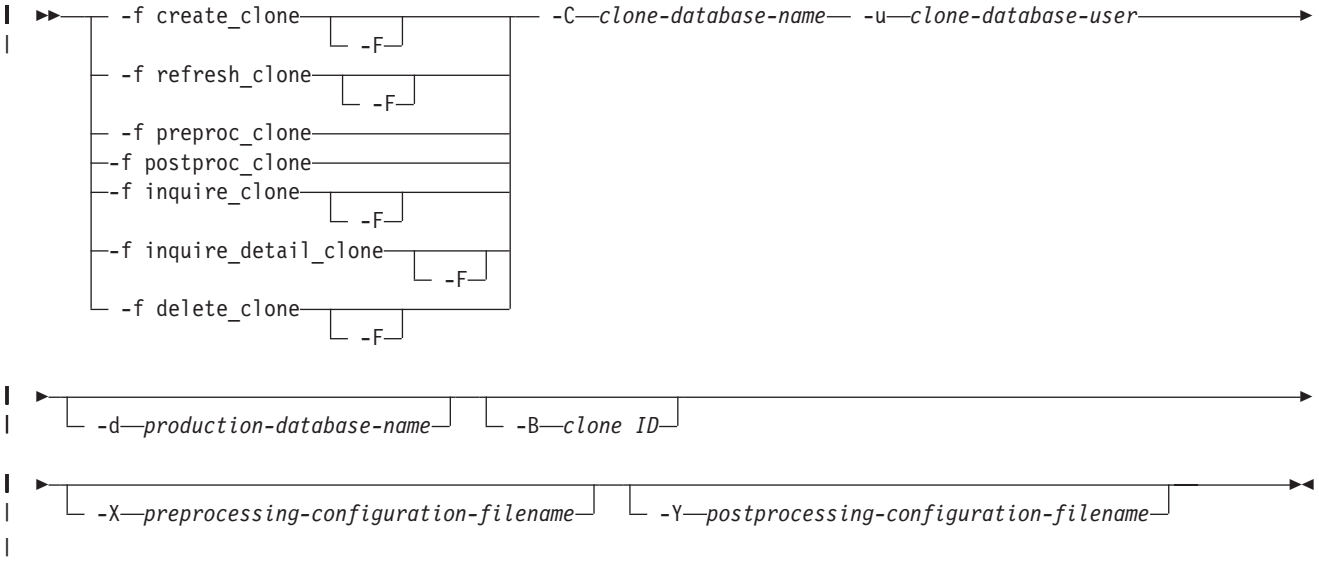


The following functions are supported by the fcmcli command option -f 'function' for FlashCopy restore, inquire, and delete of DB2 HADR databases:



function-clause: FlashCopy cloning operations

The following functions are supported by the fcmcli command option -f 'function' for FlashCopy cloning operations:



Appendix B. IBM Tivoli Storage FlashCopy Manager examples

Refer to these IBM Tivoli Storage FlashCopy Manager examples when configuring, updating, or performing product tasks.

Examples (DB2)

Example overall disk layout for a DB2 environment

Refer to this example when configuring the disk layout for a DB2 environment.

The following figure shows file systems involved in an example disk layout.

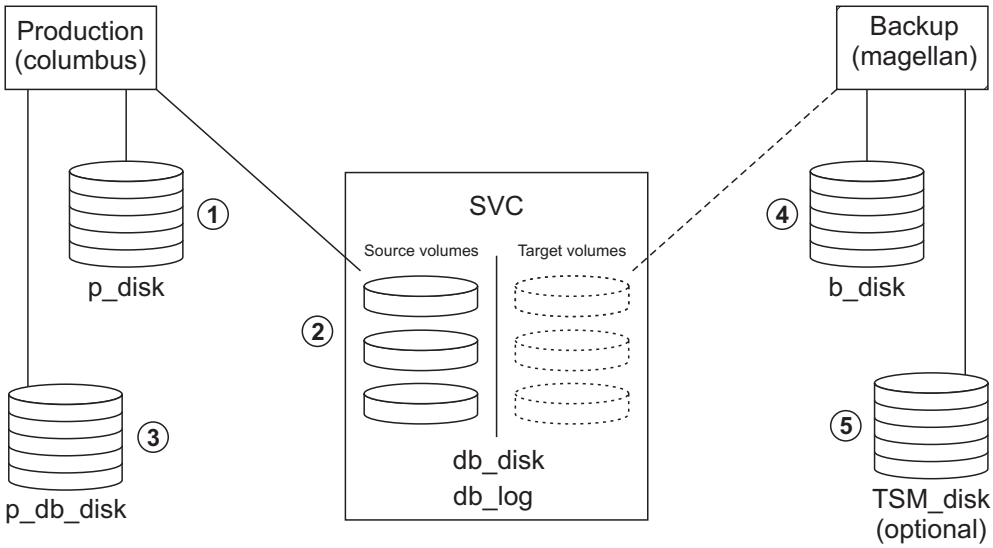


Figure 10. Example overall disk layout for a DB2 environment

The respective disk categories contain the following disk types that are used for the various file systems:

1. Local disks on the production system (p_disk category) for the file systems

   ```
   /db2/D01
   /db2/D01/db2dump
   /db2/D01/db2event
   /db2/D01/sqllib
   /sapmnt/D01
   /usr/sap/D01
   /usr/sap/trans
   /opt/IBM/db2/V9.5
   /db2/D01/acs (ACS_DIR)
   ```

2. Source volume disks on the production system (db_disk category) for the file systems

   ```
   /db2/D01/sapdata1
   /db2/D01/sapdata2
   /db2/D01/sapdata3
   /db2/D01/sapdata4
   /db2/D01/sapdata5
   /db2/D01/sapdata6
   /db2/D01/sapdatat
   /db2/D01/db2d01
   ```

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Source volume disks on the production system (db_log category) for the file system

```
/db2/D01/log_dir
```

3. Local disks on the production system (p_db_disk category) for the file systems

```
/db2/D01/log_archive
/db2/D01/log_retrieve
```

4. Local disks on the backup system (b_disk category) for the file systems

```
/db2/D01
/opt/IBM/db2/V9.5
/db2/D01/acs (ACS_DIR)
```

5. Disks for the Tivoli Storage Manager server (TSM_disk category) for the file systems

```
/tsmdb
```

Example profile for IBM Tivoli Storage FlashCopy Manager for DB2

Refer to this example when editing the IBM Tivoli Storage FlashCopy Manager profile.

The following depicts a sample profile used for a DB2 DPF environment. It only performs snapshots from 06am to 8pm and snapshots with off-loaded backups for the remaining time. These off-loaded backups use two different SAN Volume Controller clusters, one from 00am to 6am and the other cluster from 8pm to 12pm. Each cluster is backed up by a separate backup system, even though that fact is not obvious in the example.

```
>>> GLOBAL
ACS_DIR /db2/D01/acs
ACSD acsprod5 57328
TRACE NO
<<<
>>> ACSD
ACS_REPOSITORY /db2/D01/acs/acsrepository
# ADMIN_ASSISTANT NO
# REPOSITORY_LABEL TSM
<<<
>>> OFFLOAD
BACKUP_METHOD DB2
OPTIONS @/db2/D01/tdp_r3/vendor.env
# PARALLELISM AUTO
# NUM_SESSIONS 1
# NUM_BUFFERS AUTO
# BUFFER_SIZE AUTO
<<<
>>> CLIENT
# BACKUPIDPREFIX DB2___
APPLICATION_TYPE DB2
TSM_BACKUP YES
TSM_BACKUP NO USE_FOR SVC_NO_TSM
MAX_VERSIONS ADAPTIVE
# LVM_FREEZE_THAW AUTO
# NEGATIVE_LIST NO_CHECK
# TIMEOUT_FLASH 120
# GLOBAL_SYSTEM_IDENTIFIER
DEVICE_CLASS SVC2 FROM 00:00 TO 05:59
DEVICE_CLASS SVC_NO_TSM FROM 06:00 TO 20:00
DEVICE_CLASS SVC1 FROM 20:01
<<<
```

```
>>> DEVICE_CLASS SVC_NO_TSM
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.104
# COPYSERVICES_USERNAME superuser
# SVC_COPY_RATE 80
# SVC_CLEAN_RATE 50
# COPYSERVICES_COMMPROTOCOL HTTPS
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE
COPYSERVICES_SERVERPORT 5989
FLASHCOPY_TYPE COPY
# COPYSERVICES_TIMEOUT 6
# RESTORE_FORCE NO
STORAGE_SYSTEM_ID TSMDEVSVC2
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE /db2/D01/acs/acsvolumes/fct.file
BACKUP_HOST_NAME PREASSIGNED_VOLUMES
<<<
>>> DEVICE_CLASS SVC1
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.101
# COPYSERVICES_USERNAME superuser
# SVC_COPY_RATE 80
# 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 TSMDEVSVC1
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE /db2/D01/acs/acsvolumes/fct.file
BACKUP_HOST_NAME PREASSIGNED_VOLUMES
<<<
>>> DEVICE_CLASS SVC2
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.104
# COPYSERVICES_USERNAME superuser
# SVC_COPY_RATE 80
# 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 TSMDEVSVC2
TARGET_SETS VOLUMES_file
VOLUMES_FILE /db2/D01/acs/acsvolumes/fct.file
BACKUP_HOST_NAME PREASSIGNED_VOLUMES
<<<
```

Examples (native Oracle)

Example overall disk layout for a native Oracle environment

Refer to this example when configuring the disk layout in a native Oracle environment.

The following figure shows file systems involved in a sample disk layout.

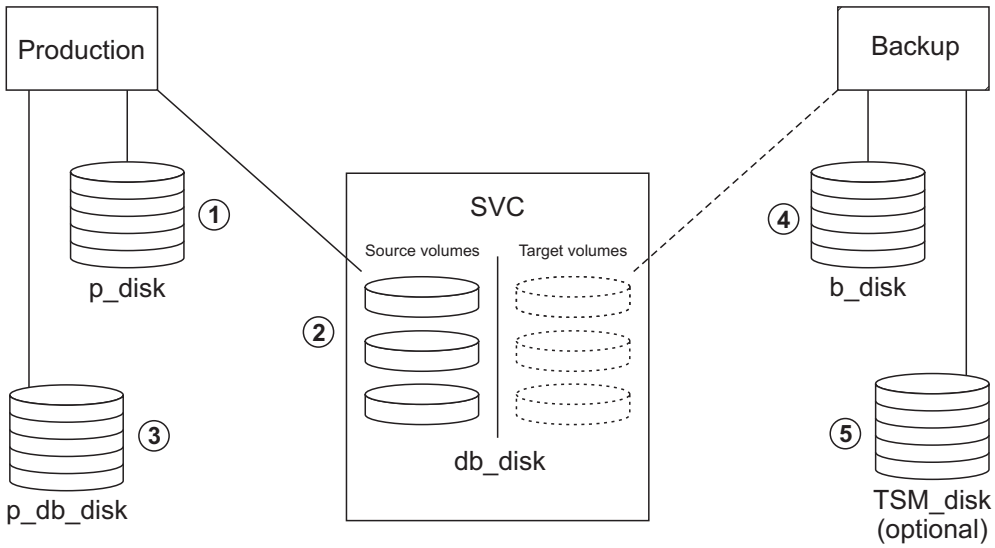

Figure 11. Example overall disk layout for a native Oracle environment

The respective disk categories contain the following disk types that are used for the various file systems:

1. Local disks on the production system (p_disk category) for the file systems

   ```
   /oracle/A01     part of VG ora_main
   /oracle/A01/acs (ACS_DIR)
   ```

   The Oracle database binary files are located in the directory that is defined by the ORACLE_HOME environment variable.

2. Source volume disks on the production system (db_disk category) for the file systems

   ```
   /oracle/A01/oradata/system    part of VG ora_d1
   /oracle/A01/oradata/temp      part of VG ora_d2
   /oracle/A01/oradata/custom     part of VG ora_d3

   /oracle/A01/origlogA          part of VG ora_l1
   /oracle/A01/origlogB          part of VG ora_l1

   /oracle/A01/mirrlogA          part of VG ora_l2
   /oracle/A01/mirrlogB          part of VG ora_l2
   ```

   The file systems for the control files must not reside on volume groups that are part of the FlashCopy backup. For FlashCopy cloning at least one of the three Oracle control files must reside on a volume group that is part of the FlashCopy cloning operation.

   ```
   /oracle/A01/cntrl/cntrlA01.dbf  part of VG ora_main
   /oracle/A01/misc/cntrlA01.dbf  part of VG ora_misc
   /oracle/A01/arch/cntrlA01.dbf   part of VG ora_arch
   ```

3. The p_db_disk category is not used for this setup.
4. Local disks on the backup system (b_disk category) for the file system

   ```
   /oracle/A01
   /oracle/A01/acs (ACS_DIR)
   ```

There is no need to create separate volume groups for logs and control files.

Example profile for Tivoli Storage FlashCopy Manager for native Oracle

Refer to this example when editing the IBM Tivoli Storage FlashCopy Manager profile.

The following depicts a sample profile:

```
>>> GLOBAL
ACS_DIR /oracle/A10/acs                                    # directory for logs, password file, etc.
ACSD prodsrv 57328                                         # <server> <port>
# TRACE NO                                                 # YES | NO
<<<
>>> CLIENT
APPLICATION_TYPE ORACLE                                    #
TARGET_DATABASE_SUSPEND YES                                # YES | NO | OFFLINE
# TSM_BACKUP NO                                            # YES | NO
# MAX_VERSIONS ADAPTIVE                                    # num | ADAPTIVE
# LVM_FREEZE_THAW AUTO                                     # AUTO | YES | NO
# NEGATIVE_LIST NO_CHECK                                   # NO_CHECK | WARN | ERROR | <path to negative list file>
# DEVICE_CLASS STANDARD                                    #
<<<
>>> OFFLOAD
BACKUP_METHOD ORACLE                                       #
# OVERWRITE_DATABASE_PARAMETER_FILE YES                    # YES | NO
# DATABASE_BACKUP_INCREMENTAL_LEVEL 0                      #
<<<
>>> ORACLE
CATALOG_DATABASE_CONNECT_STRING cat_db                     # *mandatory parameter*
CATALOG_DATABASE_USERNAME rman                             # *mandatory parameter*
DATABASE_BACKUP_SCRIPT_FILE /oracle/A10/acs/tsm_backup.scr      # *mandatory parameter*
TARGET_DATABASE_PARAMETER_FILE /oracle/A10/10gr2/dbs/initA10.ora # *mandatory parameter*
# DATABASE_CONTROL_FILE_RESTORE NO                         # YES | NO
DATABASE_CONTROL_FILE_RESTORE NO                          # YES | NO
<<<
>>> ACSD
ACS_REPOSITORY /oracle/A10/acs/acsrepository               # *mandatory parameter*
# ADMIN_ASSISTANT NO                                       # NO | <server> <port>
<<<
>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC                             # *mandatory parameter* SVC | DS8000 | XIV
COPYSERVICES_PRIMARY_SERVERNAME cim_srv                    #
TARGET_SETS VOLUMES_FILE # *mandatory parameter*
VOLUMES_FILE /oracle/A01/acs/volumes/volumes_file.fct
# COPYSERVICES_SECONDARY_SERVERNAME                        #
# COPYSERVICES_USERNAME superuser                          #
# SVC_COPY_RATE 80                                         # num
# COPYSERVICES_COMMPROTOCOL HTTPS                          # HTTP | HTTPS
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE              # NO_CERTIFICATE | <certificate file>
COPYSERVICES_SERVERPORT 5999                               # *mandatory parameter*
# FLASHCOPY_TYPE COPY                                      # COPY | INCR | NOCOPY
# COPYSERVICES_TIMEOUT 6                                   # num
# RESTORE_FORCE NO                                         # YES | NO
BACKUP_HOST_NAME NONE
<<<
```

Example profile for Tivoli Storage FlashCopy Manager for Oracle with ASM

Refer to this example when editing the IBM Tivoli Storage FlashCopy Manager profile for Oracle with ASM.

The following depicts a sample profile:

```
>>> GLOBAL
ACS_DIR /oracle/A10/acs                                    # directory for logs, password file, etc.
ACSD prodsrv 57328                                         # <server> <port>
# TRACE NO                                                 # YES | NO
<<<
>>> CLIENT
APPLICATION_TYPE ORACLE                                    #
TARGET_DATABASE_SUSPEND YES                                # YES | NO | OFFLINE
# TSM_BACKUP NO                                            # YES | NO
# MAX_VERSIONS ADAPTIVE                                    # num | ADAPTIVE
# LVM_FREEZE_THAW AUTO                                     # AUTO | YES | NO
# NEGATIVE_LIST NO_CHECK                                   # NO_CHECK | WARN | ERROR | <path to negative list file>
# DEVICE_CLASS STANDARD                                    #
VOLUME_MANAGER ASM                                         # ASM|LVM
<<<
>>> OFFLOAD
BACKUP_METHOD ORACLE                                       #
# OVERWRITE_DATABASE_PARAMETER_FILE YES                    # YES | NO
# DATABASE_BACKUP_INCREMENTAL_LEVEL 0                      #
#ASM_INSTANCE_USER AUTO                                    # User name | AUTO
#ASM_INSTANCE_ID +ASM                                      # ASM instance SID | +ASM
#ASM_ROLE SYSDBA                                           # SYSDBA or SYSASM | SYSDBA

<<<
>>> ORACLE
CATALOG_DATABASE_CONNECT_STRING cat_db                     # *mandatory parameter*
CATALOG_DATABASE_USERNAME rman                             # *mandatory parameter*
DATABASE_BACKUP_SCRIPT_FILE /oracle/A10/acs/tsm_backup.scr # *mandatory parameter*
TARGET_DATABASE_PARAMETER_FILE /oracle/A10/10gr2/dbs/initA10.ora # *mandatory parameter*
DATABASE_CONTROL_FILE_RESTORE NO                           # YES | NO
#ASM_INSTANCE_USER AUTO                                    # User name | AUTO
#ASM_INSTANCE_ID +ASM                                      # ASM instance SID | +ASM
#ASM_ROLE SYSDBA                                           # SYSDBA or SYSASM | SYSDBA
<<<
>>> ACSD
ACS_REPOSITORY /oracle/A10/acs/acsrepository               # *mandatory parameter*
# ADMIN_ASSISTANT NO                                       # NO | <server> <port>
<<<
>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC                             # *mandatory parameter* SVC | DS8000 | XIV
COPYSERVICES_PRIMARY_SERVERNAME cim_srv                    #
TARGET_SETS VOLUMES_FILE # *mandatory parameter*
VOLUMES_FILE /oracle/A01/acs/volumes/volumes_file.fct
# COPYSERVICES_SECONDARY_SERVERNAME                        #
# COPYSERVICES_USERNAME superuser                          #
# SVC_COPY_RATE 80                                         # num
# COPYSERVICES_COMMPROTOCOL HTTPS                          # HTTP | HTTPS
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE              # NO_CERTIFICATE | <certificate file>
COPYSERVICES_SERVERPORT 5999                               # *mandatory parameter*
# FLASHCOPY_TYPE COPY                                      # COPY | INCR | NOCOPY
# COPYSERVICES_TIMEOUT 6                                   # num
# RESTORE_FORCE NO                                         # YES | NO
BACKUP_HOST_NAME NONE
<<<
```

Note: The ASM_INSTANCE_USER, ASM_INSTANCE_ID, and ASM_ROLE SYSDBA parameters in the OFFLOAD section contain values for the backup server. They can be commented out if the same parameters in the ORACLE section are also valid for the backup server.

Example RMAN backup script

Refer to this example when configuring Data Protection for Oracle on the backup server.

The RMAN backup script must be specified in the profile with the DATABASE_BACKUP_SCRIPT_FILE parameter. This is an example of an RMAN backup script:

```
run
{
    allocate channel 'c1' type 'sbt_tape' parms 'ENV=(TDPO_OPTFILE=/home/oracle/tdpo.opt)';
    backup
    (database);
    release channel c1;
}
```

As shown in this example, the line break after the `backup` keyword is required.

Examples (SAP with Oracle)

Example overall disk layout for an *SAP®* with Oracle environment

Refer to this example when configuring the disk layout in an *SAP®* with Oracle environment.

The following figure shows file systems involved in a sample disk layout.

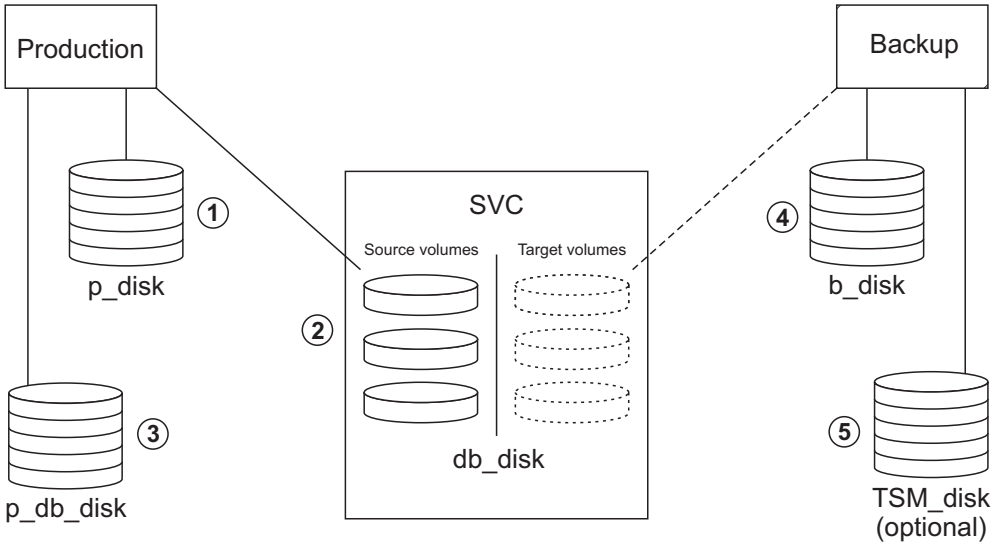

Figure 12. Example overall disk layout for an SAP® with Oracle environment

The respective disk categories contain the following disk types that are used for the various file systems:

1. Local disks on the production system (p_disk category) for the file systems

   ```
   /oracle/A01
   /usr/sap/A01
   /usr/sap/trans
   /oracle/A01/920_64
   ```

```
/oracle/A01/sapbackup
/oracle/A01/sapreorg
/sapmnt/A01
/oracle/A01/acs (ACS_DIR)
```

2. Source volume disks on the production system (db_disk category) for the file systems

```
/oracle/A01/sapdata1          part of VG sapfcl1
/oracle/A01/sapdata2      part of VG sapfcl2
/oracle/A01/sapdata3      part of VG sapfcl2
/oracle/A01/sapdata4      part of VG sapfcl3
/oracle/A01/sapdata5      part of VG sapfcl3
/oracle/A01/sapdata6      part of VG sapfcl3

/oracle/A01/origlogA      part of VG sapfcs1
/oracle/A01/origlogB      part of VG sapfcs1

/oracle/A01/mirrlogA      part of VG sapfcs2
/oracle/A01/mirrlogB      part of VG sapfcs2
```

   The sapdata<x> file systems were placed in different VGs just for test/development purposes; they could also have been in a common one.

   The Oracle control files are placed in $ORACLE_HOME/dbs/init<SID>.ora. :

```
/oracle/A01/sapdata1/cntrl/cntrlA01.dbf
/oracle/A01/origlogA/cntrl/cntrlA01.dbf
/oracle/A01/origlogB/cntrl/cntrlA01.dbf
```

3. Local disks on the production system (p_db_disk category) for the file systems

```
/oracle/A01/saparch
```

4. Local disks on the backup system (b_disk category) for the file systems

```
/oracle/A01
/usr/sap/A01
/usr/sap/trans
/oracle/A01/acs (ACS_DIR)
```

5. (Tivoli Storage Manager server) Disks for the Tivoli Storage Manager server (TSM_disk category) for the file systems used for the Tivoli Storage Manager databases, logs, and storage volumes.

Example profile for Tivoli Storage FlashCopy Manager for SAP® with Oracle (disk only)

Refer to this example when editing the IBM Tivoli Storage FlashCopy Manager profile.

The following depicts a sample profile:

```
>>> GLOBAL
# ACS_DIR /oracle/A01/acs
ACSD acsprod5 57328
# TRACE NO
<<<
>>> ACSD
ACS_REPOSITORY /oracle/A01/acs/pmtest
ADMIN_ASSISTANT no
# REPOSITORY_LABEL TSM
<<<
>>> CLIENT
# BACKUPIDPREFIX SAP___
APPLICATION_TYPE SAP_ORACLE
TARGET_DATABASE_SUSPEND YES
TSM_BACKUP YES
# MAX_VERSIONS ADAPTIVE
LVM_FREEZE_THAW 120
# TIMEOUT_FLASH 120
GLOBAL_SYSTEM_IDENTIFIER A01
# DEVICE_CLASS STANDARD
<<<
>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE XIV
# STORAGE_SYSTEM_ID
PATH_TO_XCLI /home/xivtest/XCLI
COPYSERVICES_SERVERNAME nextra
COPYSERVICES_USERNAME admin
# RECON_INTERVAL 12
# GRACE_PERIOD 24
# USE_WRITABLE_SNAPSHOTS AUTO
USE_CONSISTENCY_GROUPS NO
BACKUP_HOST_NAME acsback5
<<<
```

Example profile for Tivoli Storage FlashCopy Manager for *SAP® with Oracle* (offload)

Refer to this example when editing the IBM Tivoli Storage FlashCopy Manager profile for an off-loaded backup using IBM Tivoli Storage Manager for Enterprise Resource Planning.

Some parameters that are typically defined within the IBM Tivoli Storage FlashCopy Manager profile are defined in the IBM Tivoli Storage Manager for Enterprise Resource Planning .utl file, with some parameters under different names.

The following profile is an example of a SAP with Oracle profile that does not contain a CLIENT section:

```
>>> GLOBAL
# ACS_DIR /oracle/CET/acs
ACSD dooku 62000
TRACE YES
<<<

>>> ACSD
ACS_REPOSITORY /oracle/CET/acs/repository
# ADMIN_ASSISTANT NO
REPOSITORY_LABEL CET
<<<

>>> OFFLOAD
BACKUP_METHOD BACKINT
PROFILE /oracle/oracle11R2/dbs/initCET.utl
<<<

>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.104
# COPYSERVICES_USERNAME superuser
SVC_COPY_RATE 95
# SVC_CLEAN_RATE 50
# COPYSERVICES_COMMPROTOCOL HTTPS
# COPYSERVICES_CERTIFICATEFILE NO_CERTIFICATE
# COPYSERVICES_SERVERPORT 5989
FLASHCOPY_TYPE COPY
# COPYSERVICES_TIMEOUT 6
# RESTORE_FORCE NO
# STORAGE_SYSTEM_ID
# RECON_INTERVAL 12
BACKUP_HOST_NAME bano
TARGET_SETS T1
TARGET_NAMING %SOURCE_%TARGETSET
<<<
```

The following excerpt is an example the GLOBAL and CLIENT sections in a .utl file:

```
...
### TSM4ERP parameters
MAX_SESSIONS ...
CONFIG_FILE ...
...
### FlashCopy Manager parameters
ACS_DIR /oracle/CET/acs/
ACSD dooku 62000
TRACE ON
...
BACKUPIDPREFIX CET___
TARGET_DATABASE_SUSPEND YES
LVM_FREEZE_THAW AUTO
TSM_BACKUP_FROM_SNAPSHOT YES
MAX_SNAPSHOT_VERSIONS ADAPTIVE
DEVICE_CLASS STANDARD
...
### TSM4ERP server section parameters
SERVER ...
SESSIONS ...
```

The following example depicts the situation when the two profiles are created for the same database instance:

```
>>> GLOBAL
# ACS_DIR /oracle/CET/acs
ACSD dooku 62000
TRACE NO
<<<

>>> ACSD
ACS_REPOSITORY /oracle/CET/acs/repository
# ADMIN_ASSISTANT NO
REPOSITORY_LABEL CET
<<<

>>> CLIENT
BACKUPIDPREFIX CET___
APPLICATION_TYPE SAP_ORACLE
TARGET_DATABASE_SUSPEND NO
# MAX_VERSIONS ADAPTIVE
# LVM_FREEZE_THAW AUTO
# TIMEOUT_FLASH 120
# GLOBAL_SYSTEM_IDENTIFIER
# DEVICE_CLASS STANDARD
<<<

>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.104
# COPYSERVICES_USERNAME superuser
# CLONE_DATABASE NO
# SVC_COPY_RATE 80
# 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 BANO
TARGET_SETS T1 T2 T3 T4
TARGET_NAMING %SOURCE_%TARGETSET
<<<
```

Example Target Volumes Files

Example target volumes file (DS8000 configuration)

Refer to this example when editing the target volumes file for a DS8000 storage subsystem configuration.

The first two samples illustrate the same environment setup. It is clear that the first one is the most convenient to implement.

Tip: These two examples refer to the variant required when the TARGET_SET parameter specifies VOLUMES_DIR (legacy). In the case of TARGET_SETS = VOLUMES_FILE, the syntax of the file is different. The third and fourth samples illustrate the target volumes file for TARGET_SETS=VOLUMES_FILE, which is the recommended option to use for new configurations.

```
#================================================================#
#===
#===  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 in the Tivoli Storage FlashCopy® Manager profile.
#===
#===  It is required to embed the TARGET_VOLUME  parameter
#===  between the topic start parameter is (>>> VOLUMES_SET_x)
#===  where x is an integer number starting with 1
#===  and the topic end parameter is only (<<<).
#===
#===
#===
#===  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 inwhich the source volume is accessed.
#=======================================================================#


#
#************************** First sample ***************************#
#

>>> VOLUMES_SET_1
#=======================================================================#
# 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 has been started on the production
# system and identified all (source) volumes.
#
#
# Replace all statements below with your installation values.
#
# Definition is required for each target volume.
#=======================================================================#
TARGET_VOLUME 75924811090
TARGET_VOLUME 75924811091
TARGET_VOLUME 75924811092
TARGET_VOLUME 75924811093
TARGET_VOLUME 75924811094
TARGET_VOLUME 75924811095
<<<
#=======================================================================#



#
#************************** Second sample **************************#
#

#=======================================================================#

>>> VOLUMES_SET_1
TARGET_VOLUME 75924811190 75924811290 -
```

```
                    TARGET_VOLUME 75924811191 75924811291 -
                    TARGET_VOLUME 75924811192 75924811292 -
                    TARGET_VOLUME 75924811193 75924811293 -
                    TARGET_VOLUME 75924811194 75924811294 -
                    TARGET_VOLUME 75924811195 75924811295 -
                    <<<

                    #=========================================================================#
```

The following file is an example of a VOLUMES_FILE `.fct` file that includes the target set configuration used for cloning:

```
                    #
                    #************************* Third 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 another VOLUMES_FILE `.fct` file for DB2 EEE configurations:

```
#
#************************* Fourth 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 S97p5l1_t1 - -
        TARGET_VOLUME S97p5l2_t1 - -
    <<<
    >>> PARTITION NODE0003
        TARGET_VOLUME S97p5l3_t1 - -
        TARGET_VOLUME S97p5l4_t1 - -
    <<<
```

```
<<<

#====================================================================#
```

Example target volumes file (SAN Volume Controller configuration)

Refer to this example when editing the target volumes file for an SAN Volume Controller storage subsystem configuration.

The following two samples illustrate the same environment setup. It is clear that the first one is the most convenient to implement.

Note: These examples refer to the variant required when the TARGET_SET parameter specifies VOLUMES_DIR (legacy). In case of TARGET_SETS = VOLUMES_FILE, the syntax of the file is different. See the TARGET_FILE examples in the third and fourth samples in "Example target volumes file (DS8000 configuration)" on page 215.

```
#====================================================================#
#===
#===  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 in the Tivoli Storage FlashCopy® Manager profile
#===
#===  It is required to embed the TARGET_VOLUMES  parameter
#===  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 virtual disk name
#===       2nd value  is   source_volume virtual disk name  or  -
#===       3rd value  is   Size=2.0_GB  or  -
#===
#===       If you specify source volume name and size,
#===       you must ensure the target volume size is the same.
#===
#===       A target volume must be available in the same SVC cluster
#===       in which the source volume is accessed.
#====================================================================#


#
#************************** first sample ***************************#
#

>>> TARGET_SET VOLUMES_SET_1
#====================================================================#
# For  e a c h  target volume which is planned to be used in the
# FlashCopy operation the virtual disk name must be specified as
# the 1st parameter  followed by - -
# The characters '-' will be replaced by a (source) volume name
```

```
# 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.
#
# Definition is required for each target volume.
#====================================================================#
TARGET_VOLUME svdftgt1 - -
TARGET_VOLUME svdftgt2 - -
TARGET_VOLUME svdftgt3 - -
TARGET_VOLUME svdftgt4 - -
TARGET_VOLUME svdftgt5 - -
<<<

#====================================================================#



#
#************************* second 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 -
<<<

#====================================================================#
```

Example target volume file (mirror setup on DS8000 configuration)

Refer to this example when editing the target volumes file for a mirror setup on a DS8000 storage subsystem configuration.

The following sample illustrates the setup of a target volumes file as it is required to run the FlashCopy backup when the AIX LVM mirrors have been set up in DS8000 with serial number 7513158 (see the definition in the 'VOLUMES_SET_1' topic) for one FlashCopy backup run and with the mirrors set up in DS8000 with serial number 7512067 (see the definition in the 'VOLUMES_SET_2' topic) for another backup run. The two copy sets of LVs have been set up according to the requirements for setting up a copy set which means that 2 DS8000 units are needed.

```
#-----------------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 o n l y 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 --------------------#
```

The following sample shows a configuration of SAP in a multi-partition DB2 environment.

<ACS_DIR>/profile:

```
>>> DEVICE_CLASS STANDARD
...
TARGET_SETS VOLUMES_FILE
VOLUMES_FILE <ACS_DIR>/acsvolumes/volumes_file.fct
<<<
```

<ACS_DIR>/acsvolumes/volumes_file.fct:

```
>>> TARGET_SET 1
>>> PARTITION NODE0000
TARGET_VOLUME J01acs_td_0
TARGET_VOLUME J01acs_tl_0
<<<

>>> PARTITION NODE0001
TARGET_VOLUME J01acs_td_1
TARGET_VOLUME J01acs_tl_1
<<<

>>> PARTITION NODE0002
TARGET_VOLUME J01acs_td_2
TARGET_VOLUME J01acs_tl_2
<<<

>>> PARTITION NODE0003
TARGET_VOLUME J01acs_td_3
TARGET_VOLUME J01acs_tl_3
<<<
<<<

>>> TARGET_SET 2
>>> PARTITION NODE0000
TARGET_VOLUME J01acs_td_2_0
TARGET_VOLUME J01acs_tl_2_0
<<<

>>> PARTITION NODE0001
TARGET_VOLUME J01acs_td_2_1
TARGET_VOLUME J01acs_tl_2_1
<<<

>>> PARTITION NODE0002
TARGET_VOLUME J01acs_td_2_2
TARGET_VOLUME J01acs_tl_2_2
<<<

>>> PARTITION NODE0003
TARGET_VOLUME J01acs_td_2_3
TARGET_VOLUME J01acs_tl_2_3
<<<
<<<
```

Example profile for IBM Tivoli Storage FlashCopy Manager for Custom Applications

This example contains a sample profile for IBM Tivoli Storage FlashCopy Manager for Custom Applications 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_eha_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
<<<
```

Example profile for a DB2 HADR standby server environment

This example contains a sample configuration of a DB2 HADR standby server.

```
>>> GLOBAL
ACS_DIR /db2/CET/acs
ACSD ehonda 63000
TRACE YES
<<<

>>> ACSD
ACS_REPOSITORY /db2/CET/acs/acsrepository
REPOSITORY_LABEL CET
<<<

>>> CLIENT
BACKUPIDPREFIX CET___
APPLICATION_TYPE DB2
# MAX_VERSIONS ADAPTIVE
# LVM_FREEZE_THAW AUTO
# NEGATIVE_LIST NO_CHECK
# TIMEOUT_FLASH 120
# GLOBAL_SYSTEM_IDENTIFIER
# DEVICE_CLASS STANDARD
<<<

>>> DB2STANDBY
DB2_PRODUCTIVE_SERVER akuma 60050
DB2_ALIAS CET
PRE_FLASH_CMD /db2/CET/acs/scripts/pre_flash_cmd
POST_FLASH_CMD /db2/CET/acs/scripts/post_flash_cmd
# DB2_USERNAME db2cet
DB2_AUTH_TYPE SERVER
<<<

>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVC
COPYSERVICES_PRIMARY_SERVERNAME 192.168.1.104
# COPYSERVICES_USERNAME superuser
# CLONE_DATABASE NO
SVC_COPY_RATE 95
# 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
TARGET_NAMING %SOURCE_%TARGETSET
<<<
```

Appendix C. Special tasks

These tasks require special settings and procedures.

Migrating existing snapshot data

Review this information when using IBM Tivoli Storage FlashCopy Manager with existing snapshot data.

IBM Tivoli Storage FlashCopy Manager upgrade procedure

IBM Tivoli Storage FlashCopy Manager supports the concurrent installation of different product versions. These versions are typically installed underneath `/usr/tivoli/tsfcm/acs_<version_number>`. By invoking the appropriate installation setup script as root user, you can either configure it to protect a new database instance, or you can upgrade the version that is currently protecting a database instance.

Although you can upgrade the current version for a particular database instance, the master IBM Tivoli Storage FlashCopy Manager image (underneath `/usr/tivoli/tsfcm/acs_<version_number>`) is not automatically removed. To remove this image, you need to uninstall the package by invoking the command `/usr/tivoli/tsfcm/acs_<version_number>/uninstall/uninstaller.bin`

Note:

- When an OpenSSH connection exists with the backup servers, installation and configuration can be performed from the production system. When an OpenSSH connection does not exist, installation and upgrade tasks must be performed separately on the production system and each backup system.
- For physically partitioned DB2 environments, run the installation and configuration from one node only (typically node 0).

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

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

The upgrade from Tivoli Storage Manager for Advanced Copy Services to IBM Tivoli Storage FlashCopy Manager is performed as any standard upgrade. For example, select the database instances to protect during installation. If you plan to upgrade dedicated database instances after installing IBM Tivoli Storage FlashCopy Manager, run the setup utility separately as root user.

In addition, start the installation setup script as database instance owner from INST_DIR. This task updates the current configuration file. As a result, the existing Tivoli Storage Manager for Advanced Copy Services profile is used by IBM Tivoli Storage FlashCopy Manager.

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Note: Unlike with Tivoli Storage Manager for Advanced Copy Services, the production system is used by IBM Tivoli Storage FlashCopy Manager as the central point of control for offloaded backups to Tivoli Storage Manager. As a result, the OFFLOAD section is required in the profile on the production system. Any OFFLOAD section that is available in the backup system configuration file is discarded.

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

IBM Tivoli Storage FlashCopy Manager uses Tivoli Storage Manager for Advanced Copy Services 5.4 as a separate product, except for these situations:

- IBM Tivoli Storage FlashCopy Manager can reuse Tivoli Storage Manager for Advanced Copy Services 5.4 target volume files (.fct files).
- IBM Tivoli Storage FlashCopy Manager preserves any incremental FlashCopy relations that were established with Tivoli Storage Manager for Advanced Copy Services 5.4.

IBM Tivoli Storage FlashCopy Manager does not restore backups created with Tivoli Storage Manager for Advanced Copy Services 5.4. Use Tivoli Storage Manager for Advanced Copy Services 5.4 for that purpose.

The upgrade from Tivoli Storage Manager for Advanced Copy Services to IBM Tivoli Storage FlashCopy Manager is considered a new installation. If you want to retain existing volumes files, copy all volumes files into a single directory using the following naming conventions. If you are using logical partitioned databases, make sure to also review the note at the end of this section.

- DB2 environments:

```
<DB2 instance name>.<DB2 database name>.<device class>.<DB2 partition number>.fct
```

- Native Oracle environments:

```
<Oracle SID>.ORCL_.<device class>.ORACLE.fct
```

- SAP® with Oracle environments:

```
<DBSID>.<backup ID prefix>.<device class>.SAP_ORACLE.fct
```

Use the following settings when configuring the DEVICE_CLASS section of the profile:

```
TARGET_SET VOLUMES_DIR
VOLUMES_DIR <directory for .fct files>
```

IBM Tivoli Storage FlashCopy Manager and Tivoli Storage Manager for Advanced Copy Services can be used concurrently. However, make sure that these two products do not affect each other if they are accessing a target set. In addition, consider not using Tivoli Storage Manager for Advanced Copy Services after IBM Tivoli Storage FlashCopy Manager is successfully installed. Consider only using Tivoli Storage Manager for Advanced Copy Services in emergency situations. For example, using Tivoli Storage Manager for Advanced Copy Services to restore from those target sets unused by IBM Tivoli Storage FlashCopy Manager. Before attempting a restore with Tivoli Storage Manager for Advanced Copy Services, make sure to check whether IBM Tivoli Storage FlashCopy Manager has already used the target which you have selected for restore. Check by inspecting the IBM

Tivoli Storage FlashCopy Manager summary log file (message FMM1582I). This log file resides in the logs directory in the path specified by ACS_DIR.

Note:

- For logically partitioned DB2 environments, Tivoli Storage Manager for Advanced Copy Services 5.4 used one target set definition file (.fct) per database host. IBM Tivoli Storage FlashCopy Manager uses one target set definition file per node. To reuse the existing target set definition file (.fct file), associate all nodes that reside on the same host with a single partition group name. Use the PARTITION_GROUP parameter to associate the nodes. In this situation, IBM Tivoli Storage FlashCopy Manager uses one volumes file per PARTITION_GROUP. This setting allows the existing volume files to be reused without changes. Copy the existing target set definition files (.fct) to the directory specified by the VOLUMES_DIR parameter. Rename these files according to this naming convention:

  ```
  <DB2 instance name>.<DB2 database name>.<device class>.<partition group name>.fct
  ```

- In an AIX LVM mirrored environment, the STORAGE_SYSTEM_ID profile parameter must be added to the DEVICE_CLASS section. In addition, the HARDWARE_ID_LVM_MIRROR parameter must be renamed to STORAGE_SYSTEM_ID in the target set definition file (.fct file).

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

IBM Tivoli Storage FlashCopy Manager uses Tivoli Storage Manager for Advanced Copy Services 5.5 in this manner:

- It can reuse the Tivoli Storage Manager for Advanced Copy Services 5.5 volumes files (.fct).
- it preserves any incremental FlashCopy relations that were established with Tivoli Storage Manager for Advanced Copy Services 5.5.
- It can reuse most of the Tivoli Storage Manager for Advanced Copy Services 5.5 profile.

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

Before configuring IBM Tivoli Storage FlashCopy Manager with the installation setup script, create a copy of the existing Tivoli Storage Manager for Advanced Copy Services profile and repository directory. The repository directory is identified with the ACS_REPOSITORY parameter in the profile. When running installation setup script, update the ACS_REPOSITORY parameter with a new location for IBM Tivoli Storage FlashCopy Manager metadata. Also, set the TARGET_SETS parameter to VOLUMES_DIR. You do not need to modify the VOLUMES_DIR value and you do not need to change the .fct files located within this directory.

Once installed and configured, all future operations are performed with IBM Tivoli Storage FlashCopy Manager. In emergency situations, you can still use Tivoli Storage Manager for Advanced Copy Services 5.5 to restore from target sets that have not been used by IBM Tivoli Storage FlashCopy Manager. In this situation, you must restore the original profile and the original Tivoli Storage Manager for

Advanced Copy Services ACS_REPOSITORY directory. Also, you must run the Tivoli Storage Manager for Advanced Copy Services 5.5 installation setup script again for the current database instance. Before attempting a restore with Tivoli Storage Manager for Advanced Copy Services 5.5, make sure to check whether IBM Tivoli Storage FlashCopy Manager has already used the target which you have selected for restore. Check by inspecting the IBM Tivoli Storage FlashCopy Manager summary log file (message FMM1582I). This log file resides in the logs directory in the path specified by ACS_DIR.

Note: In an AIX LVM mirrored environment, the STORAGE_SYSTEM_ID profile parameter must be added to the DEVICE_CLASS section. In addition, the HARDWARE_ID_LVM_MIRROR parameter must be renamed to STORAGE_SYSTEM_ID in the target set definition file (.fct file).

Migrating SAN Volume Controller or DS8000 from a proxy to an embedded CIMOM

Unlike LVM mirrored environments, there is no difference between the proxy CIMOM and the embedded CIMOM. The only required changes when migrating are these adjustments:

- Update the COPYSERVICES_PRIMARY_SERVERNAME parameter in the profile.
- Update the COPYSERVICES_SECONDARY_SERVERNAME parameter in the profile (if specified).
- Reset the passwords.

In LVM mirrored environments, you must use separate DEVICE_CLASS sections for each of the storage devices. This task is done by creating 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 (if specified) parameters. Both device classes now refer to separate target set definition files (.fct) because of these settings:

- The different value of the VOLUMES_FILE parameter.
- The naming convention of volumes files (if target sets are specified using the parameter VOLUMES_DIR).

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_DIR parameter is used in an LVM mirroring environment, the STORAGE_SYSTEM_ID parameter must also be specified in the DEVICE_CLASS sections. The HARDWARE_ID_LVM_MIRROR parameter must be renamed to STORAGE_SYSTEM_ID in the target set definition file (.fct). Make sure to add rules to the CLIENT section of the profile that control the mirror to be used for the next backup operation. See DEVICE_CLASS <name> within the CLIENT section.

Installing IBM Tivoli Storage FlashCopy Manager in silent mode

You can perform the installation and distribution phases of the IBM Tivoli Storage FlashCopy Manager installation task in the non-graphic console mode. You can also use a response file for silent (or unattended) installation.

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

```
./<version>-TIV-FCM-<platform>.bin [-i console]
-DRECORDFILE=/tmp/installer.properties
```

1. To install in silent (unattended) mode, first create the response (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_2.2.0.0`
      - Linux: `/opt/tivoli/tsfcm/acs_2.2.0.0`
      - Solaris: `/opt/tivoli/tsfcm/acs_2.2.0.0`

   b. To create a log file during installation, set the variable
      `INSTALL_LOG_DESTINATION=<installation directory>/<log file name>`
   c. `LICENSE_ACCEPTED=TRUE`
   d. To define the product database component that will be installed, set the following variable:
      `CHOSEN_INSTALL_SET=<InstallSet>`

      where <InstallSet> is
      TSMFCMORA (Oracle component)
      TSMFCMSAP (SAP with Oracle component)
      TSMFCMDB2 (DB2 component)
   e. (Oracle and SAP Oracle) To set the home folder of the Oracle <SID>, use the following variable:
      `ORACLE_HOME_FOLDER=/oracle/<SID>`
   f. (DB2) For a DB2 installation: To copy the required files directly to desired IBM DB2 instances after installing in the main installation directory, set the following variable with a comma-separated list of existing IBM DB2 instances:
      `DB2_INSTANCES_SELECTED=db2inst1,db2inst2`

      If you do not want to copy the files, leave this variable blank:
      `DB2_INSTANCES_SELECTED=`
2. Invoke the executable file with the "-i silent" option (silent mode) and the "-f" option if a properties file was generated:

```
./<version>-TIV-FCM-<OS-platform>.bin -i silent [-f <properties file>]
```

   The <properties file> specification must contain a full path.

Sample properties file (DB2):

```
# Properties file for TTivoli Storage FlashCopy® Manager Installations
# Created on: May 8, 2010 4:18:38 PM
# This file contains the information, the installer needs to perform a successful installation in silent mode.
#
# Properties recorded:

# Has the license been accepted
# -----------------------------
LICENSE_ACCEPTED=TRUE

# The chosen Install Set
# ----------------------------
CHOSEN_INSTALL_SET=TSMFCMDB2

# Installation Directory
# ----------------------
USER_INSTALL_DIR=/usr/tivoli/tsfcm/acs_2.2.0.0

# Selected IBM DB2 Instances
# --------------------------
# Specify a comma separated list of existing IBM DB2 instances,
# e.g. DB2_INSTANCES_SELECTED=db2inst1,db2inst2
# During the installation all files from install directory will be copied to
# the home directory of IBM DB2 instance(s) (<instance home>/sqllib/acs)
# If you do not want to copy the files, leave it blank.
DB2_INSTANCES_SELECTED=db2inst1,db2inst2
```

Sample properties file (Oracle):

```
# Properties file for Tivoli Storage FlashCopy® Manager Installations
# Created on: May 6, 2010 10:45:09 AM
# This file contains the information, the installer needs to perform a successful installation in silent mode.
#
# Properties recorded:

# Has the license been accepted
# -----------------------------
LICENSE_ACCEPTED=TRUE

# The chosen Install Set
# ----------------------------
CHOSEN_INSTALL_SET=TSMFCMORA

# Installation Directory
# ----------------------
USER_INSTALL_DIR=/usr/tivoli/tsfcm/acs_2.2.0.0

# ORACLE_HOME Directory
# ---------------------
ORACLE_HOME_FOLDER=/oracle/SID
```

Sample properties file for SAP with Oracle:

```
# Properties file for Tivoli Storage FlashCopy® Manager Installations
# Created on: May 11, 2010 1:02:55 PM
# This file contains the information, the installer needs to perform a successful installation in silent mode.
#
# Properties recorded:

# Has the license been accepted
# -----------------------------
LICENSE_ACCEPTED=TRUE

# The chosen Install Set
# ------------------------------
CHOSEN_INSTALL_SET=TSMFCMSAP

# Installation Directory
# ----------------------
USER_INSTALL_DIR=/usr/tivoli/tsfcm/acs_2.2.0.0

# ORACLE_HOME Directory
# ---------------------
ORACLE_HOME_FOLDER=/oracle/SID

# Selected IBM DB2 Instances
# --------------------------
```

Sample properties file for IBM Tivoli Storage FlashCopy Manager for Custom Applications

The following sample is the properties file for IBM Tivoli Storage FlashCopy Manager for Custom Applications on a Linux system.

```
LICENSE_ACCEPTED=TRUE
CHOSEN_INSTALL_SET=TSMFCMGEN
USER_INSTALL_DIR=/opt/tivoli/tsfcm/acs_2.2.0.0
#ORACLE_HOME_FOLDER=
#DB2_INSTANCES_SELECTED=
LINUX_DISTRO=SLES11
```

Lines starting with "#" are treated as comments.

Special tasks for native Oracle

Information is provided about alternative procedures to adjust IBM Tivoli Storage FlashCopy Manager to your production environment.

These procedures assist with adjusting your production environment:

- Configuring system options files for the same server
- Configuring multiple server stanzas

Configuring system options files to use the same server

This procedure demonstrates how to configure system options files (dsm.sys) to point to the same Tivoli Storage Manager server.

In these examples, the client user options files (dsm.opt) in the `/usr/tivoli/tsm/client/ba/bin` and `/usr/tivoli/tsm/client/api/bin` directories are defined for a server with a TCPIP address of *arrow.la.xyzcompany.com*.

ba/bin Directory

Example: dsm.opt

```
servername tdphdw
```

Example: dsm.sys

```
servername          tdphdw
   commmethod       tcpip
   tcpport          1500
   tcpserveraddress arrow.la.xyzcompany.com
   passwordaccess   generate
   schedmode        prompted
   nodename         hdworc1
```

api/bin Directory

Example: dsm.opt

```
servername tdporc
```

Example: dsm.sys

```
servername          tdporc
   commmethod       tcpip
   tcpport          1500
   tcpserveraddress arrow.la.xyzcompany.com
   passwordaccess   prompt
   nodename         hdworc1
```

Note: The ***servername*** option in the dsm.opt and dsm.sys files define server stanza names only. The ***tcpserveraddress*** option controls which server is actually contacted.

Configuring multiple server stanzas

This procedure demonstrates how to configure multiple server stanzas in the system options file (dsm.sys).

In order to configure multiple server stanzas in the system options file (dsm.sys), copy the option settings from the Data Protection for Oracle dsm.sys file to the IBM Tivoli Storage FlashCopy Manager dsm.sys file. For example, a combined dsm.sys file for a server with the name *arrow*:

```
servername          tdphdw
   commmethod       tcpip
   tcpport          1500
   tcpserveraddress arrow.la.xyzcompany.com
   passwordaccess   generate
   schedmode        prompted

servername          tdporc
   commmethod       tcpip
   tcpport          1500
   tcpserveraddress arrow.la.xyzcompany.com
   passwordaccess   prompt
```

Appendix D. Troubleshooting IBM Tivoli Storage FlashCopy Manager

Resolving problems encountered when using IBM Tivoli Storage FlashCopy Manager requires tasks specific to the database environment.

Related reference

"Log and trace files summary" on page 234

General troubleshooting procedure

This procedure is valid for all IBM 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 50. 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
```

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```
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)
==================================================
```

Log and trace files summary

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

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

- DB2
- Oracle
- IBM Tivoli Storage FlashCopy Manager
- Storage system
- CIM
- 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 FlashCopy Manager.

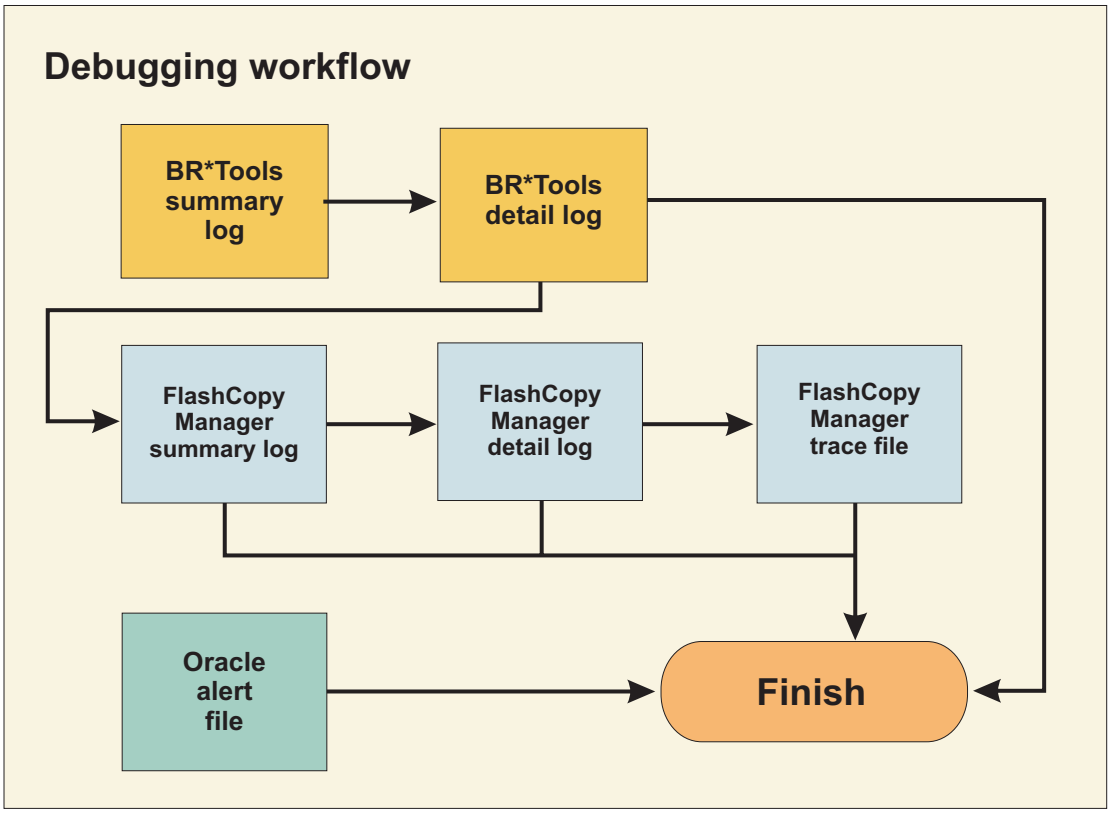

Figure 13. Debugging workflow for SAP with Oracle FlashCopy Manager

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

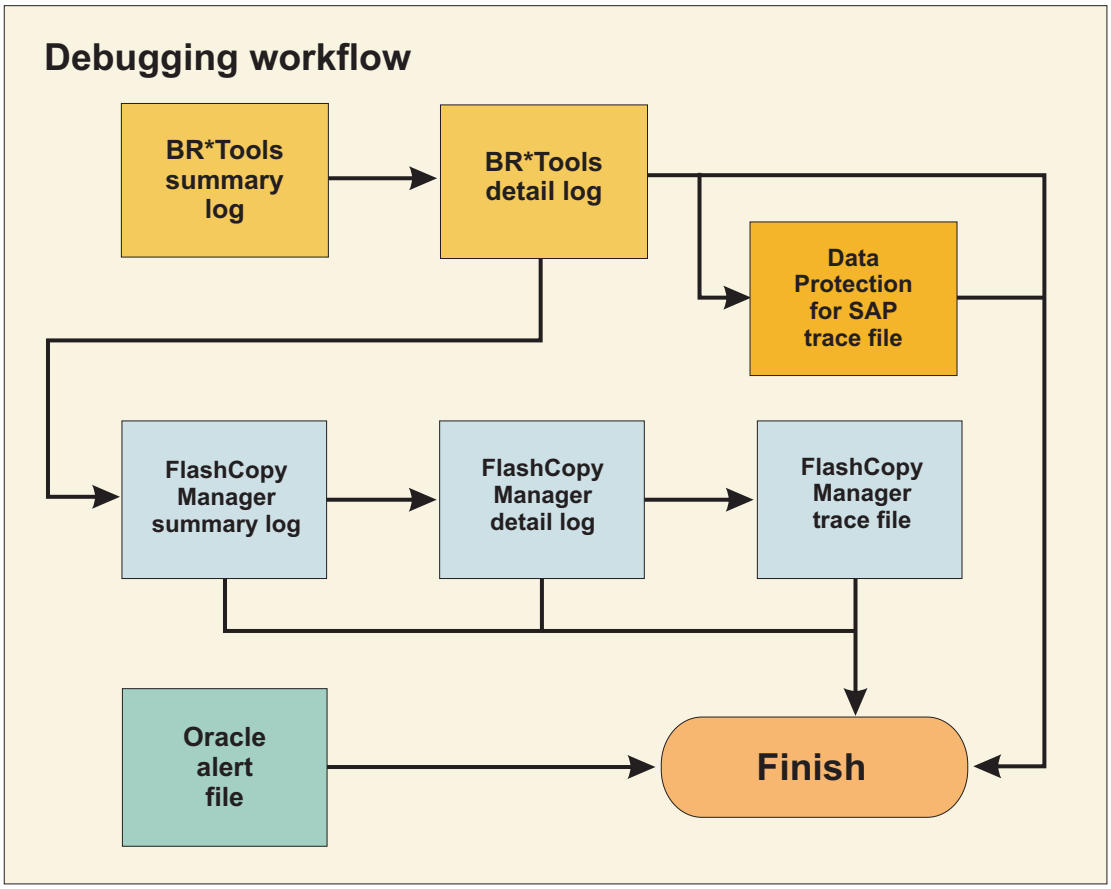

Figure 14. Debugging workflow for SAP with Oracle FlashCopy Manager with Tivoli Storage Manager

IBM Tivoli Storage FlashCopy Manager log and trace files

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

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

The following table lists the log and trace files maintained by IBM Tivoli Storage FlashCopy Manager. These files reside in

```
<ACS_DIR>/logs
```

Table 51. IBM Tivoli Storage FlashCopy Manager Log Files

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

Table 51. IBM Tivoli Storage FlashCopy Manager Log Files (continued)

Purpose	File
Note: • <timestamp> is the date ('yyyymmdd') • <longtimestamp> is the date and time ('yyyymmddHHMMSS') • <function> is a value of backup, restore, inquire, delete, mount, unmount, tsm, or clone The summary log file should always be 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.	

Table 52. IBM 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 CIM Devices (DS8000, SAN Volume Controller)	fmcima.<hostname>.<function>.<id>.trace fmcima.<hostname>.<device class>.<node num>.trace
Offload Agent (tsm4acs)	tsm4acsd.<host>.<id>.trace
fcmcli	fcmcli.<host>.<id>.trace
RMAN (when invoked by IBM Tivoli Storage FlashCopy Manager)	rman.<SID>.<id>.log
Note: • Names ending in '-d' are daemon processes (started with '-D' option). • <id> 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. • <device class> 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. • <instance> and <db hostname> can be 'undef' for query/delete requests started with db2acsutil. • <node num> 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. • <function> is backup, delete, restore, mount, unmount, or reconcile.	

Storage system log and trace files

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

Consult the CIM documentation for logging and tracing information. Currently, only the DS Open API and the SAN Volume Controller master console produce log and trace output.

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 tips for IBM Tivoli Storage FlashCopy Manager for Oracle

Resolving problems encountered when using IBM Tivoli Storage FlashCopy Manager requires tasks specific to the native Oracle database environment.

If an error condition occurs during a IBM Tivoli Storage FlashCopy Manager event, there are several sources of information you can view to help determine what the problem might be. The sources of information are listed below. If you still encounter problems after reviewing this section, you can contact Tivoli Customer Support for assistance.

Be aware of the following information:

- Make sure to increase the size of the following two Oracle options located in the `$ORACLE_HOME/dbs/init(database_name).ora` file:

```
sort_area_size = 10000000
sort_area_retained_size = 10000000
```

- When using IBM Tivoli Storage FlashCopy Manager to back up an Oracle database, the target database being backed up *cannot* reside on the same volume group as the file system containing $ORACLE_HOME. Make sure that the Oracle Server does not share a volume group with the target database.
- When performing a full offline backup of a database, the target database on the production system must be in "startup mount" state at the time **acsora** is issued. Otherwise it will not be possible to restore the resulting backup without performing recovery.

  This RMAN script template will restore the database backed up offline as described in the previous paragraph. It restores control files, datafiles, and opens the database *without* any application of logs. This script must be started with the target database in a "startup mount" state:

```
run
{
allocate channel ch1 type 'SBT_TAPE' parms
'ENV=(TDPO_OPTFILE=<full path of tdpo.opt file>)';
set until scn = <Ckp SCN for backup being restored>;
restore control file to '<full path of 1st control file>';
restore control file to '<full path of 2nd control file>';
restore control file to '<full path of 3rd control file>';
alter database mount;
restore
(database);
sql 'alter database open RESETLOGS';
release channel ch1;
}
```

The database will in an open state and in a new incarnation after this script completes. All that remains is to issue the **reset database** command to RMAN and back up the database again since the previous backups are now rendered unusable since the database is in a new incarnation.

The `<Ckp SCN for backup being restored>` value is the Checkpoint SCN listed for the backup being restored in the RMAN **list backup** command. For example, the Checkpoint SCN is 32024 in the following list:

```
List of Backup Sets
Key  Recid  Stamp  LV  Set Stamp  Set Count Completion Time
------------------------------------------------------------
26081 4  469212393 0   469212319      5       06-AUG-02

List of Backup Pieces
Key  Pc# Cp#  Status  Completion Time  Piece Name
---------------------------------------------------
26082 1  1  AVAILABLE   06-AUG-02    05dvf74v_1_1

Lis of Datafiles Included
File  Name           LV Type Ckp SCN  Ckp Time
-----------------------------------------------
1   /dev/rmyfilelv    0  Full 32024   06-AUG-02
2   /dev/rmyrollbklv  0  Full 32024   06-AUG-02
3   /dev/rmytemplv    0  Full 32024   06-AUG-02
4   /dev/rmyuserlv    0  Full 32024   06-AUG-02
```

Note that for an offline backup, the Checkpoint SCN should be the same for all of the datafiles.

Guidelines for Oracle variables

IBM Tivoli Storage FlashCopy Manager processing can be impacted when certain Oracle parameter and environment variable settings are not set with appropriate values.

It is recommended that you review this information for clarification.

PFILE parameter

When setting parameters in the profile, make sure the TARGET_DATABASE_PARAMETER_FILE parameter specifies a text-based Oracle initialization parameter file (PFILE) and not an Oracle server file (SPFILE). Use of an Oracle server file will cause IBM Tivoli Storage FlashCopy Manager processing to fail. To ensure that Oracle obtains initialization parameter settings from a text-based file and therefore, can access the TARGET_DATABASE_PARAMETER_FILE-specified value successfully, specify the PFILE parameter with the STARTUP command when starting Oracle.

TNS_ADMIN environment variable
This environment variable must be set when the SQL*Plus or Oracle Net configuration files do not reside in their default location.

IBM Tivoli Storage FlashCopy Manager for Oracle miscellaneous errors

Certain unique errors might display when using IBM Tivoli Storage FlashCopy Manager for native Oracle.

If you receive the following errors:

IBM Tivoli Storage FlashCopy Manager fails on the backup system in DBCS locales when the datafile or the path to the datafile contains a DBCS name.
This is an Oracle problem that has been reported to the Oracle development team. The Oracle Technical Assistance Request (TAR) number for this problem is 2367962.999.

The following procedure provides a workaround until the problem is resolved by Oracle:

1. Take the table space that contains the DBCS name in its datafile or the path to its datafile offline.
2. If the DBCS name is in the datafile, rename the DBCS datafile to an English name. If the DBCS name is in the path to the datafile, move the datafile to a path with an English name.
3. Log in to the Server Manager and issue the following command:
```
ALTER TABLESPACE <dbcs_tablespace_name> RENAME DATAFILE
'dbcs_path/dbcs_datafile' TO 'english_path/english_datafile';
```
4. Bring the table space online.
5. Delete the DBCS datafile if necessary.

Although IBM Tivoli Storage FlashCopy Manager supports table spaces named with DBCS, datafiles or paths to the datafiles that contain DBCS must be renamed to English before running IBM Tivoli Storage FlashCopy Manager.

Appendix E. Internet Protocol Version 6 (IPv6) Support

IBM Tivoli Storage FlashCopy Manager for UNIX and Linux supports both IPv4 and IPv6 for internal communication in that it will run in IPv4, IPv6, and mixed environments. However, it does not take advantage of new IPv6 functionality.

In a mixed environment, the actual communication to be used depends on the network settings of the adapters employed. There is no option to enforce the use of a specific protocol other than by network configuration. Specifically, the acsd service tries to listen for both IPv4 and IPv6 connection requests if the system is configured accordingly. Connection requests to acsd will be made for the addresses returned by the system for the respective port on the local host. Connection requests to other machines are made for the addresses specified by the user. Wherever TCP/IP addresses can be specified in a command line or a profile parameter, IPv6 addresses are supported. However, where an IP address and a port was traditionally specified in the format:

```
<IPv4 address>:<service or port>
```

the format needs to be changed to

```
<service or port>@<IP address>
```

if the IP address is specified in the IPV6 notation. In the case of a dotted decimal IP4 address, the traditional format can still be used.

The specification of IPv6 addresses assumes that IBM Tivoli Storage FlashCopy Manager is used in an environment in which IPv6 is supported by all hardware and software components involved and has been adequately tested in this environment.

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Appendix F. Accessibility features for Tivoli Storage FlashCopy Manager

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

Accessibility features

The following list includes the major accessibility features in Tivoli Storage FlashCopy Manager:

- Keyboard-only operation
- Interfaces that are commonly used by screen readers
- Keys that are discernible by touch but do not activate just by touching them
- Industry-standard devices for ports and connectors
- The attachment of alternative input and output devices
- User documentation provided in HTML and PDF format. Descriptive text is provided for all documentation images.

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Keyboard navigation

Tivoli Storage FlashCopy Manager follows AIX operating system conventions for keyboard navigation and access.

Tivoli Storage FlashCopy Manager follows Linux operating system conventions for keyboard navigation and access.

Tivoli Storage FlashCopy Manager follows Solaris operating system conventions for keyboard navigation and access.

Vendor software

Tivoli Storage FlashCopy Manager 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.

Related accessibility information

You can view the publications for Tivoli Storage FlashCopy Manager in Adobe® Portable Document Format (PDF) using the Adobe Acrobat Reader. You can access these or any of the other documentation PDFs at the IBM Publications Center at http://www.ibm.com/shop/publications/order/.

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