IBM Spectrum Protect Snapshot
Version 8.1.4

Oracle
UNIX and Linux

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Note:
Before you use this information and the product it supports, read the information in "Notices" on page 195.

This edition applies to version 8, release 1, modification 4 of IBM Spectrum Protect Snapshot (product numbers 5725-X22, and 5608-AB8) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this guide

This guide provides you with information about how to set up IBM Spectrum Protect™ Snapshot for UNIX and Linux. The information brings you through the steps from Planning, through to installing, configuring, administering, and operating the product for your particular setup.

IBM Spectrum Protect Snapshot for DB2® is provided as a single installation package for AIX® or Linux. The product runs on the following storage systems:

-
  - IBM® System Storage® DS8000®
  - IBM System Storage SAN Volume Controller
  - IBM XIV® Storage System
  - IBM Storwize® family and IBM Storwize V7000 Unified

IBM Spectrum Protect Snapshot runs online or offline backups of Oracle databases that are on snapshot-oriented storage systems. Optionally, it backs up to IBM Spectrum Protect storage by using IBM Spectrum Protect for Enterprise Resource Planning, IBM Spectrum Protect for Databases, or IBM Spectrum Protect backup-archive client.

IBM Spectrum Protect is a client/server licensed product that provides storage management services in a multi-platform computer environment. It is required only if the offload backup function of IBM Spectrum Protect Snapshot is needed.

Who should read this guide

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

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

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

Publications

The IBM Spectrum Protect product family includes IBM Spectrum Protect Snapshot, IBM Spectrum Protect for Space Management, IBM Spectrum Protect for Databases, and several other storage management products from IBM.

To view IBM product documentation, see IBM Knowledge Center.

What's new for IBM Spectrum Protect Snapshot for Oracle

Learn about new features and enhancements in IBM Spectrum Protect Snapshot Version 8.1.4.

New and changed information in this product documentation is indicated by a vertical bar (|) to the left-hand side of the change.

Use a single instance to protect multiple Oracle databases
With one IBM Spectrum Protect Snapshot instance, you can now protect, clone, and manage multiple Oracle databases. Manage multiple Oracle databases on the same host by a single instance user with database administration rights. Using the new Configuration Wizard configure IBM Spectrum Protect Snapshot for all databases that are protected or cloned. For more information about this feature, see Single Oracle user instance for multi-database protection.

Configuration Wizard

Use the Configuration Wizard to configure data protection and cloning for one or more Oracle databases. When you opt for the Oracle single user configuration, you can run the configuration of IBM Spectrum Protect Snapshot for all Oracle databases in a single host in one session. For more information about this feature, see Configuration Wizard.

Oracle Migration Tool
To migrate older instances of IBM Spectrum Protect Snapshot for Oracle for multi-database management with a single user instance, use the Migration Tool. For more information about this tool, see Migrating Oracle instances.

Tip: To read all the information about the Configuration Wizard and the multiple Oracle database protection with a single IBM Spectrum Protect Snapshot instance, open this PDF.

Specify different backup version retention values
For all storage devices, you can specify different backup retention periods for each device class that is configured. During the configuration process, you can define different values for each device class with the **MAX_VERSIONS** parameter in the profile. For more information about this feature, see Backup version retention.

Tip: To read all the information about the SVCDTA in this release, open this PDF.

IBM SAN Volume Controller Dynamic Target Allocation (SVC DTA) incremental backups
Run incremental backups for SVCDTA with the **FLASHCOPY_TYPE** option INCR. After the initial FlashCopy backup, incremental FlashCopy backups are run to the same target volume. The ability to run incremental backups to the SVC, results in improvements in how long the backup takes and eases the load on the SVC. For more information about incremental flash copies, see Incremental backups and MAX_VERSIONS.

New and modified parameters or functions

The following parameters are new:

ORACLE_SID
In the CLONING and CLIENT sections of the profile, the **ORACLE_SID** parameter is added to identify a protected database. The value of this parameter is the same as the environment variable ORACLE_SID for the database. You must set the ORACLE_SID parameter in an Oracle single user configuration. For more information about this parameter, see "CLIENT" on page 114 and "CLONING" on page 122.

ORACLE_HOME
When you are configuring IBM Spectrum Protect Snapshot for Oracle, the **ORACLE_HOME** parameter is used to identify the Oracle database software location. This parameter is filled in automatically and is required when you are migrating an Oracle instance into a single user environment. In that case, it has a string like ORACLE_HOME /oracle/ora12cR2/app/product/12.2.0/dbhome_1. For more information about this parameter, see "ORACLE" on page 120.

OFFLOAD_SECTION_NAME
In the CLIENT section of the profile, the **OFFLOAD_SECTION_NAME** is added to identify the set of offload parameters for a specific **ORACLE_SID**. For more information about this parameter, see "CLIENT" on page 114.

ORACLE_SECTION_NAME
In the CLIENT and CLONING sections of the profile, the **ORACLE_SECTION_NAME** is added to identify the set of parameters that describe the Oracle database. For more information about this parameter, see "CLIENT" on page 114 and "CLONING" on page 122.

The following parameters are modified for IBM Spectrum Protect Snapshot 8.1.4:

MAX_VERSIONS for all device classes
Use this parameter in the CLIENT section of the profile for each **DEVICE_CLASS** to create incremental FlashCopies. When **FLASHCOPY_TYPE** is set to INCR, the incremental FlashCopy is refreshed depending on the **MAX_VERSIONS** value set. Specify the maximum number of snapshot backup versions to be kept before the oldest backup is deleted by using **MAX_VERSIONS** to specify the maximum. For SVCDTA, when the version-delete deletes the oldest snapshot backup with an incremental FlashCopy relation, it reuses the target volumes of the expired backup and refreshes the FlashCopy relationship instead of deleting it. For more information about **MAX_VERSIONS**, see "CLIENT" on page 114.

Chapter 1. Overview

IBM Spectrum Protect Snapshot provides a method to back up and restore data by using the advanced snapshot technologies of storage systems.

The following list identifies the applications that can be protected and cloned with IBM Spectrum Protect Snapshot:

- Oracle
- Oracle in an SAP environment
- Oracle with Automatic Storage Management (ASM)
- Oracle in a RAC environment.
- DB2
- DB2 in an SAP environment
- DB2 in a partitioned database environment. You can back up and restore data from single-partition databases, and logically or physically partitioned DB2 databases.
- Custom Applications (without cloning)

IBM Spectrum Protect Snapshot can back up Oracle databases that are on snapshot-oriented storage systems or file systems.

IBM Spectrum Protect Snapshot supports AIX and Linux operating systems.

IBM Spectrum Protect Snapshot integrates with other IBM Spectrum Protect products to send snapshot backups to an IBM Spectrum Protect server. These backups are called offloaded backups.

- To send snapshot backups to an IBM Spectrum Protect server, a separate backup server is required.
- For Oracle environments, IBM Spectrum Protect for Databases is used for this operation.

The following list identifies the storage solutions or file systems that you can use with IBM Spectrum Protect Snapshot software:

- IBM XIV Storage System
- IBM Storwize family
- IBM System Storage SAN Volume Controller
- IBM System Storage DS8000

Backup and restore methods with FlashCopy and snapshots

The terms *snapshot* or *FlashCopy* are used differently depending on your hardware storage. Both denote a logical point-in-time copy where the target volume represents an exact copy of the data on a source volume. The term *snapshot* is used generically to apply to all hardware types.

Snapshots and FlashCopies

Depending on the storage hardware you use, the terms *snapshot* or *FlashCopy* are used. Both denote a logical point-in-time copy, where the target volume represents an exact copy of the data on a source volume. Data is transferred to the target

volume as the source volume is modified. This action is called copy-on-write, or redirect-on-write. The logical copy can be transformed into a physical full copy on the target volume. When target volumes must be provided in advance, the target volume must be the same size as the source volume. In addition, the target volume and source volume must have the same logical track format, and must be on the same storage system. When data is restored, it is copied from the target to the source volume. The term *snapshot* is used to signify snapshot and FlashCopy.

Types of snapshot backups

Snapshot backups can be either full copy snapshots or space-efficient snapshots. The type of snapshot backups depends on the storage environment. During a full copy snapshot, all blocks of data on the source volume are copied to the target volume. During a space efficient snapshot, only blocks of data that are written on the source volume after the snapshot was created are copied to the target volume.

Transferring snapshots to an IBM Spectrum Protect server

When you use IBM Spectrum Protect Snapshot with IBM Spectrum Protect products, you can transfer snapshots to the IBM Spectrum Protect server. To send these snapshot backups to the IBM Spectrum Protect server, you must configure a backup server or cluster.

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

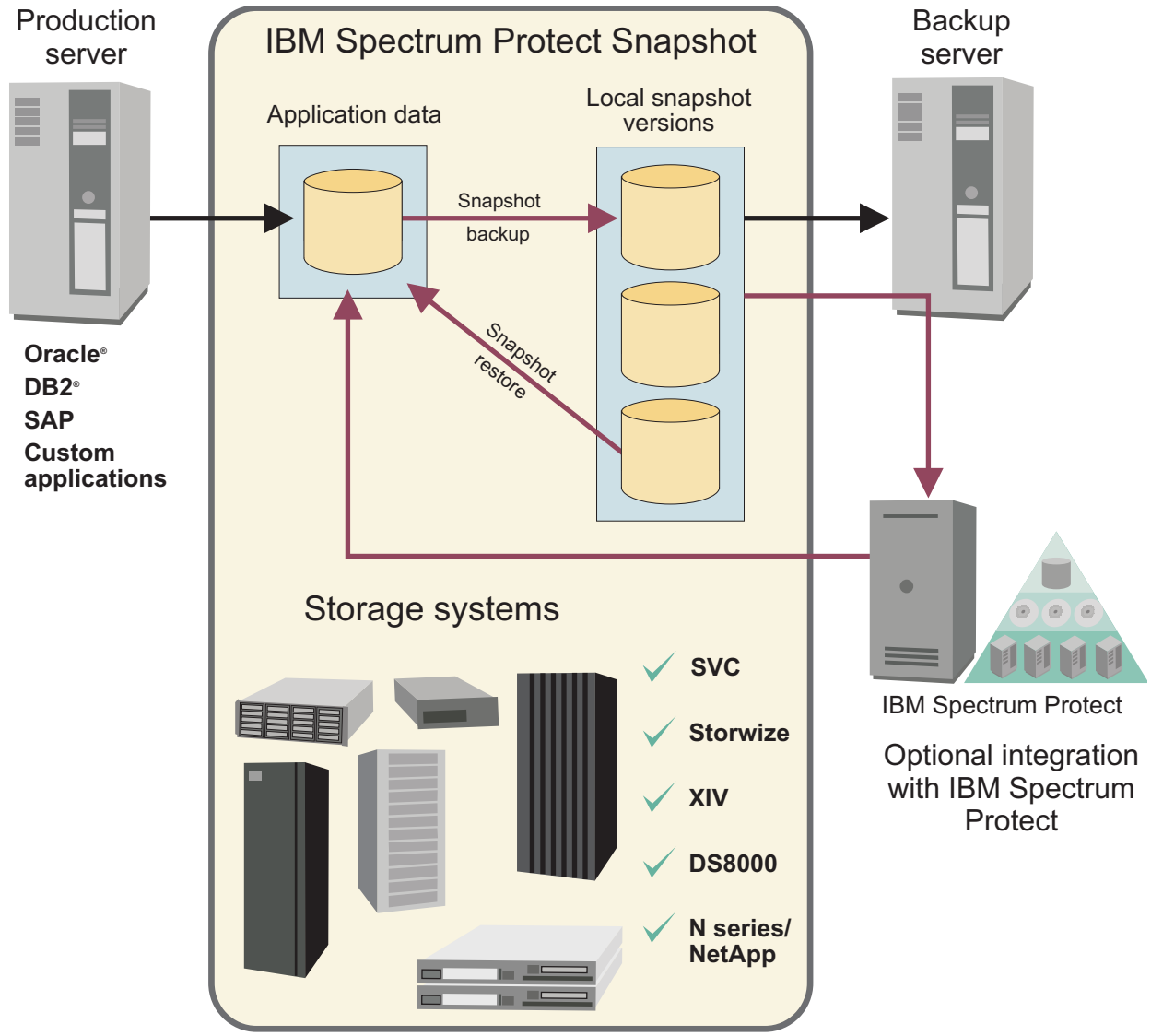


Figure 1. IBM Spectrum Protect Snapshot backup and restore environment.

Database cloning

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

IBM Spectrum Protect Snapshot uses the FlashCopy® or snapshot function of the storage hardware for database cloning. Cloned databases are required in the following scenarios:

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

Traditionally, the database cloning process redirected a restore operation to create the clone. This method has disadvantages, including system downtime and

degraded system performance. IBM Spectrum Protect Snapshot clones a database by using the storage system FlashCopy or snapshot capabilities to minimize the impact on the production database. A *clone server* or *clone system* is required by IBM Spectrum Protect Snapshot to mount a cloned database.

The following figure shows how IBM Spectrum Protect Snapshot creates and stores a cloned database on a clone server.

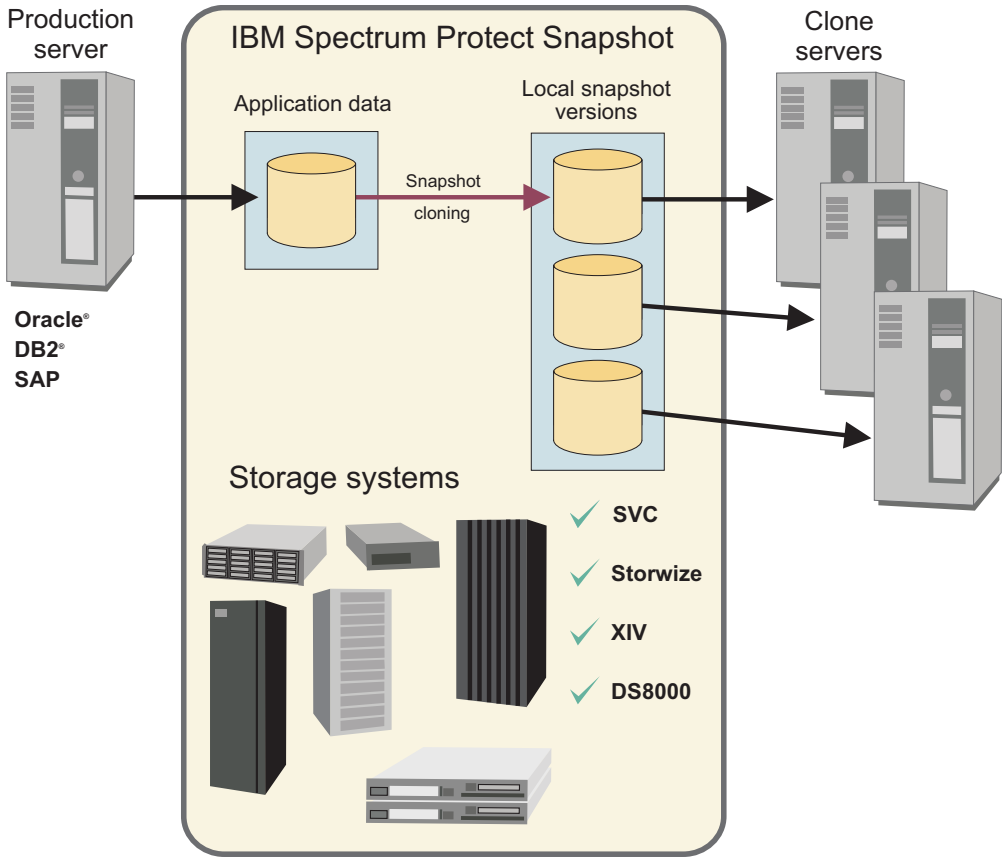


Figure 2. IBM Spectrum Protect Snapshot and database cloning

Software components

IBM Spectrum Protect Snapshot is composed of several software components.

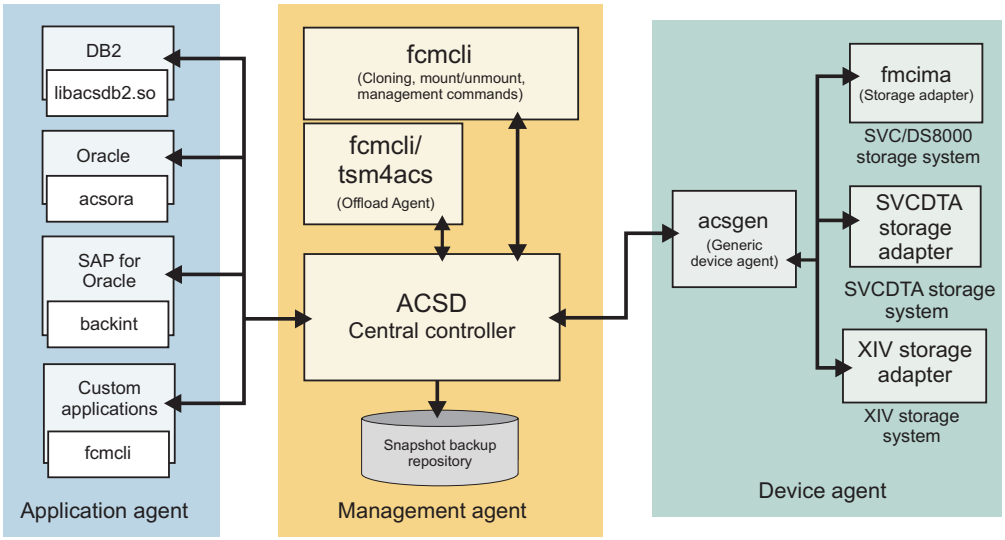


Figure 3. IBM Spectrum Protect Snapshot system components

Application agent

The application agent provides the necessary support to implement snapshot-based backup and restore operations. This agent interacts with the applications and tracks when an IBM Spectrum Protect Snapshot backup is created for a specific application.

Management agent

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

Device agent

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

The following lists the specific agents for each device type that communicate with the `acsgen` agent:

- The CIM adapter `fmcima` is used with the generic device agent `acsgen`. This adapter sends commands to the supported storage device by using the CIM interface. Examples of supported storage include DS8000, Storwize family, and SAN Volume Controller with static target allocation.
- The storage adapter for SVCDTA communicates with the CLI interfaces of SAN Volume Controller and the Storwize family storage systems with dynamic target allocation via Secure Shell.
- The XIV storage adapter is used with the generic device agent `acsgen`. This adapter communicates with the `acsgen` agent and issues commands to the XIV Storage System by using the command line interface XCLI.
- Third-party adapters that can communicate with non-IBM devices are available. Third-party adapters are not part of the IBM Spectrum Protect Snapshot product.

Offload agent
The offload agent `fcmcli` is used to send an existing snapshot to an IBM Spectrum Protect server. This agent also calls the generic device agent for mount and unmount operations on a backup system.

IBM Spectrum Protect Snapshot command line interface
The command line interface `fcmcli`, is used to issue various commands.

Chapter 2. Planning

Before you install IBM Spectrum Protect Snapshot for UNIX and Linux, review the system, application, and storage requirements.

Review the *Pre-installation Checklist* that is attached to the technote for the hardware and software requirements for IBM Spectrum Protect Snapshot. The detailed hardware and software requirements are published as a part of the *Hardware and Software Requirements* technote which can be found at this link: http://www-01.ibm.com/support/docview.wss?uid=swg21427692. From this technote, select the required software version and then select the required component link. The hardware and software requirements page contains the *Pre-installation Checklist* and an *Installation Planning* worksheet.

Note: The *Pre-installation Checklist* contains the most current requirement information, use this list to validate your environment.
The following conditions are the minimum environment requirements:

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

The *Pre-installation Checklist* documents the requirements that can be verified automatically by running the IBM Spectrum Protect Snapshot Prerequisite Checker.

The *Pre-installation Checklist* is published here: http://www.ibm.com/support/docview.wss?uid=swg214276

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

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

IBM Spectrum Protect Snapshot Prerequisite Checker

Run the checker tool to check the compatibility of the operating system, and available software that is to be used by IBM Spectrum Protect Snapshot in an AIX, or Linux environment. The Prerequisite Checker does not change the database or the system.

Run the tool to retrieve information from the operating system and database in preparation for installing IBM Spectrum Protect Snapshot for Oracle.

The Prerequisite Checker is a tool that automatically checks your environment with a number of the checks that are documented in the IBM Spectrum Protect Snapshot

Pre-installation Checklist. The *Pre-installation Checklist* is published as part of a release and is attached to the IBM Spectrum Protect Snapshot Hardware and Software Requirements technote.

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

Capacity planning

Ensure that there is sufficient storage space before you install and use IBM Spectrum Protect Snapshot.

The storage space that is required for IBM Spectrum Protect Snapshot can be divided into the following categories:

- Space that is required for the global product installation on the system.
- Space that is required to enable each individual database instance with IBM Spectrum Protect Snapshot.
- Space that is required on the storage system to store the actual snapshot backups or clones.

Space requirement for global product installation

The space that is required for the product installation of IBM Spectrum Protect Snapshot varies depending on the underlying operating system. The following table shows the default installation paths and the average space requirements.

Table 1. Space requirements for a global product installation of IBM Spectrum Protect Snapshot

Operating system	Installation path	Space required (MB)
AIX	`/usr/tivoli/tsfcm/acs_version_number`	1250
Linux	`/opt/tivoli/tsfcm/acs_version_number`	500

Space requirement for instances

IBM Spectrum Protect Snapshot must also be installed on each instance that is enabled for snapshot-based data protection or cloning. This process is called activation and must be started after the installation. During this process, all necessary files are copied from the installation path to an instance-specific directory. The space that is required for each IBM Spectrum Protect Snapshot instance is equal to the amount of space that is required for the global product installation.

The same amount of space is required for any backup or clone instance.

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

In an Oracle multi-database environment, the space that is required to protect more than one database is reduced when a single instance protects multiple Oracle databases. For more information about the multi-database environment, see Single Oracle instance for multi-database protection.

Space requirement for snapshot copies

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

- The total size of all volumes in the storage system that are part of the volume groups that contain the application data.
- The type of snapshot whether it is a full copy or a space-efficient snapshot.
- The number of backup copies.
- The number of changes that occur on the source volumes after a snapshot is taken. This factor applies to space-efficient snapshots only.

For remote mirroring with any of the following storage systems, each backup copy uses space on the remote site storage and on the local site until it is deleted.

XIV

SAN Volume Controller

IBM Storwize family

Use the **MAX_VERSIONS** parameter in the IBM Spectrum Protect Snapshot profile to limit the number of snapshots that are stored on a storage system.

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

Required communication ports

IBM Spectrum Protect Snapshot for UNIX and Linux uses ports for communication between its daemon processes on backup or cloning systems and the production system, and the storage systems. Port numbers are defined during the installation of IBM Spectrum Protect Snapshot for UNIX and Linux.

To determine the default port numbers that are used for IBM Spectrum Protect Snapshot for UNIX and Linux see the following table:

Table 2. IBM Spectrum Protect Snapshot for UNIX and Linux default port numbers

TCP Port	Initiator: Out-Bound (From Host)	Target: In-Bound (To Host)
57328	Production server and backup/cloning server	ACSD port on production system
5989 (HTTPS port)[1] 5988 (HTTP port)[1]	Production server and backup/cloning server	SAN Volume Controller CIM agent, with static target allocation Storwize family cluster CIM agent, with static target allocation

Table 2. IBM Spectrum Protect Snapshot for UNIX and Linux default port numbers (continued)

TCP Port	Initiator: Out-Bound (From Host)	Target: In-Bound (To Host)
22	Production server and backup/cloning server	SSH port on SAN Volume Controller or Storwize family cluster, with dynamic target allocation
6989 (HTTPS port)[1] 6988 (HTTP port)[1]	Production server and backup/cloning server	DS8000 DS8000 CIM Agent
7778	Production server and backup/cloning server	XIV XIV CLI
[1] The protocol is specified in the **COPYSERVICES_COMMPROTOCOL** parameter of the IBM Spectrum Protect Snapshot profile.		

Single Oracle IBM Spectrum Protect Snapshot instance for multi-database protection

When you are configuring IBM Spectrum Protect Snapshot for Oracle, you can configure the product for all Oracle databases on the same host in the same configuration process with a single user ID.

Configure and manage all Oracle databases in a single host that are administered by the same administrative user id. When the single instance is configured for one or more Oracle databases that run on that host, IBM Spectrum Protect Snapshot operations and commands can be run for all those databases. When you run IBM Spectrum Protect Snapshot backup or restore operations on a single database, the database and the location of the Oracle software are identified in the command line.

When you use a single Oracle user ID, the databases that are administered by that user ID require a single IBM Spectrum Protect Snapshot instance with one set of binaries, daemons, and one repository. This approach ensures that less disc space is required, and actions such as upgrading to a new version of the product can be run only once on that instance for all databases. Different operations on different databases can be run in parallel. Logging for all databases that are managed by an IBM Spectrum Protect Snapshot instance is done centrally by the single instance owner user.

Migration

Choose to migrate one or more existing IBM Spectrum Protect Snapshot instances to a multi-database instance. Run the Migration Tool to migrate a specific instance. When you are upgrading, the configuration is done once for each IBM Spectrum Protect Snapshot instance that protects one or more databases. For more information about migration, see the Migrating Oracle instances section.

Cloning

The same single userid must be available on all clone servers. That user ID must also have the same home directory, UID, and GID as on the production server.

Offloading

The same single user ID must be available on all backup servers to allow successful offload operations to the IBM Spectrum Protect server. That user ID must also have the same home directory, UID, and GID as on the production server.

ASM

In ASM environments, a specific Oracle grid user is still required for IBM Spectrum Protect Snapshot operations. This user must be a member of the group `asmadmin`. Each ASM node where IBM Spectrum Protect Snapshot is running requires its own CLIENT section where the appropriate ORACLE_SID is specified. If the database is cloned, there must be a CLONING section where the appropriate ORACLE_SID is specified.

Storage solutions

Before you install and configure IBM Spectrum Protect Snapshot software, review the storage solution setup. The storage device and its storage volumes must be accessible from all backup and clone servers in the environment.

IBM XIV Storage System

When IBM Spectrum Protect Snapshot creates a backup on an IBM XIV Storage System, a snapshot of all source volumes that belong to the protected application is created on the storage system. By default, this snapshot is a space-efficient read-only copy of the application.

If you set the **USE_WRITABLE_SNAPSHOTS** parameter to `NO`, the snapshots are not mounted directly on a backup host. Instead, IBM Spectrum Protect Snapshot creates duplicates from the snapshots as part of the mount procedure, and these duplicates are removed when the backup is unmounted. The duplicate is a space-efficient logical copy of the snapshot, and this copy is writable. The duplicate is effectively another image, so 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 operations of that backup. A subsequent mount operation presents the image as created when the snapshot occurred.

The **USE_WRITABLE_SNAPSHOTS** parameter specifies whether writable snapshots can be used for mount or restore operations. If writable snapshots are used, no duplicates are created during mount operations and all changes that are applied to the snapshot are preserved. For more information, see "LVM mirroring and ASM failure group environment" on page 57. A typical IBM Spectrum Protect Snapshot profile section for IBM XIV Storage System is provided here:

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

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

Dependent software packages

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

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

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

IBM Spectrum Protect Snapshot uses IBM XIV Storage System capabilities to restore writable snapshots. For writable snapshots, a mount operation directly mounts the original snapshot to another host. All changes to the snapshot are preserved, and a subsequent mount or backup operation contains all changes that occurred to the snapshot while mounted. For more information about using writable snapshots, see information about the **USE_WRITABLE_SNAPSHOTS** parameter in DEVICE_CLASS section.

(AIX only) Support for virtual I/O

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

Best practices for IBM Spectrum Protect Snapshot with IBM XIV 11.6 Real-time Compression™

You can use IBM XIV 11.6 Real-time Compression with IBM Spectrum Protect Snapshot. The usage of IBM Spectrum Protect Snapshot with compressed volumes is not changed. However, when you transform volumes that are managed by IBM Spectrum Protect Snapshot from the uncompressed state to the compressed state (or if you transform from compressed to uncompressed), use the following list of behaviors as a guide:

1. When source volume transformation is in progress (from uncompressed to compressed, or compressed to uncompressed), most IBM Spectrum Protect Snapshot operations (for example, back up, restore, and mount) fail. The XIV adapter returns the **FMM18137E** message. Run the volume transformation at a time that does not overlap with scheduled backups or other IBM Spectrum Protect Snapshot actions that run on the volume that is being transformed.
2. With the XIV system, you can transform a volume from uncompressed to compressed state (or compressed to uncompressed state) by using one of the following options:

- With the `delete_source=yes` option, delete all volume backups. If you do not delete the volume backups, the transform is unsuccessful. You can use the IBM Spectrum Protect Snapshot to manually delete the backups before the transform operation runs.
- With the `delete_source=no` option, the volume backups are retained. After the transform completes, the original (source) volume is hidden from the host system. The original volume is replaced by the transformed volume. Any instant restore operation that completes with the backups made before the transformation are restored to the hidden volume on the storage device. The restore is not made to the volume seen by the host. Note the restore to the volume that is seen by the host appears to be successful, but the source volume visible to the host system is unchanged.

When you use IBM Spectrum Protect Snapshot to protect volumes to be transformed, delete the existing snapshot backups, regardless of the `delete_source` option setting.

Related concepts:

"Remote mirror integration" on page 21

SAN Volume Controller and Storwize family storage systems

IBM Spectrum Protect Snapshot restores point-in-time copies from backups on SAN Volume Controller, and Storwize family storage systems. You can also mount images on a remote server and back up the images to an IBM Spectrum Protect server.

SAN Volume Controller storage adapter device types

IBM Spectrum Protect Snapshot for UNIX and Linux offers two backup solutions with Storwize family and SAN Volume Controller storage systems.

When you configure IBM Spectrum Protect Snapshot, you can select one of the following device types (**COPYSERVICES_HARDWARE_TYPE**):

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

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

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

Restriction: Both `SVC` and `SVCDTA` values are considered to be different hardware types, so limitations apply when they are used on the same storage system.

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

- Target volumes are created on the storage system.
- Target sets for the volumes on the storage system are created.

A *target set* represents the mapping from the production host to the target volume on the storage system. You must specify a new target set for each backup generation to be retained on the storage system.

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

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

Feature	Dynamic target volumes	Static target volumes
Command line interface	Storwize family or SAN Volume Controller command-line interface (CLI)	Common Information Model (CIM) interface
Number of snapshot images retained	Specify a value for each device class **MAX_VERSIONS** parameter. Click here for information about the CLIENT section of the profile and values for **MAX_VERSIONS**.	Limited by the number of target sets defined
Selectively restore a single FlashCopy snapshot image	Yes	Yes, however any FlashCopy image in the target set that is newer than the FlashCopy restored is deleted

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

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

Support for virtual I/O (AIX only)

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

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

IBM Spectrum Protect Snapshot uses virtual SCSI adapters to map disks from a VIO to a client LPAR. Physical volumes are required to be mapped from the VIO

to the client. However, mapping logical volumes or storage pools is not supported. On the production server, IBM Spectrum Protect Snapshot supports virtual I/O with N_Port ID Virtualization (NPIV) and Virtual I/O Server (VIOS). There is a one-to-one relationship between the virtual I/O logical volume and the storage LUN. On the backup server, IBM Spectrum Protect Snapshot supports virtual I/O with NPIV. In addition, VIOS is supported when you configure the **BACKUP_HOST_NAME** parameter to use the PREASSIGNED_VOLUMES in the IBM Spectrum Protect Snapshot profile.

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

Remote access to FlashCopy images

For static target allocation, IBM Spectrum Protect Snapshot allows mounting a FlashCopy backup image to another host. This image is writable and any changes that are made on that image are reflected in the backup and are included in the subsequent restore.

For dynamic target allocation, a writable duplicate is mounted which is dismissed on unmount. As a consequence, the original backup is not altered. For cloning operations, the backup is directly mounted in the same way as for static target allocation.

Related tasks:

"Configuring or reconfiguring IBM Spectrum Protect Snapshot" on page 42

Related information:

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

Incremental backups and MAX_VERSIONS for SVCDTA

When you configure SAN Volume Controller Dynamic target allocation, you can choose to run incremental backups. When the maximum number of backups as defined by **MAX_VERSIONS** is reached for a device class with **FLASHCOPY_TYPE** INCR, the oldest backup is deleted just before the new backup is taken. This new backup refreshes the INCR FlashCopy relation of the previous deleted backup.

For more information about device class settings, see Device class backup version retention.

Related tasks:

"Configuring Storwize family and SAN Volume Controller dynamic target allocation (SVCDTA)" on page 49

Dynamic target allocation

This solution creates dynamic target volumes on the storage system during a backup operation.

During the backup process, target volumes are created dynamically and allocated on demand. IBM Spectrum Protect Snapshot uses the Storwize family or SAN Volume Controller command line interface (CLI) to communicate with the storage system. You do not need to install a Common Information Model (CIM) server.

Tip: Ensure that OpenSSH is installed on the Production and Backup servers. During the configuration process, you are prompted for the location of the OpenSSH binary.

Important: Using the **MAX_VERSIONS** parameter in the CLIENT section of the profile, specify the number of backups to retain. Use a specific number of backups to retain or use the ADAPTIVE option for each **DEVICE_CLASS** for **DEVICE_CLASS**<*SVCDTA*>.

In SAN Volume Controller environments where the source volumes of a backup are mirrored internally and the copies are in two different SAN Volume Controller storage pools, the storage pool for the target volumes is not automatically determined. You must specify the target storage pool with the **SVC_POOLNAME** parameter in the DEVICE_CLASS section of the IBM Spectrum Protect Snapshot profile when the **COPYSERVICES_REMOTE** is *YES*.

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

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

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

Backup operations and cloning operations

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

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

Backup operations

An IBM Spectrum Protect Snapshot backup operation uses the oldest target set that is available for the specified **DEVICE_CLASS**. However, that target set might not be the oldest target set that is associated with the source volumes. This scenario is possible when more than one **DEVICE_CLASS** is specified in the IBM Spectrum Protect Snapshot profile. When the FlashCopy backup that is available on the target set is not the oldest

backup, then the older backups are deleted during the backup operation. The oldest target set is the set that is used for the oldest FlashCopy backup in a multiple target set configuration.

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

Restore operation
An IBM Spectrum Protect Snapshot restore operation deletes any FlashCopy backups that are newer than the backup that is being restored. In addition, the backup that is restored with the current operation can also be deleted.

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

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

Static target allocation

When you use SAN Volume Controller and Storwize family, IBM Spectrum Protect Snapshot software can restore FlashCopy backups before completion of a background copy.

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

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

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

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

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

To check whether a backup is going to be deleted, query the usability state of IBM Spectrum Protect Snapshot backups. If the backup is going to be deleted, during the restore process, the DESTRUCTIVELY_RESTORABLE state is set. Otherwise, the state is set to REPETITIVELY_RESTORABLE.

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

Target sets

IBM Spectrum Protect Snapshot cannot reuse a target set for a new snapshot backup unless it corresponds to the last snapshot mapping in a cascaded snapshot relationship. This scenario implies that when IBM Spectrum Protect Snapshot reuses a target set, all backups that are created before this point in time are deleted. In a non-mirrored environment, all backups that are created before this point in time are deleted when the following conditions are met:

- The same profile for the IBM Spectrum Protect Snapshot backups is used.
- This profile contains only one **DEVICE_CLASS** statement in the CLIENT section.

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

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

Recommendations for setting up the environment with static target volumes

When you set up the SAN Volume Controller and Storwize family environments for use with IBM Spectrum Protect Snapshot software, the following list identifies guidelines for the environment:

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

  For example:

  – Define three target sets in the **DISK_ONLY** device class. Schedule these disk only backups to occur at *6:00*, *12:00*, and *18:00*.

  – Define one target set in a **DUAL_BACKUP** device class. Set this schedule to create a disk and IBM Spectrum Protect backup at *00:15*.

If the value for the profile parameter **MAX_VERSIONS** is set to ADAPTIVE all disk-only backups taken before that point in time are deleted. Otherwise, the version policy causes the dual backup to fail if **MAX_VERSIONS** specifies seven versions.

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

DS8000 storage system

For the DS8000 storage system, it is not possible to restore point-in-time copies when you set the **FLASHCOPY_TYPE** parameter to *NOCOPY* in the IBM Spectrum Protect Snapshot profile.

You can mount images on a remote server and back up the images to an IBM Spectrum Protect server when you use DS8000 storage systems.

CIM server

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

IBM Spectrum Protect Snapshot requires that FlashCopy backup target volumes be created in advance on DS8000. To provide a target set definition to IBM Spectrum Protect Snapshot, organize target volumes into target sets, where each target set represents one backup generation.

IBM Spectrum Protect Snapshot automatically matches source volumes to suitable target volumes. However, each target set must contain at least one suitable target volume for each source volume to be backed up. Additional target volumes in a target set are allowed, but these target volumes are ignored.

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

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

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

Support for virtual I/O (AIX only)

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

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

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

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

Remote access to FlashCopy images

IBM Spectrum Protect Snapshot allows mounting a FlashCopy backup image to another host. This image is writable and any changes that are made on that image are reflected in the backup and are included in the subsequent restore.

Related information:

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

Reconciliation of backups

Reconciliation is the process where IBM Spectrum Protect Snapshot periodically verifies that backups on the storage system are valid.

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

The reconciliation process removes IBM Spectrum Protect Snapshot backups when the following events occur on storage systems:

All storage systems

Manual intervention causes the following events to occur:

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

The reconciliation process removes IBM Spectrum Protect Snapshot backups when the following events occur on the IBM XIV Storage System

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

The reconciliation process removes IBM Spectrum Protect Snapshot backups when the following events occur on IBM System Storage SAN Volume Controller and IBM Storwize family storage systems with static target allocation

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

The reconciliation process removes IBM Spectrum Protect Snapshot backups when the following event occurs on IBM System Storage DS8000

When a source target relationship is withdrawn backups are removed. This process does not happen automatically.

Remote mirror integration

When you use storage solutions with mirror technologies in combination with IBM Spectrum Protect Snapshot, certain criteria must be met by the environment to integrate backup, restore, and cloning operations. For IBM System Storage SAN Volume Controller and IBM System Storage DS8000 series, mirror technologies are labeled Global Mirror and Metro Mirror. For IBM XIV Storage System, mirror technologies are labeled Synchronous Remote Mirroring and Asynchronous Remote Mirroring.

SAN Volume Controller

IBM Spectrum Protect Snapshot backs up application data consistently on SAN Volume Controller storage solutions with volumes that are simultaneously used as Metro Mirror or Global Mirror sources. You can configure either the sources or the targets of the Remote Mirror to be selected as the sources for the FlashCopy backup. In addition, do not use FlashCopy targets as Global Mirror or Metro Mirror sources.

IBM System Storage DS8000

IBM Spectrum Protect Snapshot backs up DS8000 storage solutions with volumes that are simultaneously used as Global Mirror or Metro Mirror sources. In contrast to SAN Volume Controller, you can configure only the sources of the Global Mirror or Metro Mirror to be selected as the sources of the snapshot backup. When you use IBM Spectrum Protect Snapshot in this environment, do not use snapshot targets as Global Mirror and Metro Mirror sources.

IBM XIV Storage System

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

Storage solutions that use mirror technologies with IBM Spectrum Protect Snapshot must have the correct environment. The following list describes the criteria that must be met to ensure mirroring works correctly.

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

  SAN Volume Controller

  - A consistency group contains a list of snapshot or Remote Copy relationships.
  - The IBM Spectrum Protect Snapshot software creates a snapshot consistency group on the secondary site to build a consistency unit between the source and target of the snapshot.
  - You must define the consistency group for the mirror relationships between the master and auxiliary virtual disks.
  - For Metro and Global Mirror, the state of the consistency group must be consistently synchronized.

  XIV

  - The operational state of mirror must be operational.
  - A consistency group contains a list of volumes.
  - A consistency group that contains all of the remote copy target volumes must exist before you start the snapshot on the remote system. Apply the storage commands to the consistency group to simplify management.
  - The mirror relationship between the master and slave volumes must be defined in the consistency group.

    The master is where source volumes are located for the remote replication. The slave is where target volumes are located.
  - For XIV synchronous mirroring, the state of the consistency group must be consistently synchronized.
  - For XIV asynchronous mirroring, the state of the consistency group must be `RPO_OK`.
- For Metro Mirror and Synchronous Remote Mirroring, the write operation is committed to the host after the data is written to both the source and target volumes.
- For Global Mirror and Asynchronous Remote Mirroring, the write operation is committed to the host immediately after the data is written to the source volume.
- In terms of master and slave sites, the master site is where source volumes are located for the remote replication. The slave site is where target volumes are located. When a disaster occurs or when maintenance is necessary, the roles of master site and slave site can be changed.

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

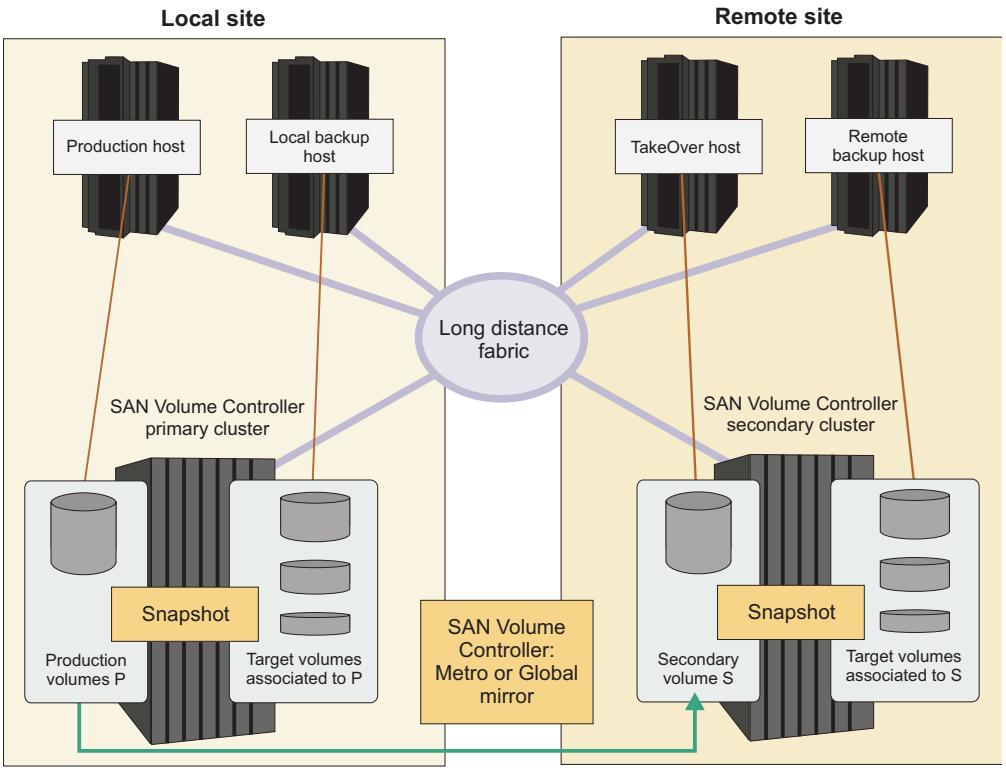


Figure 4. Remote mirroring using Metro Mirror and Global Mirror sources

Remote mirroring and consistency groups

You must verify the configuration of the consistency group on SAN Volume Controller and XIV systems that use mirroring functions before you run IBM Spectrum Protect Snapshot backup operations.

A *consistency group* is a group of copy relationships. You can group relationships into a consistency group that manages the consistency of dependent writes by creating a consistent point-in-time copy across multiple volumes or storage systems.

You must ensure that the connectivity state is online and configured for a SAN connection between the primary and secondary storage systems. The primary site contains the primary storage volumes for the production site. The volumes are then replicated to target volumes on the secondary site. IBM Spectrum Protect Snapshot requires the following configuration:

- For SAN Volume Controller, you must configure the consistency group:
  - For Metro Mirrors for static and dynamic target allocation, ensure that the state of the consistency group is consistently synchronized.
  - For Global Mirrors with dynamic target allocation, you must configure a *Global Mirror with Change Volumes* relationship:
    - Ensure that the consistency group for the relationship has cycling mode set to `multiple` by selecting the `Global Mirror with Change Volumes` option when you create the relationship between the volumes. Global Mirror with Change Volumes is the name for a point-in-time asynchronous volume replication. You can create change volumes either when you create the

Global Mirror relationships or you can add them to an existing relationship. Cycling mode and change volumes are not needed when you assign target allocation manually.

- The cycle period time set for the cycling mode and the number of I/O operations can influence the IBM Spectrum Protect Snapshot FlashCopy backup time. IBM Spectrum Protect Snapshot waits until the volumes at both sites are synchronized before a backup operation is completed. The cycle period is defined in seconds. The higher the cycle period the longer the time that is required for synchronization and to complete a FlashCopy backup. The factors that can influence the time are the number of I/O operations and the spread of the block-level changes across the storage system. The default value is 300 seconds.

  Restriction: When you set the cycle period, the initial replication from the primary site change volume to the secondary change volume can take several hours before the volumes are synchronized. If you start an IBM Spectrum Protect Snapshot backup operation during this initial replication, the backup operation can fail due to the amount of time that is taken to complete the synchronization operation. Therefore, wait until the initial replication of change volumes is completed before you start a backup operation.

- For XIV systems, you must configure the consistency groups:
  - The consistency group must contain a list of mirrors.
  - The consistency group must contain a list of all of the remote copy target-volumes and this list must exist before you start the snapshot on the remote system.
  - The mirror relationship between the master (source) and slave (target) volumes must be defined in the consistency group. The master is on the source volume. The slave is on the target volume.
  - For synchronous mirroring, the state of the consistency group must be consistently synchronized.
  - For asynchronous mirroring, the state of the consistency group must be `RPO_OK`.

Preparing applications that run on VMware or KVM

Before you install IBM Spectrum Protect Snapshot on VMware or KVM virtual machines that run Linux guest operating systems, you must verify the configuration of the application that you want to protect.

Before you begin

Different applications have specific IBM Spectrum Protect Snapshot configuration requirements. For more information about application-specific requirements, see Chapter 2, “Planning,” on page 7.

Procedure

VMware

- Before you back up data or clone databases on VMware virtual machines, ensure that all source LUNs in the backup or clone operations are attached to the virtual machine with one of the following methods:
  - VMware physical mode raw device mapping (pRDM)

  - iSCSI
  - Network file system (NFS)
- Run an IBM Spectrum Protect Snapshot restore operation from a snapshot to an existing pRDM disk. The operation does not create a virtual machine or pRDM definition as part of the restore process.

KVM

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

Checking the KVM setup

Ensure that when the IBM Spectrum Protect Snapshot KVM setup uses Block Device Mapping, the LUNs are mapped to the KVM guest as multipath devices. The LUNs must be visible as multipath devices inside the KVM guest. Run the **multipath** command to check your setup for KVM.

Procedure

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

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

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

Chapter 3. Installing and setting up IBM Spectrum Protect Snapshot

Install IBM Spectrum Protect Snapshot by following the installation steps, and launch the Configuration Wizard to configure that instance. When these steps complete successfully, activate the installation for every application you want to protect. Ensure to install IBM Spectrum Protect Snapshot on the production server first.

About this task

Depending on your environment, a separate installation of IBM Spectrum Protect Snapshot can be required on a backup or clone server. The following set of tasks are required to complete the installation process.

Procedure

1. Install IBM Spectrum Protect Snapshot on the production server. During the installation, the product is installed to a global installation directory.

   The production server is the server where the application to be protected by IBM Spectrum Protect Snapshot is located.
2. Activate the installation for every database instance you want to protect with IBM Spectrum Protect Snapshot.

   During the activation, all the necessary files are copied from the installation directory, to the database instance installation directory.
3. Launch the Configuration Wizard to configure IBM Spectrum Protect Snapshot with the `./setup_ora.sh` command.

   You can also proceed to install and configure the product on a backup or clone server.

   If Open Secure Shell (OpenSSH) is configured between the production and the backup or clone servers, IBM Spectrum Protect Snapshot can be activated and configured on the backup or clone server by using the Configuration Wizard from the production server. Otherwise, a separate installation is required.
4. If backup and clone servers are not automatically activated and configured, run the Configuration Wizard to configure IBM Spectrum Protect Snapshot for Oracle on all required servers . Backup servers or clone servers are auxiliary hosts that are required by IBM Spectrum Protect Snapshot to mount backup images and clone databases. A backup server is also required to offload backups to an IBM Spectrum Protect server.

Results

The following files and directories are created on the production server, and optionally on the backup or clone servers, during the configuration process:

- When the `ACS_DIR` directory is not identical to the instance directory, an `ACS_DIR` configuration directory is created. The path for the `ACS_DIR` directory is specified in the IBM Spectrum Protect Snapshot profile.
- A profile in the `ACS_DIR` configuration directory.
- A symbolic link from the `<instance directory>/profile` that points to the `ACS_DIR/profile` when the two directories are not identical is created.
- A password file in the `ACS_DIR/shared` directory.

IBM Spectrum Protect Snapshot daemon processes are stopped and restarted if requested.

Preparing for installing

Before you install IBM Spectrum Protect Snapshot, review the hardware, software requirements, and application environment. You must complete the Pre-installation Checklist and Planning Worksheet before you install IBM Spectrum Protect Snapshot for UNIX and Linux.

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

To prepare your environment for IBM Spectrum Protect Snapshot for UNIX and Linux, run the Prerequisite Checker tool.

Related concepts:

"Prerequisite checker for Oracle"

Required Operating System users

Each IBM Spectrum Protect Snapshot instance requires a user ID that has permission to administer all Oracle databases that are protected by the instance.

When you are accessing a database, Oracle requires that the *ORACLE_HOME* and *ORACLE_SID* environment variables are set in the user's environment. For each protected database, these values must be passed through profile variables *ORACLE_HOME* and *ORACLE_SID* to IBM Spectrum Protect Snapshot. You are asked to specify required values for *ORACLE_HOME* and *ORACLE_SID* when you are running the Configuration Wizard. These entries are included in the IBM Spectrum Protect Snapshot profile when you complete the configuration process and exit the Configuration Wizard. These values are used for all subsequent IBM Spectrum Protect Snapshot for Oracle operations.

Prerequisite checker for Oracle

Check your system by running the Prerequisite checker tool before you install IBM Spectrum Protect Snapshot for Oracle and Oracle in an SAP environment.

You must complete the *Pre-installation Checklist* checklist before you install IBM Spectrum Protect Snapshot. In AIX and Linux environments, running the Prerequisite Checker tool automatically runs some of the checks that are documented in the *Pre-installation Checklist*. Running the tool on your AIX or Linux system, automatically checks for compatible operating system, database instance, and volume group layout in preparation for installing the product.

The *Pre-installation Checklist* is published here: http://www.ibm.com/support/docview.wss?uid=swg21427692.

Installing the Prerequisite Checker

As part of your preparation activities, install and run the Prerequisite Checker tool before you install or upgrade to a new version of IBM Spectrum Protect Snapshot for UNIX and Linux. Running the tool on your system automatically checks for compatible operating system, database instance, and volume group layout in preparation for installing IBM Spectrum Protect Snapshot.

Before you begin

Verify that your environment meets the hardware and software requirements of the IBM Spectrum Protect Snapshot Prerequisite Checker.

Procedure

1. Download the IBM Spectrum Protect Prerequisite Checker installation file for your operating system from the download website. For information about downloading the Prerequisite Checker, see the Download Information.
2. Log on with the root user ID.
3. Start the installation wizard by running one of the following commands:

   AIX: `<VERSION>-FCM-PREREQ-AIX.bin [-i console | -i swing]`

   Linux: `<VERSION>-FCM-PREREQ-Linux.bin [-i console | -i swing]`

   where, `-i console` indicates that the Prerequisite Checker is installed with the console version of the installer. `-i swing` indicates that the Prerequisite Checker is installed with the GUI version of the installer. This method is the default.
4. Complete the steps of the installation wizard. Choose to install the Prerequisite Checker to an arbitrary `checker_path`.

Running the Prerequisite Checker

Run the Prerequisite Checker any number of times for any database instances on the production server, and review the `results.html` in your browser.

Before you begin

Log on to the production server that is to be supported by IBM Spectrum Protect Snapshot, with the root user ID. Check the following requirements:

- Oracle databases must be mounted.
- The default environment of the instance owner must contain all the environment settings necessary for interaction with the database.
- The instance owner must have the necessary access rights.

Procedure

1. Log on with the root user ID.
2. Change to the `checker_path` directory where the Prerequisite Checker was installed.
3. Run the `fcmprereqchecker.sh` script as follows:

   ```
   ./fcmprereqchecker.sh -u <instance_user> -s <storage_management_IP_address>
   -p <storage_management_port> -r <connection_string>
   [-o <output_path>] [-d <database_name>]
   ```

   Where,

   `instance_user` is the name of the instance owner.

   `storage_management_IP_address` is the name or IP address of the storage subsystem that contains the database files.

`storage_management_port` is the management port of the storage subsystem that contains the database files.

`output_path` is used to specify a fully qualified directory where all output files and information are written. The default output path is `checker_path/logs`.

`database_name` is used to specify the name or alias of the database to be checked.

`connection_string` for Oracle databases is the Oracle RMAN connection information including user name, password, and SID of the catalog database. For example, `-r username/password@SID`.

Interpreting the Prerequisite Checker output

After you run the Prerequisite Checker, the results are stored to the `result.html` file that can be viewed in your default browser in the Prerequisite Checker Results page. In the case of passed checks, there is no corrective action required. For failures, you must modify your system before you proceed to install IBM Spectrum Protect Snapshot for UNIX and Linux.

About this task

The Summary reports the overall result of the checks run; the status is either `Failed`, `Warning`, or `Passed`. The machine name, Operating System, and serial number are listed with the results for each check.

Procedure

- Find the `result.html` file and open it in your browser.

  The `result.html` file is stored in the `<output_path>` of the Prerequisite Checker. The default output path is `<checker_path>/logs`. If you specified a different output path with the `-o` option, the `result.html` and log files are stored there. There is a text file version of the results stored there called `result.txt`. For information about fails and warnings, including message information, review the log file in the same directory.
- If your system has `Passed`, you can proceed to work through the checks in the *Pre-installation Checklist* that were not covered by the Prerequisite Checker tool.
- If your system has `Failed`, you must fix your environment before you install the product.
- Review each warning, and where possible fix the issues and rerun the checks for your system. In some cases, you must rerun a check manually. For more information about a check, go to the *Pre-installation Checklist* that is published at this link http://www.ibm.com/support/docview.wss?uid=swg21427692.
- Follow the Next Steps that are advised in the results page.

Uninstalling the Prerequisite Checker

You can uninstall the Prerequisiste Checker tool independently of any action to the IBM Spectrum Protect Snapshot product.

Procedure

1. Log on with the root user ID.
2. Enter the following command:

   `<checker_path>/uninstall/uninstall.bin [-i console | -i swing]`

   where:

   `checker_path` is the path where the Prerequisite Checker was installed.

`-i console` indicates that the Prerequisite Checker is uninstalled using the console version of the uninstaller.

`-i swing` indicates that the Prerequisite Checker is uninstalled using the GUI version of the uninstaller.

If option `-i` is not specified, the same method used for installing the Prerequisite Checker is used for uninstalling the tool.

Results

The Prerequisite Checker executable files are removed from your system.

Preparing Oracle systems (non-SAP, non-ASM)

IBM Spectrum Protect Snapshot processes database files at a volume level on Oracle systems and requires these database files to be on one or more dedicated volume groups.

The Oracle table space database files must be on file systems that are supported by IBM Spectrum Protect Snapshot on your system. However, Oracle active log files must not be in the same volume groups as the table space data files. If Oracle database control files are in the same volume groups as the table space data files, an advanced recovery procedure is required after a restore operation completes. This procedure is described here, Step required for advanced recovery.

If other data is stored in the table space data volume groups, it is processed by IBM Spectrum Protect Snapshot and included in the IBM Spectrum Protect Snapshot backup image. During a restore operation, this data is overwritten. Therefore, do not store objects such as database binary files, online redo logs or offline redo logs on the data volume groups.

Extra files that are not associated with the database backup operation but are stored within the same file system, can cause the backup to fail. Use the **NEGATIVE_LIST** parameter in the IBM Spectrum Protect Snapshot profile to control the processing of these files. For information about this parameter, see the profile section "CLIENT" on page 114 for details.

IBM Spectrum Protect Snapshot processes table spaces only. The volume group layout that is required for Oracle systems (non-SAP and non-ASM) is detailed in the *Volume group layout requirements* section of the *Pre-installation Checklist*.

IBM Spectrum Protect Snapshot does not support a volume and storage layout where the database is spread across multiple storage devices. In an AIX logical volume manager mirroring environment, each mirror must be located within a separate storage cluster.

IBM Spectrum Protect Snapshot requires that an Oracle recovery catalog database is available when you back up data. This recovery catalog must be present regardless of the type of backup.

If a shell other than ksh or bash is used, Oracle-specific environment variables such as ORACLE_HOME and paths must be accessible when the `su - <oracle_user> -c` command is entered.

Preparing Oracle Automatic Storage Management

Ensure that you have your environment set up to protect your Oracle ASM data with IBM Spectrum Protect Snapshot.

Before you begin

Redundancy level is defined when the ASM disk group is created, and can be normal, high, or external. For more information about ASM disk group redundancies, see the Oracle product documentation. IBM Spectrum Protect Snapshot supports all three redundancy types.

Procedure

1. Define the storage devices in the IBM Spectrum Protect Snapshot profile with the **DEVICE_CLASS** profile parameter. The definitions must specify that IBM Spectrum Protect Snapshot selects the storage cluster for the current operation.

   For an ASM disk group with normal redundancy, the backup completes even if one of the failure groups is not located on the storage device. For an ASM disk group with high redundancy, the backup completes even if two of the failure groups are not located on the storage device.
2. Create the ASM disk groups. If you already created the ASM disk groups, verify that they meet the following criteria.
   - For an ASM backup, create a disk group on the backup system to host an Oracle control file. This disk group has the same name as the disk group where the control file is on the production system. During a backup operation, the Oracle control file is stored in the IBM Spectrum Protect Snapshot repository directory on the production server.
   - For ASM cloning, ensure that the ASM disk groups are on supported storage systems, otherwise the cloning operation fails.
   - Do not run any queries or operations on the Oracle database and ASM instance on the clone system while IBM Spectrum Protect Snapshot clone operations are running.
3. During the offload operation, the control file is transferred into a temporary directory within `ACS_DIR` on the backup server by IBM Spectrum Protect Snapshot. RMAN restores the control file into the locations that are specified within the database profile from this location as part of the offload operation.
4. IBM Spectrum Protect Snapshot must have an Oracle recovery catalog database available when you back up data. This recovery catalog must be present regardless of the type of backup. Typically one ASM instance can serve multiple databases.

   IBM Spectrum Protect Snapshot supports this setup when dedicated disk groups are used for each database. For normal-redundancy disk groups and high-redundancy disk groups, IBM Spectrum Protect Snapshot handles failure groups by allowing backups of disk groups that are on supported storage systems.
5. If needed, you can change the redundancy level and add failure groups after a restore operation. IBM Spectrum Protect Snapshot does not re-create failure groups when a restore operation completes.
6. Export Oracle specific environment variables for the ASM instance and paths, such as *ORACLE_HOME*. Type in one of these commands to verify that the variables are available:

   ```
   su - oracle_user -c
   ```

For ksh or bash, enter the following command with root user ID `su - oracle_user -c env | grep ORA`

7. Export Oracle Grid specific environment variables for the ASM instance and paths, such as *ORACLE_HOME* and *ORACLE_SID*. Type in one of these commands to verify that the variables are available:

   ```
   su - grid_user -c
   su - grid_user -c env | grep ORA
   ```

ASM disk group layout

An ASM disk group is a collection of disks that Oracle ASM manages. Because IBM Spectrum Protect Snapshot processes database files at the ASM disk group level, the database files are required to be on dedicated disk groups. Non-application data that is stored on these disk groups is also processed by IBM Spectrum Protect Snapshot and is included in the backup images. This non-application data is overwritten during a restore operation.

For ASM cloning, the control files must be stored in an ASM disk group. If any control file is not on an ASM disk group, the cloning operation fails with an error.

Extra files that are not associated with the database backup operation but are stored within the same file system, can cause the backup to fail. Use the **NEGATIVE_LIST** parameter in the IBM Spectrum Protect Snapshot profile to control the processing of these files. For information about this parameter, see the profile section "CLIENT" on page 114 for details.

IBM Spectrum Protect Snapshot processes table spaces only. The disk group layouts that are required when you are backing up or cloning in an ASM environment are detailed in the *Volume group layout requirements* section of the *Pre-installation Checklist*.

ASM in a DS8000 environment

For IBM System Storage DS8000 environments, IBM Spectrum Protect Snapshot does not use FlashCopy consistency groups when a FlashCopy backup is created. All table space files must be on a single disk group. There is no consistency across multiple LUNs on this storage system.

Ensure that all table space files are on a single disk group on DS8000 system. In addition, verify that the disk group contains exactly one LUN on the DS8000. IBM Spectrum Protect Snapshot does not support databases that are distributed across multiple storage clusters. There is one exception to this statement, and that is in environments where failure groups are used in a manner where every storage cluster contains a complete image of the databases.

ASM failure groups

IBM Spectrum Protect Snapshot supports Oracle Automatic Storage Management (ASM) failure groups.

When the ASM database is configured with normal or high redundancy, the disk groups are composed of two or three failure groups. These groups can be on two or three respective storage device. IBM Spectrum Protect Snapshot creates a backup entirely within only one of the storage device.

If you use ASM failure groups, review these guidelines:

- In setups where all failure groups are on one storage device, IBM Spectrum Protect Snapshot backs up all failure groups.

- In setups where all failure groups are on different storage device, IBM Spectrum Protect Snapshot backs up all failure groups that are on the storage device that is configured for the current operation. For more information, see "DEVICE_CLASS *device*" on page 128.
- IBM Spectrum Protect Snapshot does not split the failure groups on a remote system.
- Failure group support does not require a backup server.
- IBM Spectrum Protect Snapshot does not re-create failure groups when a restore operation is completed. You must add the failure groups manually to achieve the appropriate redundancy level.

ASM cloning parameters and IBM Spectrum Protect Snapshot

The ASM parameters that point to ASM disk groups on a clone system affect the IBM Spectrum Protect Snapshot in certain scenarios. Review the list of ASM parameters when you are preparing IBM Spectrum Protect Snapshot for Oracle ASM.

IBM Spectrum Protect Snapshot parameters

VOLUME_MGR

For the cloning section of the IBM Spectrum Protect Snapshot profile, this parameter must be set to *ASM* to support ASM cloning.

ENHANCED_PARTITIONING

When **VOLUME_MGR** is set to *ASM*, the **ENHANCED_PARTITIONING** parameter is not evaluated by IBM Spectrum Protect Snapshot, and the default setting applies.

FLASH_DIR_LIST

For ASM cloning, ensure that this parameter is not configured. If this parameter is configured in the cloning section of the profile file when **VOLUME_MGR** is set to *ASM*, IBM Spectrum Protect Snapshot stops and sends an error message.

Oracle parameters

DB_CREATE_FILE_DEST

The parameter **DB_CREATE_FILE_DEST** setting on your production system is also used on the clone system when the parameter **OVERWRITE_DATABASE_PARAMETER_FILE** is set to YES. When you create new data files, the specified location must be available on the clone system.

The following situations are possible:

DB_CREATE_FILE_DEST points to the ASM disk group that is part of the snapshot. No action is required.

DB_CREATE_FILE_DEST points to the ASM disk group that is not part of the snapshot. The ASM disk groups must be created on the clone server before the clone operation.

DB_CREATE_FILE_DEST points to a directory on a file system. No action is required. The directory is created on the clone system.

DB_CREATE_ONLINE_LOG_DEST_*n*

The parameter **DB_CREATE_ONLINE_LOG_DEST_*n*** setting on your production system is also used on the clone system when the parameter **OVERWRITE_DATABASE_PARAMETER_FILE** is set to YES. When you create new

log files, the specified location must be available on the clone system. The same situations as specified for parameter **DB_CREATE_FILE_DEST** are possible.

LOG_ARCHIVE_DEST

The log archive destination that is specified with **LOG_ARCHIVE_DEST** and **LOG_ARCHIVE_DEST_***n* can point to regular file systems or ASM disk groups. IBM Spectrum Protect Snapshot turns off archive logging on the clone database as part of the clone operation. Archive logging can be activated manually after the clone operation finishes, or through postprocessing scripts.

CONTROL_FILES

All database control files for ASM cloning must be on ASM disk groups. The LUNs of these disk groups are added to the snapshot backup.

Preparing Oracle RAC

Before you install IBM Spectrum Protect Snapshot in an Oracle RAC environment, you must set up a shared file system. With a shared file system, you can share the IBM Spectrum Protect Snapshot repository, configuration, and binary files between all RAC nodes. IBM Spectrum Protect Snapshot can be used to work on clones that were created on any of the RAC nodes. A clone that is created on one RAC node can be inquired, refreshed, and deleted from every other node within the RAC cluster in one operation.

Before you begin

Before you proceed to install IBM Spectrum Protect Snapshot in an Oracle RAC environment, ensure that all the Prerequisite checks for ASM cloning pass successfully. ASM disk layout checks, and Operation System user and group requirements must pass before you proceed.

Procedure

Create a shared file system for the IBM Spectrum Protect Snapshot repository, configuration, and binary files such as ACFS or NFS.

Related tasks:

"Cloning Oracle RAC databases" on page 86

Preparing backup and cloning servers

Backup servers and clone servers are auxiliary hosts where IBM Spectrum Protect Snapshot can mount backups and clones.

A backup server or clone server is used to offload the backup image to an IBM Spectrum Protect server. The sending of data to the IBM Spectrum Protect server happens from the backup server and not from the production server where the protected application is running. Configure and manage backup or clone servers with the Configuration Wizard. If you want to configure a server for offload snapshots to IBM Spectrum Protect, configure this setup by running the Configuration Wizard. A clone server creates a clone of the productive database from a snapshot backup. You can share one backup or clone server among multiple applications or you can have multiple backup or clone servers. A backup server can also serve as a clone server. However, IBM Spectrum Protect Snapshot does not allow backup images to be mounted directly on the production server. A backup or

clone server must be set up as a separate host.

When a backup server is needed

Backup servers are auxiliary hosts where IBM Spectrum Protect Snapshot can mount backups. The number of required IBM Spectrum Protect Snapshot backup servers is determined by the number of servers that are used to access backup images.

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

- Mount backup images on another server.
- When IBM Spectrum Protect Snapshot is used with other products for example, IBM Spectrum Protect for Enterprise Resource Planning to offload backups to an IBM Spectrum Protect server.
- When IBM Spectrum Protect Snapshot requires a mount during a backup operation because one of the following conditions exists:
  - The database is running in an LVM mirrored environment on AIX.
  - Conditions that require a so called IBM Spectrum Protect Snapshot forced mount operation for the different storage subsystem environments:

    SAN Volume Controller, Storwize family, and DS8000
    A forced mount is required if the option `PREASSIGNED_VOLUMES` is set for the profile parameter **`BACKUP_HOST_NAME`** and the operating system is Linux.

    DS8000
    A forced mount is required on AIX if the option `PREASSIGNED_VOLUMES` is set for the profile parameter **`BACKUP_HOST_NAME`** and a freeze and thaw action was not executed for the file systems.

Backup servers are auxiliary hosts where IBM Spectrum Protect Snapshot can mount backups.

A clone server is a single server, that can also be used as a backup server. A clone server is required when you use the cloning functionality of IBM Spectrum Protect Snapshot.

Installation prerequisites for backup and clone servers

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

Backup server prerequisites:

When IBM Spectrum Protect Snapshot is used in an environment with IBM Spectrum Protect, a backup server is required. This backup server is used to offload the backup workload from the production server to the backup server, and sends the application critical backups to an IBM Spectrum Protect server. Ensure that the required setting are in place before you install IBM Spectrum Protect Snapshot on the backup server.

To run the software, the following settings are required on the backup server:

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

IBM Spectrum Protect for Databases is used by IBM Spectrum Protect Snapshot to start a subsequent backup to IBM Spectrum Protect, and must be installed and configured on the backup server.

IBM Spectrum Protect API is used by these clients and must be installed and configured on both the production and the backup servers.

Update the IBM Spectrum Protect backup-archive client node password on the production server and all backup servers whenever it changes. When IBM Spectrum Protect is configured to use the **PASSWORDACCESS GENERATE** parameter, the password can change without notification.

- If the IBM Spectrum Protect backup-archive client is configured to use the **PASSWORDACCESS GENERATE** parameter, use the IBM Spectrum Protect proxy-node capability to avoid authentication errors when the password is reset.
- Create one data node on the IBM Spectrum Protect server where all IBM Spectrum Protect clients from all backup and production servers are sending and retrieving data.
- Create one authentication node for each production server and backup server that is configured as proxy node to this data node.

Clone server prerequisites:

For setting up a cloning server, the database instances must be installed and configured on the clone server. Ensure that all the prerequisites are in place before you set up the clone server.

For FlashCopy cloning, the database instances must be installed and configured on the clone server.

IBM Spectrum Protect Snapshot requires the following settings for cloning:

- A clone database instance with the same version and name as the database instance on the production server must be installed on the clone server.
- The user name and group name of the clone database instance owner on the clone system must be available on the clone server. The user ID (UID) and group ID (GID) can be different from the UID and GID of the production server database instance.
- For cloning in Oracle environments, the database SID cannot contain lowercase letters. If the SID contains lowercase letters, the clone database is created, but the lowercase letters in the SID of the clone system are converted to capitalized letters.

Offload backups to an IBM Spectrum Protect server with Oracle RMAN:

To offload incremental backups from an Oracle environment, IBM Spectrum Protect Snapshot requires an Oracle database instance to be installed and configured on the backup server.

The Oracle specific environment variables, for example **ORACLE_HOME**, and paths must be exported so that they are accessible if the `su - <instance owner> -c` command is entered. This accessibility can be verified by running `su - <instance owner> -c env | grep ORACLE` as root user. The Oracle recovery catalog database must exist and must be accessible from the production and backup server for the Oracle user ID. In this database, Oracle RMAN records all offloaded backups. For details on the setup of a recovery catalog database, see the Oracle manuals. To verify this setup, run the following command as the Oracle user on the production host:

```
rman target / catalog <catalog_user>/<catalog_password>@
 <catalog_connect_string>
```

To verify the setup of the backup system, run the following command as the root user on the backup host:

```
su -<instance_owner> -c "rman target / catalog <catalog_user>/
 <password>@<catalog_connection_string>"
```

The command must be able to connect to both the target and the recovery catalog databases, and show the RMAN prompt. This operation can be finished with the `quit` command. For example,

```
$ rman target / catalog  rman/rman@catdb

Recovery Manager: Release 11.2.0.3.0 - Production on Fri Aug 5 13:59:53 2016

Copyright (c) 1982, 2011, Oracle and/or its affiliates.  All rights reserved.

connected to target database: P01 (DBID=1213110920, not open)
connected to recovery catalog database

RMAN> quit


Recovery Manager complete.
$
```

Preparing backup and cloning servers for VMware or KVM

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

Before you begin

Review "Installation prerequisites for backup and clone servers" on page 36 to ensure that all requirements for backup and clone servers are met. These requirements are also required for backup servers on virtual machines.

Procedure

- Verify that all target LUNs in backup or clone operations are attached to the virtual machine with one of the following attachment methods:
  - iSCSI
  - Network file system (NFS)

- Verify that all target LUNs in backup operations are attached to the virtual machine with one of the following attachment methods:
  - iSCSI
  - Network file system (NFS)

Installing and uninstallingIBM Spectrum Protect Snapshot for Oracle

Install or uninstall IBM Spectrum Protect Snapshot using the graphical installation wizard, or the console wizard in interactive or silent mode

Installing IBM Spectrum Protect Snapshot in interactive mode

Install IBM Spectrum Protect Snapshot on the production server by using the graphical installation wizard, or the console wizard in interactive or silent mode.

Before you begin

For the most up-to-date requirements, review the *Hardware and Software Requirements* technote that is associated with the IBM Spectrum Protect Snapshot release. This technote is available in the *IBM Spectrum Protect Snapshot - All Requirement Documents* website at: https://www.ibm.com/support/docview.wss?uid=swg21427692. Follow the link to the requirements technote for your specific release and version, and review the *Pre-Installation Checklist* and *Planning Worksheet*.

IBM Spectrum Protect Snapshot installation packages are delivered as individual files. They are provided as an image that is downloaded from IBM Passport Advantage®.

The files are named like

```
<version>-TIV-TSFCM-<platform>.bin
```

Before you install IBM Spectrum Protect Snapshot on AIX or Linux, run the Prerequisite Checker to ensure that the prerequisites are met before you proceed with the installation process.

Procedure

To install IBM Spectrum Protect Snapshot on the production server, complete these steps.

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

   Graphical user interface with the installation wizard

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

   ```
   ./<version>-TIV-TSFCM-<platform>.bin
   ```

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

Console mode

To install in console mode, enter the following command:

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

2. Follow the prompts to install IBM Spectrum Protect Snapshot.
3. In the Pre-Installation Summary, review your installation settings.

   The installation directory for AIX is `/usr/tivoli/tsfcm/acs_<version>`

   The installation directory for Linux is `/opt/tivoli/tsfcm/acs_<version>` If an error occurs during the installation process, correct the errors and restart the installation procedure. Find the `installation.log` file in the installation directory to troubleshoot installation errors.

What to do next

After activating the instance, you must configure the instance to complete the setup.

Related concepts:

"Prerequisite checker for Oracle" on page 28

Related tasks:

"Activating an instance" on page 41

"Configuring or reconfiguring IBM Spectrum Protect Snapshot" on page 42

"Setting up IBM Spectrum Protect Snapshot separately on backup or clone servers" on page 65

Installing in silent mode

To install IBM Spectrum Protect Snapshot in silent mode, you must create a properties file.

About this task

You can generate a properties file when you are installing the product in interactive mode. You can use this properties file to install similar setups in silent mode.

Procedure

1. Install IBM Spectrum Protect Snapshot in interactive mode and generate a properties file with the following command that is run from the installation directory:

   ```
   ./<version>-TIV-TSFCM-<platform>.bin [-i console] -DRECORDFILE=<properties_file>
   ```

   For example,

   ```
   ./8.1.0.4-TIV-TSFCM-AIX.bin -DRECORDFILE=/tmp/installation.properties
   ```

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

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

   The *properties_file* specification must contain a full path. For example,

   ```
   ./8.1.0.4-TIV-TSFCM-AIX.bin -i silent -f /tmp/installation.properties
   ```

3. Review the `installation.log` file in the installation directory to complete the process.

What to do next

Activation

Uninstalling the software

Complete the uninstallation procedure to uninstall a version of the product from your system.

Procedure

1. Determine the installation path of the version of the product you want to uninstall. The following paths provide the location of the installation files:
   - For AIX operating systems, it is this path, `/usr/tivoli/tsfcm/acs_<version>`.
   - For Linux operating systems, it is this path, `/opt/tivoli/tsfcm/acs_<version>`.
2. Run the appropriate command for your operating system from the installation path:
   - For AIX operating systems, use this command `/usr/tivoli/tsfcm/acs_<version>/uninstall/uninstaller.bin`.
   - For Linux, use this command `/opt/tivoli/tsfcm/acs_<version>/uninstall/uninstaller.bin`.

Activating an instance

During the activation process, the necessary files are copied from the installation directory to an instance-specific directory. The installer does not activate the instance. In order to activate an instance, follow the procedure.

Procedure

1. Log in to the production server and use the root user ID. Change to the global installation directory.
2. Run the following command:
   - To activate an instance in a non-RAC Oracle environment

     ```
     ./setup_ora.sh -a install -d <instance_owner_$HOME>
     ```
   - To activate an instance in a RAC environment with a shared filesystem

     ```
     ./setup_ora.sh -a install -d <instance_owner_$HOME> -t
     <directory_in_shared_file_ system>
     ```

     The **-t** parameter for Oracle RAC specifies a target directory within a shared file system so that the IBM Spectrum Protect Snapshot binary files are copied to the shared file system. A link is created from the instance directory to the corresponding directory in the shared file system. These files are then available on all nodes of the Oracle RAC cluster.

   The command creates the instance-specific path for IBM Spectrum Protect Snapshot executable files at `<instance_owner_$HOME>/acs`. This directory is referred to as instance directory.

What to do next

After activating the instance, you must configure the instance to complete the setup.

Configure IBM Spectrum Protect Snapshot to backup or clone Oracle databases by running the configuration wizard. From within the instance directory

<instance_owner_$HOME>/acs as the instance user, call the wizard by running the ./setup_ora.sh command.

Related concepts:

"Preparing backup and cloning servers" on page 35

Related tasks:

"Configuring or reconfiguring IBM Spectrum Protect Snapshot"

Configuring or reconfiguring IBM Spectrum Protect Snapshot

After successfully installing and activating IBM Spectrum Protect Snapshot for Oracle, run the Configuration Wizard to configure the product on the production server. The wizard is called with the ./setup_ora.sh command, and each panel steps you through the entire configuration of the instance.

Before you begin

Ensure you installed the product successfully and that the instance is activated. For more information about this procedure, see Activating the instance.

To toggle between advanced and basic modes or to view and edit parameter values, press Ctrl+A. For more information about the Configuration Wizard, see Running the Configuration Wizard.

For more information about configuration files and different profile parameters, see Configuration files. To read about the profile contents and which parameters are editable in advanced mode, see Profile.

Depending on your environment and the functionality to be used, extra configuration files might be required when you are configuring the product. The configuration wizard checks that these files exist, but does not verify the contents. They must be complete before you run any IBM Spectrum Protect Snapshot functions.

Procedure

1. From the production database instance on the production server, log on as the database instance owner, and go to the instance directory.

   ```
   <instance_owner_$HOME>/acs/
   ```

2. Run the following command to launch the Configuration Wizard.

   ```
   ./setup_ora.sh
   ```

3. Navigate through the Configuration Wizard to complete your entire configuration of the IBM Spectrum Protect Snapshot for Oracle instance.
4. Use keystrokes to select an option. You can choose to configure a new database for protection and create a profile, or to manage existing databases and update an existing profile.
   - Choose to **Protect a new database** to set up and configure a new Oracle database to protect and to create a new profile.
   - Choose to **Manage protected databases** to amend an existing configuration for protected Oracle databases and to update the existing profile.
5. If you want to clone a new database, select that option to step you through the process, or if you want to manage cloned databases chose **Manage databases configured for cloning**.

6. If you want to manage the backup server or a clone server, choose **Manage backup and clone systems**.
7. If you want to edit global settings such as the ACSD password or to stop and start daemons, select **Edit global settings**.

   Tip: Press `Ctrl+A` in a configuration panel to open an advanced view that shows all parameters in editable form. Press `Ctrl+A` to switch back to a basic view that shows a subset of parameters.
8. Depending on your environment, choose one of the following steps.
   - Non-RAC environment:

     Create a CLIENT section for every database that is backed up by the IBM Spectrum Protect Snapshot instance.

     Create a CLONING section for every database that is cloned with IBM Spectrum Protect Snapshot.
   - RAC environment:

     Create a CLIENT section for every node where IBM Spectrum Protect Snapshot runs.

     Create a CLONING section for every node where IBM Spectrum Protect Snapshot runs.

Results

After you configured an instance, the following changes are made to the production server:

- The IBM Spectrum Protect Snapshot profile is created in the ACS_DIR directory. Parameter values reflect values that you set during the configuration process.
- An `<ACS_DIR>/shared` directory is created for shared information for the production, backup, and clone servers.
- The IBM Spectrum Protect Snapshot repository for the metadata of each backup is created in the ACS_REPOSITORY directory. The ACS_REPOSITORY directory defaults to `<ACS_DIR>/acsrepository`
- A logs directory for IBM Spectrum Protect Snapshot logs and traces is created at `<ACS_DIR>/logs`.
- For secure communication with IBM Spectrum Protect Snapshot daemons, IBM Global Security Kit key database files `fcmcert.*` are created in the instance directory, with an `fcmselfcert.arm` file that contains a representation of the production server's self-signed public key. For more information about secure communication, see Installing the GSKit.
- IBM Spectrum Protect Snapshot daemons that are required for the configuration, start automatically.

Related tasks:

"Setting up IBM Spectrum Protect Snapshot separately on backup or clone servers" on page 65

Related reference:

"Profile" on page 109

Appendix A, "Configuration files," on page 109

Running the Configuration Wizard

You must launch and run the Configuration Wizard to configure IBM Spectrum Protect Snapshot for Oracle. Navigate through each of the panels to configure the product or to reconfigure the profile in your Oracle environment. The Configuration Wizard is used to configure all Oracle instances, both multi-database environment and single user instances.

Before you begin

Log onto the production server as the database owner and go to the instance directory `<instance owner $HOME>/acs`. Run the Configuration Wizard from this directory.

Tip: Use the Configuration Wizard to create as many CLIENT or CLONING sections that you need for your Oracle environment.

About this task

For more information about configuration files and different profile parameters, see Configuration files. To read about the profile contents and parameter settings, see Profile.

Launch the configuration wizard from the production server to configure or reconfigure your IBM Spectrum Protect Snapshot instance profile, and the Oracle databases protected in that production or cloned instance.

Procedure

1. Launch the Configuration Wizard from the instance home directory, by running the following command.

   ```
   ./setup_ora.sh
   ```

2. Select an option by using the down and up arrow keys of your keyboard to highlight the option. Press **Enter** to choose that option.

   Tip: Use the **Tab** key to move to different parts of the configuration panel.

   - If you are configuring for the first time or you are reconfiguring to add another database to protect, choose **Protect a new database**.
   - If you are reconfiguring the setup, choose **Manage protected databases**.
   - If you are cloning, choose **Clone a new database**.
   - If you are reconfiguring cloned databases, choose **Manage databases configured for cloning**.
   - If you are creating or reconfiguring clone or backup systems, choose **Manage backup and clone systems**.
   - If you are editing global settings, choose **Edit global settings**.

   Tip: Press `Ctrl+A` in a configuration panel to open an advanced view that shows all parameters in editable form. Press `Ctrl+A` to switch back to a basic view that shows a subset of parameters.

What to do next

For more information about backing up data or cloning, see Backing up Oracle data or "Cloning databases" on page 85.

Configuration Wizard controls

To navigate the Configuration Wizard panels, use control keys on your keyboard.

Keyboard keystrokes

- Use arrow keys to navigate through the panel.
- Use the Enter key to select menu items or to press a button on the current panel.
- Use the Tab key to move to different sections of the panel.
- Use the Space-bar to select and deselect list items.
- Use **Ctrl+A** to display the profile parameters for a panel, similar to running the script in advanced mode.
- Use the **F1** key to call the command line-help.

Migrating IBM Spectrum Protect Snapshot for Oracle instances

When you want to migrate older instances of IBM Spectrum Protect Snapshot for Oracle for multi-databases management with a single IBM Spectrum Protect Snapshot for Oracle instance, use the Migration Tool. Enter `instancemigration_ora.sh` in the instance directory to launch the tool.

Before you begin

Ensure that the instance is activated. For more information about this procedure, see Activating the instance.

Procedure

1. After successfully configuring the production database instance with the Configuration Wizard, launch the Migration Tool from the `acs` directory by entering the following command as the root user.

   ```
   instancemigration_ora.sh
   ```

2. Select one IBM Spectrum Protect Snapshot instance to be migrated into the multi-database instance and press **Enter** to see a detailed view. To confirm that the displayed instance is the one you want to migrate, press **Migrate instance**. Repeat this step for each instance you require to migrate into the multi-database instance. The active profile is named `profile` and is in the `ACS_DIR` unless you specified a different profile.

   The daemons are temporarily stopped when migrating the new instance without overwriting anything.

3. Set up backup and clone servers to complete the migration by using the Configuration Wizard options.

Results

The updated profile contains all the information for the new instance of IBM Spectrum Protect Snapshot for Oracle with the information for the migrated instances. All backups and clones of the migrated instance are available for IBM Spectrum Protect Snapshot operations. All passwords and repository information is migrated to the instance.

Related tasks:

"Setting up IBM Spectrum Protect Snapshot separately on backup or clone servers" on page 65

Configuring Oracle RAC for daemon high availability

You can configure IBM Spectrum Protect Snapshot in an Oracle RAC environment so that the IBM Spectrum Protect Snapshot daemons are highly available. When you choose this configuration, IBM Spectrum Protect Snapshot remains operable even if the RAC node that is hosting the daemons fails. The Configuration Wizard stops and starts daemons as required.

Before you begin

Ensure that a shared file system exists for the IBM Spectrum Protect Snapshot repository, configuration, and binary files. For more information about this prerequisite, see "Preparing Oracle RAC" on page 35.

When you choose to configure IBM Spectrum Protect Snapshot for Oracle RAC, the product defines Oracle RAC node names. Each node is made available to the mount agent that is running on the backup or clone server. The mount agent then attempts to connect to the management daemon for each node name. When you complete the configuration and exit the Configuration Wizard, choose to start the daemons automatically. The local node where RAC is running is configured when the process completes.

Procedure

Choose **Protecting a new database** with the Configuration Wizard, and step through each of the panels.
Running the Configuration Wizard configures the local node where RAC is running, and stops and starts the daemons automatically. To ensure that the daemons are available on all other RAC nodes, you must manually add them to `/etc/inittab`, or create the upstart jobs. Alternatively, use `systemd` on all other RAC nodes. A locking mechanism that uses the shared file system, ensures that only one daemon is active at a time.
The Configuration Wizard creates a link from `Oracle_instance_owner_$HOME_directory/acs` to the target directory in the shared file system on the local node where you ran the configuration. You must manually create that link on all other RAC nodes to operate IBM Spectrum Protect Snapshot from other nodes.

Related tasks:

"Setting up daemons" on page 64

Configuring storage environments

IBM Spectrum Protect Snapshot requires the connection and configuration information for all storage devices where data is to be protected. For IBM System Storage DS8000 environments and IBM System Storage SAN Volume Controller with static target allocation, information on the associated volumes is also required.

IBM Spectrum Protect Snapshot organizes information on storage hardware in device classes. A device class is a representation of a specific storage device with its connection information and related configuration. There must be a separate **DEVICE_CLASS** defined for each storage device. If the same storage device is used with various functions and configurations, a separate device class must be defined for each configuration. An example of a different function, can be running full and incremental backups on different days of the week.

Device classes are documented as **DEVICE_CLASS** sections in the IBM Spectrum Protect Snapshot profile. Parameters in a **DEVICE_CLASS** section describe the characteristics of a storage device. Therefore, they are independent of the protected application, but different parameters are required for the various types of supported storage hardware.

Each **DEVICE_CLASS** can have specific version retention that is controlled through the profile parameter **MAX_VERSIONS**, which is set during configuration. For more information about DEVICE_CLASS version control with **MAX_VERSIONS** parameter, see Device class backup version retention.

Not all of the configuration topics are applicable to each storage system. For a list of storage environments and their associated configuration topics, see the following table.

Storage environment	Topics
IBM System Storage DS8000	"Configuring the CIM adapter for SP 800-131A compliant encryption" on page 52 "Select the **FLASHCOPY_TYPE**" on page 52 "Target set definitions" on page 54 "LVM mirroring and ASM failure group environment" on page 57
IBM System Storage SAN Volume Controller or IBM Storwize family with dynamic target set allocation	"Configuring Storwize family and SAN Volume Controller dynamic target allocation (SVCDTA)" on page 49 "Select the **FLASHCOPY_TYPE**" on page 52 "LVM mirroring and ASM failure group environment" on page 57 "Configuring for remote mirroring" on page 61
IBM System Storage SAN Volume Controller or IBM Storwize family with static target set allocation	"Configuring the CIM adapter for SP 800-131A compliant encryption" on page 52 "Select the **FLASHCOPY_TYPE**" on page 52 "Target set definitions" on page 54 "LVM mirroring and ASM failure group environment" on page 57 "Configuring for remote mirroring" on page 61
IBM XIV Storage System	"LVM mirroring and ASM failure group environment" on page 57

For a complete list of parameters for each type of storage hardware, see "DEVICE_CLASS *device*" on page 128.

Backup version retention

Specify the number backups to be retained by using the **MAX_VERSIONS** parameter when you are configuring IBM Spectrum Protect Snapshot.

When you configure the product with the Configuration Wizard, specify how many backup versions to be retained for each device class that is defined. Each device class can have a specific retention rate rather than one defined for all device classes. During configuration, specify the **MAX_VERSIONS** for each DEVICE_CLASS.

For example, if two device classes are configured and the first has a **MAX_VERSIONS** set to 2 there are always two versions that are kept for that device class. The oldest version is deleted once a new backup is made. If you configure another device class with **MAX_VERSIONS** set to 3, it always retains three backup versions for that device class. If you do not specify a USE_FOR device class option, and you have two device classes in use with a **MAX_VERSIONS** set to 2, there are four versions that are kept in total.

Example of MAX_VERSIONS for different device classes profile

In the following example, there are four backup versions to be kept when backups are taken with DC_XIV1 and four backup versions to be kept when backups are taken with DC_XIV2. Three backup versions are kept for backups that are taken with device class STANDARD. All other device classes have a **MAX_VERSIONS** value of two, in this case SOME_OTHER_DC. That means that 13 backup versions are kept with this profile: two for SOME_OTHER_DC, three for STANDARD, and four each for DC_XIV1 and DC_XIV2. Thirteen backups are retained for this sample profile.

```
>>> CLIENT
MAX_VERSIONS 2
MAX_VERSIONS 3 USE_FOR STANDARD
MAX_VERSIONS 4 USE_FOR DC_XIV1
MAX_VERSIONS 4 USE_FOR DC_XIV2
DEVICE_CLASS STANDARD DC_XIV1 DC_XIV2 SOME_OTHER_DC
APPLICATION_TYPE GENERIC
TSM_BACKUP NO
NEGATIVE_LIST NO_CHECK
<<<

>>> DEVICE_CLASS STANDARD
...
<<<

>>> DEVICE_CLASS SOME_OTHER_DC
...
<<<

>>> DEVICE_CLASS DC_XIV1
...
<<<

>>> DEVICE_CLASS DC_XIV2
...
<<<
```

In the following example, **MAX_VERSIONS** is set to 2. There are four backup versions retained, two for each device class as there is no USE_FOR device class option specified.

```
MAX_VERSIONS 2

>>> DEVICE_CLASS STANDARD
...
<<<
>>> DEVICE_CLASS SOME_OTHER_DC
...
<<<

is the same like:

MAX_VERSIONS 2 USE_FOR STANDARD
MAX_VERSIONS 2 USE_FOR SOME_OTHER_DC

>>> DEVICE_CLASS STANDARD
...
<<<
>>> DEVICE_CLASS SOME_OTHER_DC
...
<<<
```

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

To allow dynamic volume creation during backup operations, you must enable Secure Shell (SSH) remote access to the storage system command-line interface (CLI) with Secure Shell (SSH) keys. An SSH key pair must be created to authenticate users for a secure connection to SAN Volume Controller.

Before you begin

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

About this task

SSH is used to remotely enter commands on the SAN Volume Controller CLI. The following steps are required to enable CLI access with SSH keys:

- Generate a public and a private key pair
- Import the public key to the storage system
- Configure IBM Spectrum Protect Snapshot to authenticate with the private key.

The IBM Spectrum Protect Snapshot user must have a unique SSH key at the SAN Volume Controller. After you generate the key pair, import the public key and add a key file for the SAN Volume Controller user as specified in the IBM Spectrum Protect Snapshot profile. The parameters are **COPYSERVICES_USERNAME** and **COPYSERVICES_REMOTE_USERNAME**. The user at the remote site also needs a key file.

The IBM Spectrum Protect Snapshot user owns the private key and has RW access to that key file.

The full path to the private key file is specified in the profile. By default, the path is `$HOME/.ssh/svc_sshkey`. The public counterpart of the private key file must be imported to the SAN Volume Controller and associated to the user.

Procedure

1. Generate an RSA key pair on the production server for the storage user name to access the storage system by entering the following command from the `$HOME/.ssh` directory. Ensure to enter the command as the database instance owner or application backup user from the `$HOME/.ssh` directory.

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

   This command generates two files, which you are prompted to name. If you select the name `svc_sshkey`, the private key is named `svc_sshkey`, and the public key is named `svc_sshkey.pub`.

   Tip: Do not enter a passphrase for the file when prompted. For SVCDTA dynamic target allocation, the passphrase must be empty.
2. If you do not remotely install the backup or cloning servers with SSH, you must copy the key pair to the backup and clone servers. Ensure that the key pair is stored in the same path as on the production server.
3. Upload the public key to the storage system for the SAN Volume Controller user that is specified by **COPYSERVICES_USERNAME** in the profile.

   For instructions about how to upload to the storage system, see the documentation that is provided for your storage system. The documentation is available in IBM SAN Volume Controller Knowledge Center http://www.ibm.com/support/knowledgecenter/STPVGU/welcome?lang=en.
4. Switch to the IBM Spectrum Protect Snapshot instance directory and run the following command to launch the Configuration Wizard:

   ```
   ./setup_ora.sh
   ```

   Note: If you want to use a different SSH binary file and private key file than the one named `svc_sshkey` in the default path `$HOME/.ssh`, press **Ctrl+A** from the Configuration Wizard to show the full list of parameters.
5. Specify a **SSH_DIR** path and enter the path where the Secure Shell protocols and executable files are installed. The default location is `/usr/bin`.
6. Specify the value for **SVC_SSHKEY_FULLPATH** as the path and the file name for the private keyfile. The following example shows the default path and file name:

   ```
   SVC_SSHKEY_FULLPATH    $HOME/.ssh/svc_sshkey
   ```
7. Step through the Configuration Wizard panels for IBM Spectrum Protect Snapshot for Oracle for SAN Volume Controller. When you configure SAN Volume Controller Dynamic Target Allocation, the profile that is created is saved with the necessary parameters.
8. The IBM Spectrum Protect Snapshot daemons are automatically restarted by Configuration Wizard.

What to do next

If you are using SAN Volume Controller remote mirroring, you can create another SSH key to facilitate mirroring with the remote cluster. The key file **SVC_REMOTE_SSHKEY_FULLPATH** parameter specifies the private key file that is used for connecting to the secondary SAN Volume Controller site, and is specified by **COPYSERVICES_REMOTE_SERVERNAME**. The remote site user is the one specified by the parameter **COPYSERVICES_REMOTE_USERNAME**.

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

Change an existing configuration of IBM Spectrum Protect Snapshot for UNIX and Linux to use SVC dynamic target allocation (DTA) without losing older backups. Change the value of **COPYSERVICES_HARDWARE_TYPE: SVC** to **SVCDTA** to update the profile and complete the migration.

About this task

Use the following information to modify an existing IBM Spectrum Protect Snapshot profile and reconfigure the product to SVCDTA.

Procedure

1. Log on as the database instance owner from the production database instance on the production server. From the instance directory, start the Configuration Wizard by running this command.

   ./setup_ora.sh
2. Choose **Manage protected databases** and modify the profile by changing the value of **COPYSERVICES_HARDWARE_TYPE** from SVC to SVCDTA.

   Tip: Pressing Ctrl+A displays additional parameters in advanced mode.
3. If **MAX_VERSIONS** is set to ADAPTIVE, you must return to the CLIENT section, and change the **MAX_VERSIONS** parameter from ADAPTIVE to a fixed number.
4. Enter the existing server information for the storage system host name **COPYSERVICES_SERVERNAME**<TCP/IP host name>.
5. Enter the user name for the primary storage device **COPYSERVICES_USERNAME**. The default value is superuser.
6. Enter the path and the file name of the private SSH key file in parameter **SVC_SSHKEY_FULLPATH**. For example,

   SVC_SSHKEY_FULLPATH *$HOME/.ssh/svc_sshkey*
7. Accept the defaults for the remaining parameters, or change the values where required.

   Note: Do not change the FlashCopy type.

Results

The updated profile is saved, and if required you can specify a backup system or quit the configuration.IBM Spectrum Protect Snapshot for UNIX and Linux is configured to use the SAN Volume Controller storage adapter with dynamic target allocation.

After reconfiguring the profile for SVCDTA, all backups are managed by the new dynamic target allocation adapter, including all backups that were taken with the CIM adapter. Continue to mount, restore, delete, and expire backups as usual. When **FLASHCOPY_TYPE** is set to INCR, you can also refresh backups as required.

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

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

Before you begin

Ensure that the storage system is enabled for SP 800-131A standard encryption. For instructions about how to identify if the system is enabled, see the documentation that is provided for your storage system. For the SVC adapter with dynamic target allocation (type SVCDTA), compliance with SP 800-131A is provided by the OpenSSH client version that is installed on the same host as the product.

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

Procedure

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

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

   where *ibm_storage_cluster_ip* specifies the IP address of the storage system, and *5989* specifies the port number for the HTTPS connection.
2. Save the output to a text file and place the file in a secure location on the production and backup servers.
3. Run the Configuration Wizard.
4. Set the **COPYSERVICES_CERTIFICATEFILE** parameter for the storage system device class, by entering the fully qualified path to where the certificate file is located. For example:

   ```
   COPYSERVICES_CERTIFICATEFILE    <ACS_DIR>/truststore/svc_cluster.cert
   ```
5. Complete the configuration updates and save the updates. The daemons are stopped and stared automatically.

Select the FLASHCOPY_TYPE

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

Using different FlashCopy types for different backup generations is a valid strategy for IBM Spectrum Protect Snapshot. 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. The rules allow IBM Spectrum Protect Snapshot to

select the appropriate DEVICE_CLASS section for the next backup. For more information about the **DEVICE_CLASS** parameter, see the CLIENT section.

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

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

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

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

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

The types of snapshots that are supported by IBM Spectrum Protect Snapshot, depending on the storage solution and operating system, are indicated in the following table.

Table 5. Supported storage subsystems and FlashCopy types

Device	COPY	INCR	NOCOPY	Space-efficient snapshots	Changes made to a mounted snapshot backup
IBM System Storage DS8000	Yes	Yes	Yes	N/A	Remains persistent and alters the content of the backup.
IBM System Storage SAN Volume Controller IBM Storwize family with static target allocation	Yes	Yes	Yes Includes space-efficient copies if configured so.	N/A	Remains persistent and alters the content of the backup.
IBM System Storage SAN Volume Controller IBM Storwize family with dynamic target allocation	Yes	Yes	Yes	N/A	Reverted during unmount and does not alter the backup.
IBM XIV Storage System	N/A	N/A	N/A	Yes	Reverted during unmount and does not alter the backup or remains persistent and alters the content of the backup. See parameter **USE_WRITABLE_SNAPSHOTS** in XIV System DEVICE_CLASS in the Reference section.

Target set definitions

IBM Spectrum Protect Snapshot requires target sets to be defined for SAN Volume Controller, Storwize family, and DS8000. A target set contains volumes that are allocated in the same storage subsystem, and are of the same size as the volumes that contain the data to be protected. The number of target sets determines the number of backup versions that can be kept at a time.

Define targets by using target set definition files, as follows:

- SAN Volume Controller
- Storwize family
- DS8000

Alternatively, use a naming convention for SAN Volume Controller and Storwize family only. This convention determines the name of the target for both the source volume name and the target set name as specified for the current operation.

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

Target set definition files:

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

During the backup process, IBM Spectrum Protect Snapshot software matches source volumes to suitable targets within a target set. To determine source target relations, associate a source name with a target name in a target set definition file. In this scenario, the relationship between the source and target is required. Backup processing fails if one of the targets is unavailable for the specified source. For details on the target selection algorithms, see "Target set and target volumes files" on page 149.

If IBM Spectrum Protect Snapshot 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 IBM Spectrum Protect. Because all target volumes within a single target are mounted to the same host, assign all target volumes within a target set to the same host. When you use multiple backup servers within your environment, use multiple target set definition files.

For SAN Volume Controller and Storwize family storage solutions, IBM Spectrum Protect Snapshot can assign the target volumes dynamically during the mount operation. In this case, you must not assign the target volumes in advance of the mount operation.

```
>>> TARGET_SET SET_1 # IBM Spectrum Protect Snapshot 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
<<<
```

Referring to target set definitions from the profile: The following example is a section from an IBM Spectrum Protect Snapshot profile file that shows the association between **TARGET_SETS**, **VOLUMES_FILE**, and *name of target set definition file* parameters.

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

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

Target set definitions using the naming convention:

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

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

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

```
>>> Device_Class SVC_01
.
.
TARGET_SETS t1 t2
.
.
<<<
>>> Device_Class SVC_02
.
.
TARGET_SETS t3 t4
.
.
<<<
>>> Device_Class SVC_03
.
.
TARGET_SETS t5 t6
.
.
<<<
```

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

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

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

*name of source volume*_bt1

*name of source volume*_bt2

*name of source volume*_bt3

LVM mirroring and ASM failure group environment

In a Logical Volume Manager (LVM) mirroring on AIX, and an Oracle Automatic Storage Management (ASM) failure group environment, multiple DEVICE_CLASS configuration sections are required. One section per storage subsystem or LVM mirror is required.

The **LVM_MIRRORING** parameter must be specified in the DEVICE_CLASS configuration section with a value of YES. This example shows the configuration,

```
>>> DEVICE_CLASS MIRR_1
COPYSERVICES_HARDWARE_TYPE   DS8000
COPYSERVICES_PRIMARY_SERVERNAME  DS8000_1
LVM_MIRRORING                          YES
TARGET_SETS     VOLUMES_FILE
VOLUMES_FILE     <name of target set definition file 1>
FLASHCOPY_TYPE     INCR
<<<
>>> DEVICE_CLASS MIRR_2
COPYSERVICES_HARDWARE_TYPE   DS8000
COPYSERVICES_PRIMARY_SERVERNAME  DS8000_2
LVM_MIRRORING                          YES
TARGET_SETS     VOLUMES_FILE
VOLUMES_FILE     <name of target set definition file 2>
FLASHCOPY_TYPE     INCR
<<<
```

Backup and clone server assignment

With IBM Spectrum Protect Snapshot software, you can mount backup images and clone images. Each backup image and clone image is mounted on a server. However, you cannot mount a backup image or a clone image on more than one server at one time.

IBM Spectrum Protect Snapshot mount operation can be started by one of the following methods:

- By issuing a mount command from the command-line interface.
- By issuing a **create_clone** or **refresh_clone** command from the command-line interface.
- By issuing a backup command in environments where a forced mount is required during a backup operation.
- When IBM Spectrum Protect Snapshot is used with IBM Spectrum Protect and you offload backups to IBM Spectrum Protect.

A IBM Spectrum Protect Snapshot mount operation can be started by one of the following methods:

- By issuing a mount command from the command-line interface.
- By issuing a backup command in environments where a forced mount is required during a backup operation.
- When IBM Spectrum Protect Snapshot is used with IBM Spectrum Protect and you offload backups to IBM Spectrum Protect.

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

The information that you enter during the installation and configuration of IBM Spectrum Protect Snapshot is used to create a profile. The DEVICE_CLASS section of the profile specifies the backup host name where the backup images are mounted. There can be multiple DEVICE_CLASS sections. The CLIENT section specifies the DEVICE_CLASS to use for backup and offload operations.

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

IBM XIV Storage Systems.
The assignment automatically occurs during the mount request.

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

DS8000, SAN Volume Controller, and Storwize family
If the **BACKUP_HOST_NAME** parameter is specified as *PREASSIGNED_VOLUMES* in the DEVICE_CLASS section, the target volumes must be preassigned to a specific backup or clone server before you issue a mount command. Ensure that the target volumes of all target sets associated with a specific DEVICE_CLASS are assigned to the same hosts. This setting ensures that targets associated with a single device class are mounted from the same backup or clone server.

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

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

IBM XIV Storage Systems.
The assignment automatically occurs during the mount request.

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

DS8000, SAN Volume Controller, and Storwize family
If the **BACKUP_HOST_NAME** parameter is specified as *PREASSIGNED_VOLUMES* in the DEVICE_CLASS section, the target volumes must be preassigned to a specific backup server before you issue a mount command. Ensure that the target volumes of all target sets associated with a specific DEVICE_CLASS are assigned to the same hosts. This setting ensures that targets associated with a single device class are mounted from the same backup server.

For all IBM Spectrum Protect Snapshot mount operations, there can be only one backup server for each device class. If the identified servers have not mounted a backup image, the mount request is propagated to those servers. The backup is then mounted.

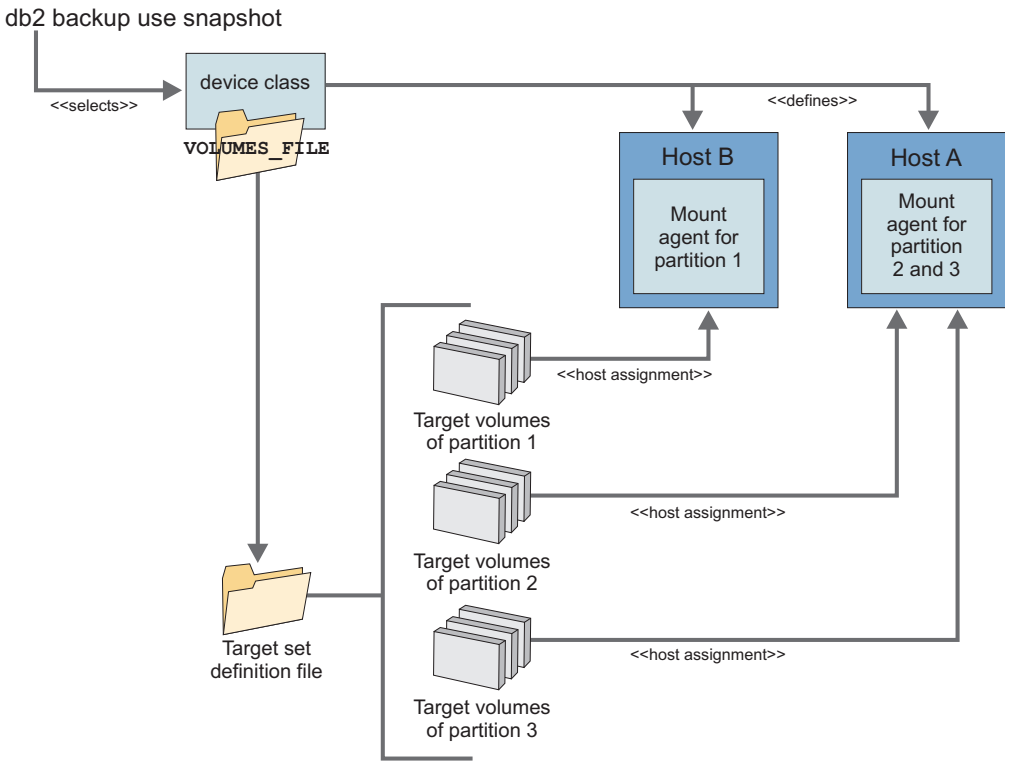


Figure 5. IBM Spectrum Protect Snapshot host assignments. This example shows a DB2 configuration.

Managing backups and clones with the DEVICE_CLASS parameter

Use the **DEVICE_CLASS** parameter in the CLIENT section of the IBM Spectrum Protect Snapshot profile file to select the storage device configuration for backups. In the CLONING section of the profile file, use this parameter to select the storage device configurations for cloning.

The IBM Spectrum Protect Snapshot **DEVICE_CLASS** profile parameter can be used as a filter to determine these backup criteria:

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

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

- List of target sets on DS8000, SAN Volume Controller, or Storwize family
- The type of snapshot backup to be completed (for example, incremental or copy)
- The mount location of the backup
- Whether a snapshot backup should be offloaded to an IBM Spectrum Protect server.

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

From the Oracle in an SAP environment interface
`-S device class` in SAP BR*Tools configuration profile (`.sap`) `util_options parameter`.

From the Oracle environment
`-s device class` on the `acsora -f backup` command.

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

Examples of how to use DEVICE_CLASS filters

This example creates alternating backups to each mirror. Device classes MIRROR_1 and MIRROR_2 refer to two separate storage clusters. Only those backups that are created to MIRROR_2 are offloaded to the IBM Spectrum Protect server:

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

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

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

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

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

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

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

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

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 uses a different device class. The clone server 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
...
<<<
```

Configuring for remote mirroring

When you configure IBM Spectrum Protect Snapshot, you can set the configuration parameters to create snapshots by using target volumes of remote mirroring relationships. These target volumes are used to create application consistent snapshot backups.

Before you begin

Before you configure IBM Spectrum Protect Snapshot to use target volumes that are associated with remote mirroring one of the following technologies must be deployed:

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

Configuring for remote mirroring on SVC

When you configure IBM Spectrum Protect Snapshot for Oracle, set the configuration parameters when you run the Configuration Wizard to create snapshots by using target volumes of remote mirroring relationships. These target volumes are used to create application consistent snapshot backups.

About this task

To configure IBM Spectrum Protect Snapshot with SAN Volume Controller or Storwize family Global Mirror and Metro Mirror, complete the following steps:

Procedure

1. On the SAN Volume Controller or Storwize family system, create a partnership between the primary and secondary clusters. For example, you can run the following commands from the command-line interface:

   ```
   ssh -i/dir/ssh-identity username@hostname or ip_primary_cluster
    svctask mkpartnership -bandwidth bandwidth_in_mbps remote_cluster_name
    or remote_cluster_id
   ```

2. Start the Global Mirror and Metro Mirror relationship by using either the graphical user interface or command-line interface. If you use the command-line interface, the following commands are provided as an example:

   ```
   ssh -i/dir/ssh-identity username@hostname or ip_primary_cluster
    svctask chpartnership -start remote_cluster_name or remote_cluster_id
   ```

3. Verify that the following information is true for the environment:
   - The production volumes are on the primary storage system.
   - The production volumes are in a remote mirror relationship with the remote volumes that are either in the secondary cluster, or in the same cluster.
   - All the remote mirror relationships are defined in a consistency group.
4. Run the Configuration Wizard to configure a dedicated device class for the snapshot backups on the remote cluster. When you configure the new DEVICE_CLASS section with the wizard, look for the following prompt:

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

   Enter *yes*. The **COPYSERVICES_REMOTE_SERVERNAME**, **COPYSERVICES_REMOTE_USERNAME**, and **TAKEOVER_HOST_NAME** parameters are also required for remote mirroring.
5. The SSH parameter **SVC_SSHKEY_FULLPATH** specifies the path and the file name to the private SSH key file required for SAN Volume Controller. For remote mirroring, **SVC_REMOTE_SSHKEY_FULLPATH** specifies the second SSH key file to be used for authentication on the remote site storage device. The key file is used to authenticate to the storage system with the user name specified for the **COPYSERVICES_REMOTE_USERNAME** parameter. If you do not want to create a new key pair for the remote site, one key can be shared for both storage sites.
6. If you are using SAN Volume Controller with static target allocation, you must allocate target volumes. On the remote cluster of the SAN Volume Controller or Storwize family, specify the corresponding snapshot target volumes for each source. To specify the snapshot target volumes, use one of the following options:
   - Parameter **TARGET_SETS** with **VOLUMES_FILE**. For example:

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

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

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

Configuring for remote mirroring on XIV

When you configure IBM Spectrum Protect Snapshot, you can set the configuration parameters to create snapshots by using target volumes of remote mirroring relationships. These target volumes are used to create application consistent snapshot backups.

About this task

To configure IBM Spectrum Protect Snapshot with XIV Synchronous Remote Mirroring and Asynchronous Remote Mirroring, complete the following steps:

Procedure

1. On the SAN Volume Controller or Storwize family system, create a partnership between the primary and secondary clusters. For example, you can run the following commands from the command-line interface:

   ```
   ssh -i/dir/ssh-identity username@hostname or ip_primary_cluster
    svctask mkpartnership -bandwidth bandwidth_in_mbps remote_cluster_name
    or remote_cluster_id
   ```

2. Start the Global Mirror and Metro Mirror relationship by using either the graphical user interface or command-line interface. If you use the command-line interface, the following commands are provided as an example:

   ```
   ssh -i/dir/ssh-identity username@hostname or ip_primary_cluster
    svctask chpartnership -start remote_cluster_name or remote_cluster_id
   ```

3. Verify that the following information is true for the environment:
   - The production volumes are on the primary storage system.
   - The production volumes are in a remote mirror relationship with the remote volumes that are either in the secondary cluster, or in the same cluster.
   - All the remote mirror relationships are defined in a consistency group.
4. Run the Configuration Wizard to configure a dedicated device class for snapshot backups on the remote cluster. Select *yes* for **COPYSERVICES_REMOTE_SERVERNAME**. **COPYSERVICES_REMOTE_USERNAME**, and **TAKEOVER_HOST_NAME** parameters are also required for remote mirroring.
5. The SSH parameter **SVC_SSHKEY_FULLPATH** specifies the path and the file name to the private SSH key file required for SAN Volume Controller. For remote mirroring, **SVC_REMOTE_SSHKEY_FULLPATH** specifies the second SSH key file to be used for authentication on the remote site storage device. The key file is used to authenticate to the storage system with the user name specified for the **COPYSERVICES_REMOTE_USERNAME** parameter. If you do not want to create a new key pair for the remote site, one key can be shared for both storage sites.
6. If you are using SAN Volume Controller with static target allocation, you must allocate target volumes. On the remote cluster of the SAN Volume Controller or Storwize family, specify the corresponding snapshot target volumes for each source. To specify the snapshot target volumes, use one of the following options:
   - Parameter **TARGET_SETS** with **VOLUMES_FILE**. For example:

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

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

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

7. Verify the username and password before saving and exiting the Configuration Wizard.

Example

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

To configure IBM Spectrum Protect Snapshot with IBM XIV Storage System with Asynchronous Remote Mirroring at both sites, certain ports must be open within the firewalls:

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

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

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

All ports must be bidirectional.

Setting up daemons

By default, IBM Spectrum Protect Snapshot daemons are started and restarted automatically. If you need to stop and start the daemon processes for any reason, you can do this as required.

About this task

Important: If you want to configure the background daemons in a clustered environment, add the commands that are listed here to the High Availability (HA) startup scripts on the production system.

- `<instance directory>/acsd`
- `<instance directory>/acsgen -D`
- `<instance directory>/fcmcli -D (optional)`

The following daemons are started for the productive instance:

- The management agent, acsd
- The generic device agent, acsgen -D
- The offload agent, fcmcli -D, if offloaded backups to an IBM Spectrum Protect server are requested to be started immediately after a snapshot backup.

For each backup or clone instance, a mount agent, acsgen -D -M, must be started.

- `<instance directory>/acsgen -D -M -s <deviceclass>[,<deviceclass>...]`
- `<clone instance directory>/acsgen -D -M -s <clone_deviceclass>[,<clone_deviceclass>...]`

When you run the Configuration Wizard, the daemons are started automatically when you complete the process. If you need to stop and start the daemons independently from a configuration process, launch the Configuration Wizard, and select **Edit global settings**. Use the **Stop background daemons** and **Start**

background daemons options as required.

Related reference:

"Administrative commands" on page 165

Postinstallation and post-configuration tasks

After you install IBM Spectrum Protect Snapshot, you can set up extra backup and clone servers.

Launch the Configuration Wizard to configure IBM Spectrum Protect Snapshot for Oracle on multiple backup servers from the production server when you install Open Secure Shell (OpenSSH) enabling backup servers for remote installation and configuration. NFS shares between the production server and backup server are not required for this type of remote installation.

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

If OpenSSH is not available, follow the instructions for "Setting up IBM Spectrum Protect Snapshot separately on backup or clone servers" and launch the Configuration Wizard. Choose **Manage protected databases** and step through the panels. Before you run the Configuration Wizard on a backup or clone server, stop IBM Spectrum Protect Snapshot on the production server. For details about how to stop an activated IBM Spectrum Protect Snapshot instance, see IBM Spectrum Protect Snapshot commands and scripts.

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

- The use of alternative storage hardware might require a reconfiguration of IBM Spectrum Protect Snapshot on the backup server.
- Changes to the scheduling policy for offloaded IBM Spectrum Protect backups might require you to configure the backup server again.
- If self-signed certificates are used, all changes to the certificates require a reconfiguration of the backup server.
- If OpenSSH is not used, you must copy the `fcmselfcert.arm` file to the backup server before running the Configuration Wizard to configure the backup server again.

In these cases, stop IBM Spectrum Protect Snapshot on the production server before reconfiguring the backup server. Otherwise, you are prompted to stop IBM Spectrum Protect Snapshot on the production server.

Setting up IBM Spectrum Protect Snapshot separately on backup or clone servers

When you are configuring the production server, it is recommended that you set up a backup or clone server as required. To manage backup or clone servers from the production system use the Configuration Wizard. You need Open Secure Shell (OpenSSH) to run the configuration. If it is not possible to set up from the production server, you must set up the backup or clone server separately with the Configuration Wizard. If this is the case, all upgrades to IBM Spectrum Protect Snapshot must be done separately on all servers.

Before you begin

Ensure that you installed the product, and activated and configured the instance. Take a note of the hostname of the production server and the device classes that the backup or clone server are to use. If the default names were changed, ensure that you know the port of the IBM Spectrum Protect management agent (ACSD), and the ACS_DIR directory name. The default ACS_DIR directory is <instance owner $HOME>/acs.

Locate the following items on the production server before you proceed.

- The shared directory in the ACS_DIR directory.
- The fcmselfcert.arm file in the instance directory. This file is needed when standard CA-signed certificates are not used for server authentication. To find out more about setting up Secure Socket Layer (SSL) and Transport Layer Security (TLS), see IBM Global Security Kit configuration

Related tasks:

"Running the Configuration Wizard" on page 44

Related reference:

"Configuration Wizard controls" on page 45

Setting up IBM Spectrum Protect Snapshot on a backup server

To set up IBM Spectrum Protect Snapshot on a backup server separately, complete the following steps on the backup server.

Procedure

Prepare the instance that is to be configured.

1. Install IBM Spectrum Protect Snapshot on the backup server. For more information about how to install the product, see Installing in interactive mode.
2. Activate the instance on the backup server. For more information about how to activate an instance, see Activating an instance.
3. Log on to the backup system with the instance owner user ID.
4. If standard CA-signed certificates are not used for server authentication, copy the fcmselfcert.arm file of the production system to the instance directory on the backup system.

   ```
   cd <instance directory>
   scp <instance owner>@<production server>:<instance directory>/fcmselfcert.arm .
   ```

5. Check the backup server for the ACS_DIR directory. Use the following command to create the directory:

   ```
   mkdir -p <ACS_DIR>
   ```

6. Copy the <ACS_DIR>/shared directory on the production system to the ACS_DIR directory on the backup system:

   ```
   cd <ACS_DIR>
   scp -r <instance owner>@<production server>:<ACS_DIR>/shared .
   ```

7. From the instance directory, run the setup script.

   ```
   cd <instance directory>
   ./setup_ora.sh
   ```

   When you are configuring the backup server, call the script as follows: ./setup_ora.sh -backupsystem.

8. Follow the prompts, ensuring to select **On-Site Backup System configuration**.
9. When you are asked for the **Hostname and port of machine running Management Agent (ACSD)**, enter the hostname of the production server, and the port of the management agent.

   If the default port 57328 is used, entering the hostname is sufficient. When asked for the device classes to use for this backup system, enter the backup device classes that the server is to be used for.

Related tasks:

"Running the Configuration Wizard" on page 44

Related reference:

"Configuration Wizard controls" on page 45

Setting up IBM Spectrum Protect Snapshot on a clone server

To install IBM Spectrum Protect Snapshot on a clone server separately, complete the following steps on the clone server.

Procedure

Prepare the clone instance.

1. Install IBM Spectrum Protect Snapshot on the clone server. For more information about how to install the product, see Installing in interactive mode.
2. Activate the clone instance on the clone server. For more information about how to activate an instance, see Activating an instance.
3. Log on to the clone system with the clone system owner ID.
4. If standard CA-signed certificates are not used for server authentication, copy the `fcmselfcert.arm` file on the production system, to the clone system in the instance directory.

   ```
   cd <clone instance directory>
   scp <instance owner>@<production server>:<instance directory>/fcmselfcert.arm .
   ```

5. Check the clone server for the ACS_DIR directory. Create it with this command if it is not there,

   ```
   mkdir -p <ACS_DIR of clone instance>
   ```

6. Copy the `<ACS_DIR>/shared directory` on the production system to the ACS_DIR directory of the clone instance:

   ```
   cd <ACS_DIR of clone instance>
   scp -r <instance owner>@<production server>:<ACS_DIR>/shared .
   ```

7. From the clone instance directory, run the setup script.

   ```
   cd <instance directory>
   ./setup_ora.sh -backupsystem
   ```

8. Follow the prompts through the **On-Site Backup System configuration**.
9. When you are asked for the **Hostname and port of machine running Management Agent {ACSD}**, enter the hostname of the production server, and the port of the management agent.

   If the default port 57328 is used, entering the hostname is sufficient. When asked for the device classes to use for this backup system, enter the backup device classes that the server is to be used for.

Upgrading IBM Spectrum Protect Snapshot on a backup or clone server

Backup and clone instances must always be kept on the same IBM Spectrum Protect Snapshot version and level. When you upgrade the software on the production server, you must upgrade the corresponding backup or clone servers.

Procedure

1. Install IBM Spectrum Protect Snapshot. This procedure is described in Installing in interactive mode.
2. Activate the backup or clone instance. This procedure is described in Activating an instance.

What to do next

Typically, it is not necessary to run the Configuration Wizard on a backup or clone server after the initial configuration. Some exceptions require a reconfiguration of IBM Spectrum Protect Snapshot for Oracle as follows.

- If any changes were made to the production server or to the port of the management agent, a reconfiguration of IBM Spectrum Protect Snapshot on the backup server is required.
- If any changes were made to the device classes.
- If self-signed certificates are used and were changed. All changes to the certificates require a reconfiguration of the backup server. To do this reconfiguration, you must copy the `fcmselfcert.arm` file from the production server before you reconfigure the server.

In all cases, you must copy the `<ACS_DIR>/shared directory` from the production server to the backup or clone server that is being configured.

Upgrading

To upgrade to a newer version of IBM Spectrum Protect Snapshot, you must install that newer version. The updates are effective for instances only after you activate them with the new version of the product.

Before you begin

When you are upgrading an instance, make sure to update its backup and clone systems.

Procedure

1. Install the new version of the product as described here, “Installing IBM Spectrum Protect Snapshot in interactive mode” on page 39
2. After the product is installed successfully, the application-specific instances must be activated with the new version. “Activating an instance” on page 41
3. Run the Configuration Wizard from within each activated application instance, choosing the **Manage protected databases** option to modify the existing profile. Step through the parameters in the wizard.

   Running the Configuration Wizard updates the profile with new parameters and removes deprecated parameters, or renames them if required. If the backup system was not installed, activated, and configured separately, upgrade to the new version on your backup or clone system by selecting it from the wizard and choosing the option to **update IBM Spectrum Protect Snapshot**

installation. Follow the instructions described here, "Configuring or reconfiguring IBM Spectrum Protect Snapshot" on page 42. If the backup or clone system was installed, activated, and configured separately, follow the instructions in Setting up backup or clone servers.

4. Uninstall the older version of the product. Follow the instructions described here, "Uninstalling the software" on page 41

Upgrading from IBM Tivoli Storage FlashCopy Manager version 3.1

The use of consistency groups is required for IBM Spectrum Protect Snapshot. The profile parameter **USE_CONSISTENCY_GROUPS** is no longer supported and is removed automatically from an IBM Tivoli Storage FlashCopy Manager v3.1 profile when the upgraded instance is configured.

About this task

Use the Configuration Wizard to migrate a profile that was created for IBM Tivoli Storage FlashCopy Manager V3.1 to IBM Spectrum Protect Snapshot.

Procedure

1. Log in to the production server with the instance owner ID, go to the instance directory, and launch the Configuration Wizard with the following command:

   ```
   ./setup_ora.sh
   ```

2. Follow the configuration panels to complete the migration.

What to do next

For each IBM Tivoli Storage FlashCopy Manager Version 3.1 profile that has the **USE_CONSISTENCY_GROUPS** parameter, repeat the steps to automatically remove the parameter.

Chapter 4. Protecting your data with IBM Spectrum Protect Snapshot

Backing up data

Create snapshot backups of your databases and applications with IBM Spectrum Protect Snapshot. Integrated the product with IBM Spectrum Protect clients to offload backups to an IBM Spectrum Protect server.

Backing up Oracle databases

IBM Spectrum Protect Snapshot integrates with multiple components when you back up an Oracle database.

The following table summarizes the commands that are associated with backing up an Oracle database.

Table 6. Summary of Backup Commands for Oracle

Snapshot backup (disk only)	Backing up to an IBM Spectrum Protect server		
	From production database (tape only)	**Integrated with snapshot**	**From existing snapshot**
acsora -f backup	RMAN by using Data Protection for Oracle	**acsora -f backup**[1]	**fcmcli -f tape_backup**[2], [3]

Note:

1. The IBM Spectrum Protect Snapshot profile parameter **TSM_BACKUP** is set to one of the following options: YES, MANDATE, or LATEST, and the offload agent (tsm4acs) is running in daemon mode on the production server.
2. The profile parameter **TSM_BACKUP** is set to one of the following options: YES, MANDATE, or LATEST, and the offload agent is not running in daemon mode.
3. The fcmcli -f tape_backup operation must be issued from the production system.

You must use the Oracle instance owner ID and go to the INSTANCE_DIR directory before you enter any backup commands. IBM Spectrum Protect Snapshot backs up the database control file and the database profile on the production server to the IBM Spectrum Protect Snapshot repository. These files are required by IBM Spectrum Protect Snapshot on the backup server to start the database instance and to run the offloaded backup to the IBM Spectrum Protect server. Furthermore, the database control file can be optionally restored during a FlashCopy restore (profile parameter **DATABASE_CONTROL_FILE_RESTORE**).

By default, the IBM Spectrum Protect Snapshot software does not back up the transaction logs of the Oracle database. The database administrator is responsible for backing up the Oracle database transaction logs. After every full database online backup, back up the transaction logs to the IBM Spectrum Protect server.

The same commands can be used to back up Oracle databases that use Oracle Automatic Storage Management (ASM) and Oracle Real Application Clusters (RAC) based on Oracle ASM. An Oracle recovery catalog is required for IBM Spectrum Protect Snapshot backups. This recovery catalog is a requirement even if a disk only backup is requested.

Backing up an Oracle database to IBM Spectrum Protect server

IBM Spectrum Protect Snapshot require specific software when you back up an Oracle database to IBM Spectrum Protect server.

Before you back up to IBM Spectrum Protect server, ensure that the following requirements are met:

- Data Protection for Oracle must be configured on the backup server.
- A `RMAN backup script` that is 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 (**ENV** parameter). 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 "RMAN backup script example" on page 190.

Manually backing up Oracle databases:

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

Procedure

1. Log on to the production server and use the database instance owner user ID.
2. Change to the instance directory.
3. Enter the following command:

   ```
   acsora -f backup
   ```

Table 7. Files used during a manual backup

File name	Description	Default location
`acsora`	IBM Spectrum Protect Snapshot production system executable file	*INSTANCE_DIR*
`fcmcli`	IBM Spectrum Protect Snapshot production and backup system executable file	*INSTANCE_DIR*
`profile`	IBM Spectrum Protect Snapshot profile	*ACS_DIR*

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

Automating Oracle database backups:

A fully automated backup uses the RMAN backup script to fully automate online backups of Oracle databases.

Synchronous and asynchronous offloaded backups are different. Synchronous means that the backup on the backup host starts as soon as a snapshot is started. In this case, the offload agent, tsm4acs, is already started as a daemon by the init process. Asynchronous means that offloaded backups are triggered manually or triggered by another scheduler by starting the fcmcli **-f tape_backup** command. This type of backup is useful if the backup must be delayed until the required resources are available. When configure the product on the production server, you specify when to run the offloaded backups.

Oracle Data Guard standby database backup and restore

Run offline backups of Oracle Data Guard standby database as you would backup an Oracle database. The configuration, commands, and options are the same.

The Oracle Data Guard setup is composed of a primary database and one or more standby databases. Access to the primary database is read/write, while the standby databases that are always synchronized to the primary database, have read-only access. This setup is used as a high-availability setup, in which any of the standby databases can take over the role of primary database. In a failover or switchover scenario, the standby database becomes the primary database.

Related concepts:

"Backing up Oracle databases" on page 71

"Restore Oracle Data Guard standby or primary database" on page 83

Support of Oracle Automatic Storage Management failure groups

Oracle ASM organizes data in disk groups that consist of a collection of disk drives that are in the same loop as configured by the storage subsystem.IBM Spectrum Protect Snapshot uses an ASM instance to map these disk groups to physical disks. Each disk group can have multiple failure groups that are redundant copies of each other. These failure groups can be used as a technique to mirror storage volumes.

To use this technique, define disk groups with normal redundancy that are composed of two failure groups, and place the volumes for each of the failure groups on a dedicated storage cluster. Alternatively, define disk groups with high redundancy that are composed of three failure groups. Although the default Oracle System ID (SID) for the ASM instance is `+ASM`, other SIDs are supported.

In such a configuration, IBM Spectrum Protect Snapshot can create FlashCopy backups of an individual failure group for all of the following supported storage devices:

- DS8000
- Storwize family
- SAN Volume Controller
- IBM XIV Storage System

Snapshot backup of individual mirrors

IBM Spectrum Protect Snapshot supports mirroring.

Mirroring by using the AIX logical volume manager (LVM mirroring)

IBM Spectrum Protect Snapshot provides LVM mirroring support for the following storage devices:

- DS8000
- IBM XIV Storage System
- Storwize family
- SAN Volume Controller

For those devices, IBM Spectrum Protect Snapshot creates a snapshot backup where only one of the mirrors is copied during the backup. When LVM is used to mirror the database across sites, you can create offloaded tape backups on either site with IBM Spectrum Protect Snapshot. In this situation, you do not have to transfer the backup image across sites. To complete this task, a backup server is required on either site where backup images can be mounted to transfer them to secondary backup media.

For DS8000, you can create at most one INCREMENTAL snapshot per source volume. However, in LVM environments, each source volume is mirrored. Therefore, IBM Spectrum Protect Snapshot can create two INCREMENTAL snapshot backups for DS8000.

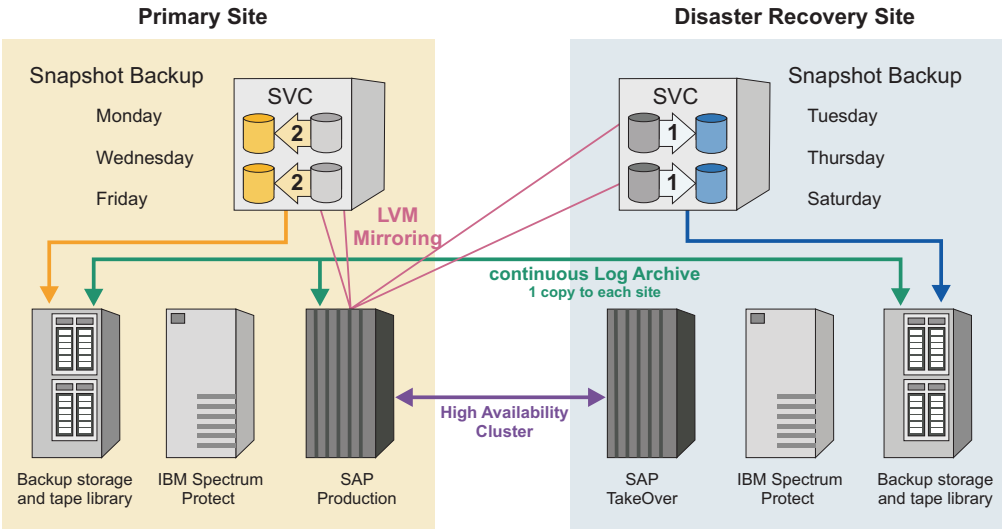


Figure 6. Cross-site mirrored SAP database that is protected with IBM Spectrum Protect Snapshot and an IBM Spectrum Protect server.

AIX LVM mirroring advantages

- Only one of the two LVM mirrors are used for the snapshot. Using one mirror saves the number of needed target volumes and reduces the time that is needed for creating the snapshot.
- Avoids unnecessary performance degradation within the storage system.

- All LVM mirrors on the production system remain synchronized when the snapshot is created.
- Online or offline snapshot backups can be created in both LVM mirrored and non-LVM mirrored environments. The backup and restore procedures as provided in the applicable documentation remain unchanged.
- The snapshot 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 snapshot backup request.
- IBM Spectrum Protect Snapshot provides information about asymmetrical LVM mirror setups when they are encountered. The snapshot backup can fail in such environments, indicating a general deficiency of the high-availability setup.

IBM Spectrum Protect Snapshot requires that the LVM mirroring sets are in different storage subsystems. For example, different SAN Volume Controller clusters. Complete mirrors must be stored on both storage clusters. If this setting is not possible, IBM Spectrum Protect Snapshot continues processing for those clusters where a complete image of the application can be found.

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

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

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

Support of AIX enhanced concurrent capable volume groups

To support high-availability environments, IBM Spectrum Protect Snapshot supports enhanced concurrent capable volume groups.

Heterogeneous device mirroring

IBM Spectrum Protect Snapshot does not require the storage devices of different mirrors to be at the same version level.

Backing up data with remote mirroring

When you back up data with remote mirroring, you can create local and remote snapshot backups.

About this task

The local and remote snapshot backups can be created for Oracle databases.

These steps can be applied to the following scenarios:

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

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

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

Procedure

1. Verify IBM Spectrum Protect Snapshot is installed in a supported environment. You must have a database that is running on the primary cluster. The primary cluster is mirrored to a remote cluster with the storage feature for remote mirroring.
2. Configure IBM Spectrum Protect Snapshot for remote mirroring with the Configuration Wizard. A remote mirroring configuration includes the following parameters in the DEVICE_CLASS section:
   - **COPYSERVICES_REMOTE** YES
   - **COPYSERVICES_REMOTE_SERVERNAME** <*SERVER_NAME*>
   - **COPYSERVICES_REMOTE_USERNAME** <*USER_NAME*>
   - **TAKEOVER_HOST_NAME** <*HOST_NAME*>
3. Verify that the DEVICE_CLASS section that was created for remote mirroring during the configuration process, is selected. To verify, go to the CLIENT section of the profile. In the CLIENT section, the DEVICE_CLASS that is in use is selected.
4. From the production host, start the remote snapshot backup by typing in the following command:

   ```
   acsora -f backup
   ```

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

   A snapshot consistency group is created in the remote cluster. The target of the mirroring relationships is the source of this new snapshot consistency group.

   Important: Using some storage systems, the snapshot backup requires available space on the target storage pool so that it can create the snapshot. Increase the capacity on the requested storage pool, or free up items that are using existing capacity, if there is not enough space. Check the message for the exact amount of storage space that is required.
5. To verify that the backup is complete, from a command prompt window, enter the following command:

   ```
   fcmcli -f inquire_detail
   ```

What to do next

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

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

Related tasks:

"Updating DEVICE_CLASS *device* for mirroring" on page 128

Related reference:

"Mounting and unmounting snapshots on a secondary system" on page 177

Logical Volume Manager support (AIX only)

You can use IBM Spectrum Protect Snapshot in environments where volume groups are mirrored between two storage clusters by using Logical Volume Manager (LVM) mirroring on AIX.

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

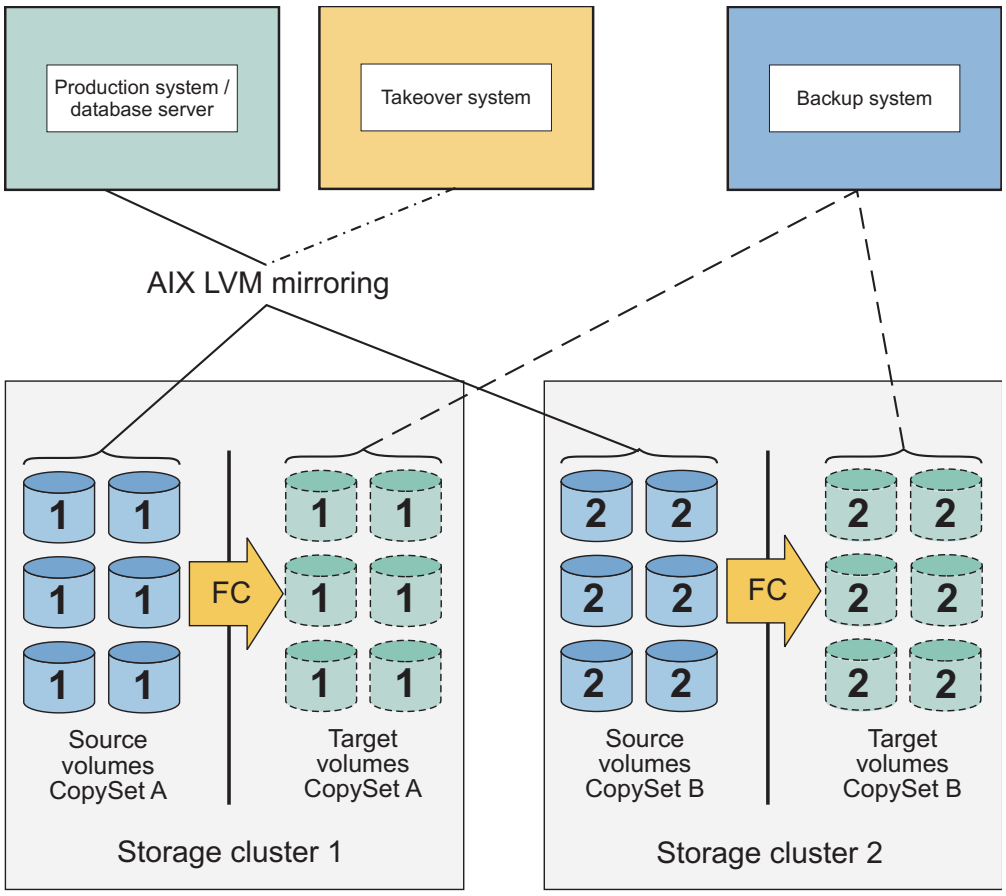


Figure 7. IBM Spectrum Protect Snapshot in an LVM environment

Restoring Oracle databases

Restore databases with IBM Spectrum Protect Snapshot for Oracle by restoring from a snapshot on the storage subsystem, or restoring data from IBM Spectrum Protect. Specific command entries are used when restoring Oracle databases.

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

Table 8. Summary of Restore Commands for Native Oracle

Snapshot Restore	Restore from IBM Spectrum Protect
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.

Restoring from a snapshot backup

Follow the steps to restore an Oracle database. In a case where a control file copy was stored in the data volume group or data disk group, follow the steps to recover the current copy of the control file.

Before you begin

Ensure that the following requirements are met:

- The redo logs for the database are in a disk group that is not shared with any Oracle data files.
- The Oracle RAC data files are stored on a supported storage system.

About this task

After the snapshot restore process completes, you can start the recovery of the restored RAC database. In the example that is used, the database is called `MYDB`.

Procedure

1. Stop the database that is to be restored. Log on to the production server with the Oracle RAC instance owner user ID.

   ```
   srvctl stop database -d MYDB
   ```

   To find an existing backup ID, type the following command: `acsora -f inquire`.
2. Restore a snapshot backup. Choose one of the following methods:
   - Restore the last snapshot backup by specifying the command,

     ```
     acsora -f restore
     ```
   - To restore an older snapshot backup, specify the backup ID of that backup as follows:

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

     where the *backup ID* is the ID of the snapshot backup that you want to restore.
3. After the snapshot restore process completes, you must recover the database. Choose one of the following recovery types: The recovery type is specified in the profile file. For more information about recovery types, see **DATABASE_CONTROL_FILE_RESTORE** in "ORACLE" on page 120.
   - If **DATABASE_CONTROL_FILE_RESTORE** `YES` is specified in the IBM Spectrum Protect Snapshot profile file, an incomplete recovery is needed.
   - If **DATABASE_CONTROL_FILE_RESTORE** `NO` is specified in the IBM Spectrum Protect Snapshot profile file, a complete recovery is needed.
4.

   Tip: The steps for advanced recovery follow:
   If a control file exists in the data volume group or data disk group, and it was not restored, there will be inconsistent copies of the control file after the snapshot restore operation finishes. To restore the control file copy that was overwritten by the restore operation from a current copy, follow these steps:
   a. Start the instance without mounting the database by entering the following command:

      ```
      SQL> startup nomount
      ```

b. Use RMAN to restore a current copy of the control file that is not part of the data disk group, and is not restored.

```
RMAN> restore controlfile from '<control_file_copy_name>'
```

c. Mount the database, and recover the database for a complete recovery.

```
SQL> alter database mount;
SQL> recover database;
```

d. Open the database if you want to continue working with the fully recovered database.

```
SQL> alter database open;
```

Results

If you restored the control file from a current copy, the control file in the data disk group is overwritten to that current version.

Important: On some storage system types, the snapshot restore requires sufficient available space on the target storage pool in order to restore the necessary volume. If there is not enough storage space available, you can increase the capacity on the requested storage pool, or free up some capacity. Check the message for the exact amount of storage space that is required.

Restoring Oracle Real Application Clusters database snapshots

Follow the steps to restore an Oracle Restoring Oracle Real Application Clusters (RAC) database. In the example that is used in this task, an Oracle RAC database snapshot with two instances is restored.

Before you begin

Ensure that the following requirements are met:

- The redo logs for the database are in a disk group that is not shared with any Oracle data files.
- The Oracle RAC data files are stored on a supported storage system.

About this task

After the snapshot restore process completes, you can start the recovery of the restored RAC database. In the example that is used, the database is called `MYDB`, with two instances that are called `MYDB1` and `MYDB2`. The procedure is for a complete recovery. For incomplete recoveries, refer to the Oracle documentation.

Procedure

1. Stop the database that is to be restored. Log on to the production server with the Oracle RAC instance owner user ID.

   ```
   srvctl stop database -d MYDB
   ```

2. Restore a snapshot backup. Choose one of the following methods:
   - Restore the last snapshot backup by specifying the command,

     ```
     acsora -f restore
     ```

   - To restore an older snapshot backup, specify the backup ID of that backup as follows:

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

where the *backup ID* is the ID of the snapshot backup that you want to restore.

To find an existing backup ID, type the following command: `acsora -f inquire`.

3. After the snapshot restore processing completes, you must recover the database. The recovery type is specified in the profile file. For more information about recovery types, see **DATABASE_CONTROL_FILE_RESTORE** in "ORACLE" on page 120.
   - If **DATABASE_CONTROL_FILE_RESTORE** YES is specified in the IBM Spectrum Protect Snapshot profile file, an incomplete recovery is needed.
   - If **DATABASE_CONTROL_FILE_RESTORE** NO is specified in the IBM Spectrum Protect Snapshot profile file, a complete recovery is needed.

   Important: For all scenarios using snapshot technology with IBM Spectrum Protect Snapshot and using certain storage systems, the snapshot restore requires available space on the target storage pool so that it can restore the necessary volume. If there is not enough storage space available, you can increase the capacity on the requested storage pool, or free up some items that are using existing capacity. Check the message for the exact amount of storage space that is required.

   For a complete recovery of the database, follow these steps:

   a. Mount the database on the database instance where you want to run the recovery.

      ```
      srvctl start instance -d MYDB -i MYDB001 -o mount
      ```

      If you want an incomplete recovery, do not proceed to the next sub step, see your Oracle documentation for information about incomplete recoveries.

   b. Recover and open the database to complete the recovery operation.

      ```
      SQL> recover database; SQL> alter database open;
      ```

   c. Start all other database instances by entering the following command:

      ```
      srvctl start instance -d MYDB  -i MYDB002
      ```

   d. If you used normal or high redundancy, synchronize the failure groups that were not included in the restore operation.

Restoring Oracle databases from IBM Spectrum Protect

IBM Spectrum Protect 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.

Restoring the entire database

Follow these tasks to restore IBM Spectrum Protect backups as an entire database.

Procedure

To restore an entire database backup, complete the following steps:

1. If the database is running, enter the following command to stop the database:

   ```
   shutdown;
   ```

2. Enter the following command to mount the database:

   ```
   startup mount;
   ```

3. Enter the following command to 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. The following 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;
}
```

   The previous example also applies to Linux, Solaris, and HP-UX, except that the path to the `tdpo.opt` file differs. On Linux, Solaris and HP-UX, the path is likely to start with `/opt/tivoli`.

5. Recover the database by entering the following command to connect to the target database:

```
recover database;
```

What to do next

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

Restoring files

To restore IBM Spectrum Protect Snapshot backups by restoring specific files, complete the following steps.

Procedure

1. If the database is running, enter the following command to stop the database:

```
shutdown;
```

2. Enter the following command to mount the database:

```
startup mount;
```

3. Enter the following command to start RMAN and connect to the target database and the recovery catalog. Enter the 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 a 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. The following 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 can also apply to Linux, Solaris and HP-UX platforms, except that the path to the `tdpo.opt` file differs. On Linux, Solaris and HP-UX platforms, the path is likely to start with `/opt/tivoli`.

5. Enter the following SQL command to bring the data file online. The *n* variable is the number of the data file.

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

6. Recover the data file by connecting to the target database and entering the following command:

   ```
   recover datafile n;
   ```

What to do next

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

Restore Oracle Data Guard standby or primary database

When you are restoring an Oracle Data Guard database, there are two scenarios to choose from that depend on if a failover or switchover between the primary and the standby database took place. After a switchover or failover, when the standby database is changed to the primary database, the value of the **DATABASE_CONTROL_FILE_RESTORE** allows you to choose from two recovery settings.

In the first scenario, the standby database remains in the standby database role. When that standby database is restored it results in a standby database with the point in time of the IBM Spectrum Protect Snapshot backup. The synchronization with the Oracle Data Guard primary database can be restarted. In order for the synchronization to succeed, all the required archive logs must be available on the primary database.

In the second scenario, if the standby database was changed to the primary database, choose one of the following settings:

- **DATABASE_CONTROL_FILE_RESTORE** parameter set to `NO`. A database recovery is required after the restore operation. In this case, the archived logs are required. This action results in an Oracle Data Guard primary database recovered to a specified point in time.
- **DATABASE_CONTROL_FILE_RESTORE** parameter set to `YES`. A database recovery is not possible after the restore operation. The result of the restore operation is an Oracle Data Guard standby database with the point in time of the IBM Spectrum Protect Snapshot backup.

Related concepts:

"Oracle Data Guard standby database backup and restore" on page 73

Related reference:

"Restoring Oracle databases" on page 78

Restoring data with remote mirroring

Restore data on a remote site with IBM Spectrum Protect Snapshot.

Before you begin

The restore operations for the remote site must meet the following environment conditions:

- Data is successfully backed up and the backup copy of data is accessible on the remote site.
- A takeover host is running with the same operating system level as the production host.
- The takeover host is configured on the remote side.
- The database instance is created on the takeover host.
- IBM Spectrum Protect Snapshot software is installed on the takeover host. The software level on the production host and on the takeover host are the same.

Note: Never edit the existing DEVICE_CLASS parameters in the profile. For takeover operations, always add new DEVICE_CLASSES for the new local and new remote sites.

Restoring Oracle data with remote mirroring

About this task

The takeover operation is complete, and the reversal of roles and remote relationships are already in place. If not already included in the takeover operation, stop the acsd daemon on the primary production host, and transfer all the repository files from the primary production host to the takeover host. The repository files are in the directory defined by the parameter **ACS_REPOSITORY** in the ACSD section of the profile.

Note: The snapshot restore operation requires sufficient available space on the target storage pool so that it can restore the necessary volume. Increase the capacity on the requested storage pool or free up some items that are using existing capacity in cases where there is insufficient space.

The database is restored to the takeover host by using the IBM Spectrum Protect Snapshot snapshot local repository after the remote backup. Complete the following steps:

Procedure

1. Update the IBM Spectrum Protect Snapshot configuration parameters by running the Configuration Wizard. Specifically, set the **ACSD** parameter to use the acsd on the takeover host in the GLOBAL section. Do not use the acsd of the production host.
2. Start the IBM Spectrum Protect Snapshot acsd daemon on the takeover host.
3. From the backups that are displayed, select the remote backup to use for the restore. The backups are displayed after you enter the query command on the takeover host. For example, **acsora -f inquire_detail**.
4. Start the restore by entering the following command:

   ```
   acsora -f restore -b <backup_id>
   ```

Results

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

You must restart the remote relationships before taking another snapshot of remote mirroring targets. For IBM XIV Storage System, the remote relationships are removed. You must re-create the remote relationships before taking another snapshot of remote mirroring targets.

Cloning databases

IBM Spectrum Protect Snapshot uses the FlashCopy or snapshot function of the storage solutions for database cloning. This method eliminates downtime and minimizes the impact on the production database.

For FlashCopy backup, the physical volume identification numbers (PVIDs) are not changed. For FlashCopy cloning, the PVIDs of the FlashCopy target disks are automatically changed by the IBM Spectrum Protect Snapshot software. You can have several cloned databases of one source database that are running on one host. Each clone target requires a unique database name.

With IBM Spectrum Protect Snapshot, a cloning process can be started with an online or offline source database. For online IBM Spectrum Protect Snapshot 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 IBM Spectrum Protect Snapshot cloning process. Each clone target requires a unique database name.IBM Spectrum Protect Snapshot 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.

Archiving logs on cloned databases

Note: Do not run any queries or operations on the Oracle database and ASM instance on the clone system while IBM Spectrum Protect Snapshot clone operations are running.

When the source database cloned is in ARCHIVELOG mode, the resulting cloned database will not be configured as ARCHIVELOG but as NOARCHIVELOG mode. If you want to archive redo logs on the cloned database you must configure the database to enable archive logging, and specify a valid path to store the logs.

Cloning and IBM System Storage SAN Volume Controller

When you clone databases and use IBM System Storage SAN Volume Controller, the space-efficient disks can be used as a target for FlashCopy cloning operations. However, when you use SAN Volume Controller space-efficient disks as a target for FlashCopy cloning, there are restrictions on the FlashCopy backups. You can complete cloning operations from the cloning source volumes. If you want to complete FlashCopy backup and FlashCopy cloning from the same source disks, use full target disks.

To use SAN Volume Controller space-efficient disks, in the **DEVICE_CLASS** that is used for cloning operations, set the **ALLOW_NOCOPY_FLASHCOPY** parameter to YES.

Cloning databases with IBM Spectrum Protect Snapshot

Create a database clone with IBM Spectrum Protect Snapshot using the `fcmcli -f create_clone` command or the `fcmcli -f refresh_clone` command.

When you enter one of the commands to create or refresh a clone, the 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 occurs only 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 Spectrum Protect Snapshot starts the cloned database.
7. The selected postprocessing scripts are run to clean up the clone database. This step occurs only when the `-Y` *`post-processing_configuration_file`* option is used.

Cloning Oracle RAC databases

After you share the FlashCopy repository, configuration and binary files, an Oracle RAC database clone can be created from every node of the Oracle RAC cluster. IBM Spectrum Protect Snapshot can operate on the clone from all RAC nodes, so that a clone created on one RAC node can be inquired, refreshed, or deleted from any other node within the RAC cluster.

Before you begin

For information about how to share the FlashCopy repository, configuration and binary files, see "Preparing Oracle RAC" on page 35.

About this task

There are multiple options for the clone system in an Oracle RAC multi-node architecture. While the production system is a multi-node RAC database, the installation options for the clone system include the following options:

- A single-node non-RAC instance
- A single-node RAC instance

To use one of the production system cluster nodes as a clone target system is not allowed. The ASM disk groups of the production system instance use the same names as the disk groups in the snapshots. This naming clash leads to a conflict.

Use the following procedure to clone Oracle RAC databases.

Procedure

1. Choose to the preprocessing scripts for cloning when you are creating or refreshing a clone.

2. Type in one of the following commands to clone the database:
   - `-f create_clone` if you are creating a clone.
   - `-f refresh_clone` if you are refreshing a clone.
3. Type in one of the following commands to work with the clone:
   - `-f inquire_clone` if you are querying a clone.
   - `-f delete_clone` if you are deleting a clone.

What to do next

IBM Spectrum Protect Snapshot uses a PFILE for initialization on the single-node RAC clone target server. If you intend to extend the clone target server by more nodes, you must create a shared SPFILE for all nodes of the clone target RAC cluster.

Note, in an Oracle RAC cluster, all instances must use the same SPFILE. Each local `init<ORACLE_SID>.ora` file contains only one entry that points to a shared server parameter file. The following instance shows an example:

```
SPFILE='+disk_group_name/dbunique_name/spfiledbname.ora'
```

For more information about adding RAC nodes to the created clone database, see the Oracle information here http://docs.oracle.com/cd/E11882_01/rac.112/e41960/adddelunix.htm .

Related concepts:

"Configuration files used for cloning" on page 88

Related reference:

"Cloning commands" on page 161

Oracle instance names on the clone server for Oracle RAC

IBM Spectrum Protect Snapshot always creates an Oracle instance numbered 1 on the clone target server. The Oracle instance number from where the command was entered does not change this numbering system.

Examples

In the following case, a database that is named `ORR` was cloned from an instance that is named `ORR3`, to a target database named `CLO`. IBM Spectrum Protect Snapshot creates an Oracle instance with `SID CLO1` on the clone target system.

For a policy managed RAC database that is named `ORR`, with an instance named `ORR_3`, IBM Spectrum Protect Snapshot creates an Oracle instance with `SID CLO_1` on the clone target system.

Cloning an Oracle Data Guard standby database

IBM Spectrum Protect Snapshot can clone an Oracle Data Guard standby database.

To clone an Oracle Data Guard standby database, on the Oracle Data Guard standby server complete the following steps:

- Shut down the Oracle Data Guard standby instance.
- Log on to the Oracle Data Guard standby server and use the Oracle instance user ID.
- To create a clone, enter the following command:

```
./fcmcli -f create_clone -C CLONE_ORACLE_SID -u CLONE_ORACLE_USER
```

This clone is a stand-alone Oracle database that can be opened in read and write mode. You can use the cloning command optional function **-X** *preprocessing-configuration-filename* and **-Y** *postprocessing-configuration-filename* to run preprocessing and postprocessing scripts on the cloned target system. You can use shell or sql scripts.

Tip: If the IBM Spectrum Protect Snapshot profile parameter **OVERWRITE_DATABASE_PARAMETER_FILE** is set to YES, the initDBSID.ora file is copied from the Oracle Data Guard standby server to the clone target system. This file contains Data Guard configuration information that is not required by the clone instance and can cause problems. Therefore, create a customized initDBSID.ora file for the Oracle clone instance and set the IBM Spectrum Protect Snapshot **OVERWRITE_DATABASE_PARAMETER_FILE** profile parameter to NO. You can copy the initDBSID.ora file and remove any specific Data Guard configuration information.

Typically Oracle temporary tablespace files are not present in the Data Guard standby server. If the temporary tablespace files are on the same file systems as the Oracle data files, no additional configuration is required by IBM Spectrum Protect Snapshot. If the temporary tablespace files are on a dedicated file system or volume group, use the **FLASH_DIR_LIST** parameter in the cloning section of IBM Spectrum Protect Snapshot profile to include these files. Use the **FLASH_DIR_LIST** parameter to specify a fully qualified directory name and file name. This file contains the mount points where the Oracle temporary files are located. Use a separate line for each mount point. Then, IBM Spectrum Protect Snapshot includes the mount points and the corresponding volume groups in the FlashCopy cloning operation.

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 on the cloning environment. Because all possible environments cannot be covered by one package, preprocessing and postprocessing must be considered outside the scope of IBM Spectrum Protect Snapshot cloning.

IBM Spectrum Protect Snapshot provides a framework in which you can run shell scripts and component scripts on the clone system. Run the shell scripts before a clone database is unmounted and after a new clone database is created. Then, you can fully automate the cloning process.

Configuration files used for cloning

IBM Spectrum Protect Snapshot uses preprocessing and postprocessing configuration files during cloning operations. 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:

- Files and scripts are stored on the clone system.
- Files and scripts have permissions for read and write access for the clone database instance owner. The preprocessing and postprocessing scripts have permissions for read and write access for the user who updates and runs the

scripts. If the scripts are run by any user registered on the system, the scripts are owned by the root user. The root user has permission to read and write for the User, Group, and World user groups.

- Files and scripts have permission for read access for the production database instance owner.

Attention: If a write access level for the World user group is given, there is a security risk.

An example of a preprocessing configuration file for Oracle is: `/oracle/P01/acs/preprocessing.ini`. When adding processing configuration files, place each script on a separate line as shown in the following 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 are specified with fully qualified file names. Each line of the processing configuration file represents one processing script. The IBM Spectrum Protect Snapshot 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 is 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 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. 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`. This addition requires that the owner of the script be the same as the user who is the intended operator of the script. In this example, `c01adm` is

the owner of the script. There is one exception. If a preprocessing or postprocessing script is owned by the root user, the script can be run by any user registered on the system.

The processing scripts that are defined in the processing configuration files run sequentially. The return code of each script is validated. The following values are used:

RC=0 Processing ends successfully. If this script is the last script to be run, continue cloning. If this script is not the last script, continue with the next script.

RC=1 Processing ends successfully with warning. If this script is the last script to be run, continue cloning. If this script is not the last script, continue with the next script.

RC=2 Processing ends with an error. Cloning immediately stops. No additional scripts run.

The return code for each script is written to the cloning log files. The output is written to dedicated log files with the following file names:

`clone_preproc.<timestamp>`
`clone_postproc.<timestamp>`

Cloning processing example

An example of a cloning configuration file, showing the production database named `P01`, and the clone database named `C01`.

```
./fcmcli -f preproc_clone -u oraclec01 -C C01 -X /oracle/C01/acs/preprocessing.ini
./fcmcli -f postproc_clone -u oraclec01 -C C01 -Y /oracle/C01/acs/postprocessing.ini
```

If a processing script needs extra 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
```

The IBM Spectrum Protect Snapshot command-line interface issues a call to the processing script with the six default arguments. After these arguments are provided, extra command-line options are sent. 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}
```

Usability states of snapshot backup operations

To view the usability states of a snapshot backup, use the **-f inquire_detail** command option with the **fcmcli** command.

Table 9. Usability states

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

Table 9. Usability states (continued)

Usability state value	Meaning
TAPE_BACKUP_PENDING	Indicates that a requested backup to an IBM Spectrum Protect server is not yet started or is not yet finished successfully. The offload agent checks for backups with this state, and runs the requested tape backup. After the tape backup finishes successfully, this state is reset. If the tape backup stops with an error, the **TAPE_BACKUP_PENDING** state remains set, **TAPE_BACKUP_IN_PROGRESS** is reset, and a *retry* counter is incremented.
TAPE_BACKUP_IN_PROGRESS	Indicates that the requested tape backup was started by the IBM Spectrum Protect Snapshot offload agent. If the backup fails, this state is reset.
TAPE_BACKUP_COMPLETE	Indicates that the requested tape backup is finished by the IBM Spectrum Protect Snapshot offload agent.
TAPE_BACKUP_FAILED	Indicates that the tape backup of the IBM Spectrum Protect Snapshot offload agent was not successful. The operation will not be retried.
CLONE_DATABASE	Indicates that an IBM Spectrum Protect Snapshot cloning operation was started.
RESTORING	Indicates that an IBM Spectrum Protect Snapshot restore operation was started.

Usability state diagrams

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

Snapshot backup

The first state diagram shows the usability state changes during an IBM Spectrum Protect Snapshot backup operation. Depending on the storage system that is used some states differ.

For example, on XIV, the snapshot backup is immediately restorable and the restore can be repeated multiple times. After successfully processing on DS8000, and SAN Volume Controller and Storwize family devices, the **BACKGROUND_MONITOR_PENDING** usability state is changed to **FULL_COPY** and **PHYSICAL_PROTECTION** by a monitoring daemon (**acsgen -D**) when a `COPY` snapshot backup was requested.

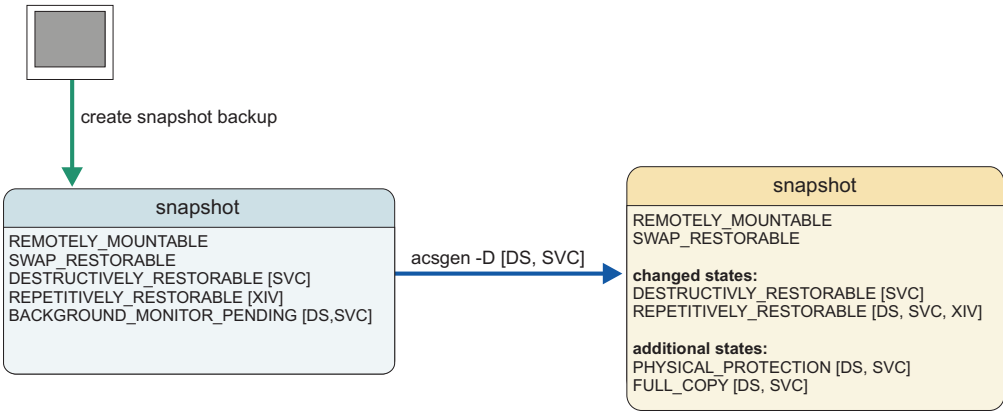


Figure 8. Usability States during snapshot backup

Snapshot restore

The second state diagram shows the usability state changes during an IBM Spectrum Protect Snapshot restore operation. On the DS8000 and SAN Volume Controller storage systems, the usability states change during a snapshot restore operation.

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

For XIV there is no usability state change during restore processing.

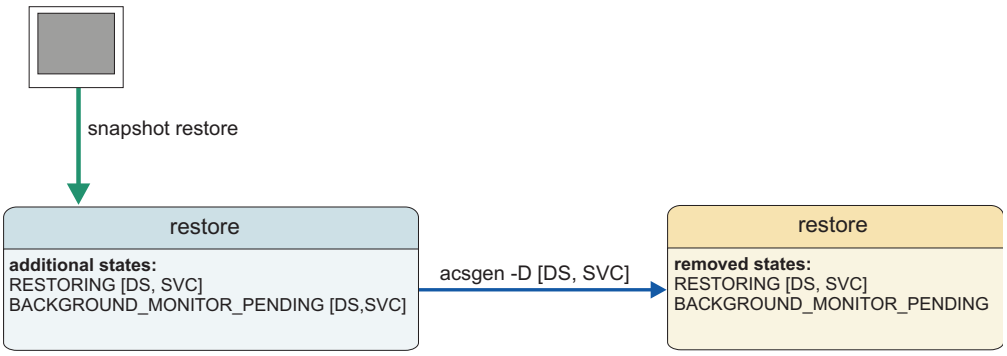


Figure 9. Usability states during snapshot restore

Snapshot delete

The next state diagram shows the usability state changes during an IBM Spectrum Protect Snapshot delete operation. There are two types of delete operations: delete and delete with force option. For both types, the snapshot backup is set to the **DELETING** state. After processing completes, the background monitor daemon (**acsgen -D**), switches the states to **DELETED**.

Snapshots on XIV systems are deleted, and the snapshot backup is removed from the IBM Spectrum Protect Snapshot repository by the background monitor daemon.

On the DS8000 and SAN Volume Controller storage systems, the snapshot relations are not deleted by the background monitor operation unless the delete force option was used on the delete command. For these systems, the snapshot backup is not deleted from the IBM Spectrum Protect Snapshot repository. Instead, the FlashCopy relations of a deleted snapshot backup can be reused when a new backup is created.

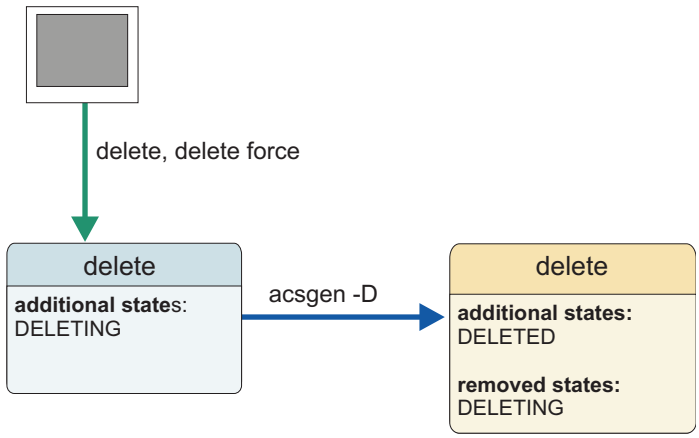


Figure 10. Usability states during snapshot delete

Snapshot mount

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

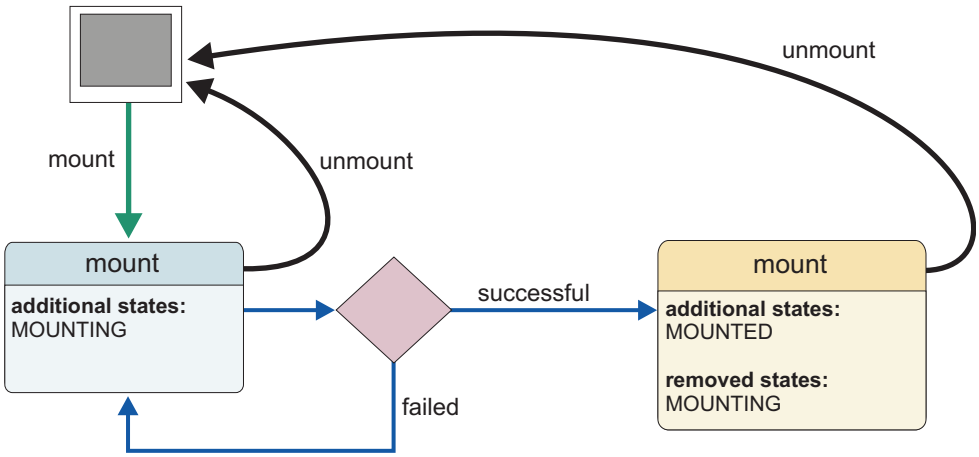


Figure 11. Usability states during snapshot mount

Snapshot offload

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

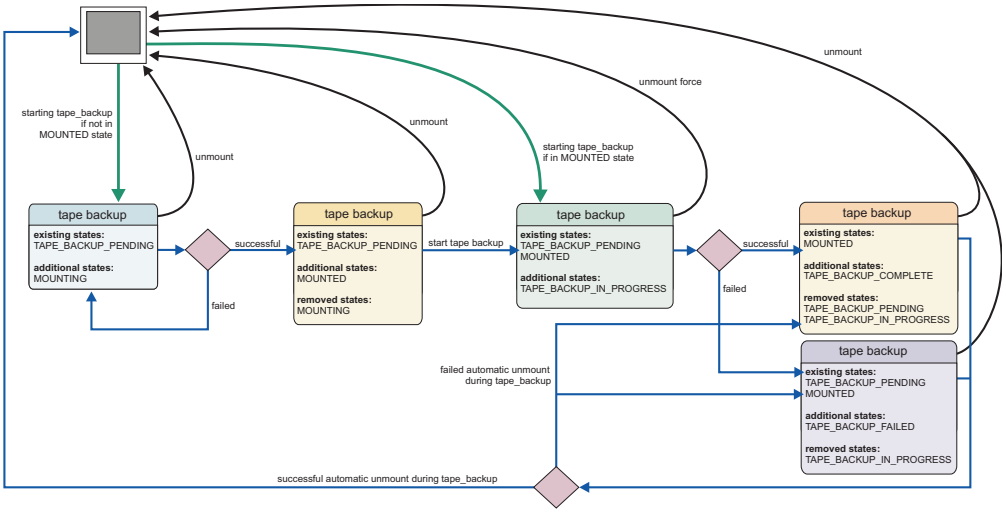


Figure 12. Usability states during snapshot offload

The usability state **TAPE_BACKUP_PENDING** can be removed by using the IBM Spectrum Protect Snapshot function **fcmcli -f update_status** with the option `-S TSM_BACKUP=NO`. This state is also removed by starting a new snapshot backup with the option `TSM_BACKUP[_FROM_SNAPSHOT] LATEST`. This option automatically removes the usability state **TAPE_BACKUP_PENDING** from all snapshot backups that exist in the IBM Spectrum Protect Snapshot repository.

Chapter 5. Troubleshooting

There are multiple resources for support.

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

- IBM Spectrum Protect Snapshot wiki on the developerWorks® site.
- Service Management Connect
- IBM Spectrum Protect Snapshot product support. Enter the search term, such as an authorized program analysis report (APAR) number, release level, or operating system to narrow the search criteria for your support need.

General troubleshooting procedure

This procedure is valid for all IBM Spectrum Protect Snapshot 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 10. 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 IBM Spectrum Protect
MNT	Mount and unmount services
CLO	FlashCopy cloning operations

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

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

```
GEN 00:10:00 (70a)
==================================================

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

==================================================
DB  00:10:00 (70a) FMM1510I New connection received.
DB  00:10:00 (70a) FMM1513I *****> Database client connected: db2s95, database S95,
                    partition NODE0000
DB  00:10:00 (70a) FMM1574I Backup for db2s95.S95.DEVICE_CLASS:STANDARD.NODE0000 is
                   created using DEVICE_CLASS
 DEVICE_CLASS:STANDARD.
```

```
DB  00:10:01 (80c) FMM1510I New connection received.
DB  00:10:01 (80c) FMM1514I *****> Device client connected.
DB  00:10:01 (80c) FMM6219I Backup to TSM: NO
DB  00:10:01 (80c) FMM1582I The target set 1 will be used for the current backup.
DB  00:10:44 (70a) FMM1014I Operation backup completed successful.
GEN 00:12:28 (70e)
==================================================
```

Logging and tracing files

Log and trace files are updated during IBM Spectrum Protect Snapshot operations.

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

- Oracle
- IBM Spectrum Protect Snapshot
- Storage system
- CIM
- IBM Spectrum Protect for Enterprise Resource Planning
- Operating system

Log files and trace files

Refer to these examples of the log and trace files that are maintained by IBM Spectrum Protect Snapshot.

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

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

The following tables list the log and trace files that are maintained by IBM Spectrum Protect Snapshot. These files are in *`ACS_DIR`*`/logs`.

Table 11. IBM Spectrum Protect Snapshot log files

Purpose	File
Overview of operations and their result.	summary.*timestamp*.log
Overview about the monitoring of the background copy that is done by the storage device.	monitor.*timestamp*.log
Detailed log of a particular operation.	details/*function.longtimestamp*
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 is always used as an entry point. All major events, such as the start of a new operation or errors, are recorded in this file. A new summary log file is created for every day and records all operations of one day within a single file.	

Table 12. IBM Spectrum Protect Snapshot 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, Storwize family)	fmcima.*hostname*.*function*.*id*.trace fmcima.*hostname*.*device class*.*node num*.*id*.trace
Offload Agent (tsm4acs)	tsm4acs. *host*.*id*.trace
fcmcli	fcmcli.*host*.*id*.trace
RMAN (when started by IBM Spectrum Protect Snapshot)	rman.*SID*.*id*.log

Notes:

- 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 and delete requests that are 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.

Table 13. IBM Spectrum Protect Snapshot return codes.

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

Table 14. IBM Spectrum Protect Snapshot installer exit codes.

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

Table 15. DB2 vendor reason codes.

Reason Code	Explanation	User Response
0	The operation is successful.	None
2	Communication error with device	TheIBM Spectrum Protect Snapshot operation failed. Check the db2diag.log and the IBM Spectrum Protect Snapshot summary log file for details.
3	The DB2 and vendor products are incompatible	The IBM Spectrum Protect Snapshot operation failed during initialization of the IBM Spectrum Protect Snapshot vendor library. The DB2 API version does not match the IBM Spectrum Protect Snapshot vendor library version. Check the db2diag.log for details.
6	Object specified cannot be found	The IBM Spectrum Protect Snapshot operation failed because the requested object cannot be found in the IBM Spectrum Protect Snapshot repository. Check the db2diag.log and the IBM Spectrum Protect Snapshot summary log file for details.
8	Invalid user ID specified	The IBM Spectrum Protect Snapshot operation failed because an invalid user ID was specified on the db2 command line. Check the db2diag.log.

Table 15. DB2 vendor reason codes (continued).

Reason Code	Explanation	User Response
9	Invalid password provided	The IBM Spectrum Protect Snapshot operation failed because an invalid password was specified on the db2 command line. Check the db2diag.log.
10	Invalid options specified	The IBM Spectrum Protect Snapshot operation failed because an invalid db2 command-line option was specified. Check the db2diag.log.
11	Initialization failed	The IBM Spectrum Protect Snapshot operation failed because the IBM Spectrum Protect Snapshot vendor library cannot be initialized. Check the db2diag.log and the IBM Spectrum Protect Snapshot summary log file for details.
14	End of data reached	Not an error condition.
18	Device error	The IBM Spectrum Protect Snapshot operation failed. Check the IBM Spectrum Protect Snapshot summary log file for details.
19	Warning	The IBM Spectrum Protect Snapshot operation is successful with warning messages. Check the IBM Spectrum Protect Snapshot summary log file for details.
21	More data to come	Not an error condition.
26	Delete object fails	The IBM Spectrum Protect Snapshot delete operation failed. Check theIBM Spectrum Protect Snapshot summary log file for details.
29	Abort request failed	The IBM Spectrum Protect Snapshot abort request failed. Check the IBM Spectrum Protect Snapshot summary log file for details.
30	Unexpected Error	The IBM Spectrum Protect Snapshot operation failed. Check the IBM Spectrum Protect Snapshot summary log file for details.
31	No data has been returned	Not an error condition.
32	Object not under Backup Adapter control	The IBM Spectrum Protect Snapshot operation failed because the object specified for a restore or query is not under the control of IBM Spectrum Protect Snapshot. It might be under control of IBM Spectrum Protect for Enterprise Resource Planning, for example. Check the db2diag.log and the IBM Spectrum Protect Snapshot summary log file for details.

Table 15. DB2 vendor reason codes (continued).

Reason Code	Explanation	User Response
34	Another database or application is using the same storage groups	The IBM Spectrum Protect Snapshot snapshot backup operation failed because another database or application is using the same storage group. Check the db2diag.log and the IBM Spectrum Protect Snapshot summary log file for details.

Storage system log and trace files

Storage system log and trace files are updated during IBM Spectrum Protect Snapshot operations.

Consult the documentation for the configured storage system.

CIM log and trace files

CIM log and trace files are updated during IBM Spectrum Protect Snapshot operations.

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

IBM Spectrum Protect for Enterprise Resource Planning log and trace files

IBM Spectrum Protect for Enterprise Resource Planning 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 IBM Spectrum Protect for Enterprise Resource Planning *Installation and User's Guide* for details concerning logs and traces within IBM Spectrum Protect for Enterprise Resource Planning.

Important: A trace file can be requested by specifying the TRACEFILE parameter in the IBM Spectrum Protect for Enterprise Resource Planning profile. However, do not place this file on NFS, because this might cause network problems due to the high volume of trace entries being written.

Troubleshooting mirroring relationships

There are some questions that might arise when implementing IBM Spectrum Protect Snapshot and storage systems with mirroring technologies. The following information is provided to help you answer questions unique to your environment.

Question

Why are some remote mirroring relationships missing?

Answer

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

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

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

Question

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

Answer

Go to the storage solution. Synchronize the consistency groups. For more information about synchronizing consistency groups, see the documentation that is provided with the storage hardware.

Question

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

Answer

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

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

Question

(XIV only) One of the following issues exists.

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

How are these issues resolved?

Answer

Verify that the consistency groups meet the following requirements:

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

One consistency group per database partition is needed.

Troubleshooting storage solutions

There are some common problems that might occur when using IBM Spectrum Protect Snapshot and storage solutions. These problems and the solutions are provided to help you complete problem determination activities.

Question

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

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

How can this error be resolved?

Answer

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

```
# lslv lvDS1data1
LOGICAL VOLUME: lvDS1data1 VOLUME GROUP: DS1data1vg
...
MOUNT POINT: /db2/DS1/db2ds1/NODE0001 LABEL: /db2/DS1/db2ds1/NODE0001
```

Troubleshooting connectivity problems

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

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

Question

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

Answer

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

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

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

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

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

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

Troubleshooting tips for IBM Spectrum Protect Snapshot for Oracle

Resolving problems encountered when using IBM Spectrum Protect Snapshot requires tasks specific to the native Oracle database environment.

If an error condition occurs during an IBM Spectrum Protect Snapshot event, there are several sources of information you can view to help determine what the problem might be. 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 Spectrum Protect Snapshot 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 server 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

When the SQL*Plus or Oracle Net configuration files do not reside in their default location, set the **`TNS_ADMIN`** environment variable.

To run offloaded backups of Oracle databases, a recovery catalog database is needed. The database must be accessible by RMAN from the production host and the backup host. On the production host, use the following command to verify if the connection can be established. Before entering the command, log on as the database instance owner.

```
rman target / catalog catalog_db_user/catalog_user_password@catalog_db_connect_string
```

On the backup host, log on as the root user and enter the following command:

```
su - oracle_instance_owner -c rman target / catalog catalog_db_user/
catalog_user_password@catalog_db_connect_string
```

If you receive errors that say RMAN is unable to connect to the catalog database, verify the configuration of the `tsnames.ora` on the host where the command was run. In addition, verify the listener configuration on the host where the catalog database runs. For details about the setup of the catalog database and the listener configuration, see documentation provided by Oracle.

IBM Spectrum Protect Snapshot for Oracle miscellaneous errors

Certain unique errors might occur when you use IBM Spectrum Protect Snapshot for native Oracle.

If you receive the following errors:

IBM Spectrum Protect Snapshot fails on the backup server in DBCS locales when the datafile or the path to the datafile contains a DBCS name.

This error is an Oracle problem that was 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 Spectrum Protect Snapshot supports table spaces that are named with DBCS, datafiles or paths to the datafiles that contain DBCS must be renamed to English before running IBM Spectrum Protect Snapshot.

Internet Protocol Version 6 (IPv6) support

The IBM Spectrum Protect Snapshot for UNIX and Linux software operates in IPv4, IPv6, and mixed environments.

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

<IPv4 address>:<service or port>

the format needs to be changed for IPv environments only:

<service or port>@<IP address>

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

Appendix A. Configuration files

After you have completed configuring IBM Spectrum Protect Snapshot for Oracle with the Configuration Wizard, the information you entered is stored in the profile.

IBM Spectrum Protect Snapshot uses the following configuration files:

- Profile
- Target volumes file
- Password file
- IBM Spectrum Protect options

Profile

When you complete configuring IBM Spectrum Protect Snapshot for Oracle, the information you enter is used to create the profile. To update and edit the profile, launch the Configuration Wizard and reconfigure what is required. This action updates the active profile. Each section of the profile includes parameters and options that determine how the IBM Spectrum Protect Snapshot backs up and restores data in your environment. The following information explains the various parameters and options.

When you use IBM Spectrum Protect Snapshot executable commands, the profile is identified by the value that is specified for option `-p`.

The profile is divided into the following sections:

- `GLOBAL`
- `ACSD`
- `CLIENT`
- `DEVICE_CLASS` *`device`*
- `OFFLOAD`
- `ORACLE`
- `CLONING`

In some cases, there are multiple `DEVICE_CLASS` sections. Each `DEVICE_CLASS` section must have a unique *`device`* instance name.

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

`GLOBAL` The `GLOBAL` section contains information that is required and used by all IBM Spectrum Protect Snapshot components. The components reference the information in the `GLOBAL` section during the startup process. Changes to the Global section require a restart of IBM Spectrum Protect Snapshot.

IBM Spectrum Protect Snapshot can be installed on multiple systems within a database environment. For example, when a database is distributed among multiple application hosts or when a backup server is used to transfer snapshot backups to IBM Spectrum Protect server. When IBM Spectrum Protect Snapshot is installed on multiple systems within a

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

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

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

CLIENT The CLIENT section contains all parameters that are related to back up operations, including parameters for database applications, whether an IBM Spectrum Protect backup is to be created from the snapshot, how many snapshot backup generations to retain, and which DEVICE_CLASS section is used during snapshot creation. The CLIENT section is used by the snapshot backup library that is loaded to start backup or restore processing.

DEVICE_CLASS *device*

The DEVICE_CLASS section contains parameters that are related to the storage device. A DEVICE_CLASS section describes the characteristics of a storage device that can be used to create a snapshot backup. The parameters and options that are used in the DEVICE_CLASS section depend on the storage solution.

Each storage solution that is used in the environment must have a DEVICE_CLASS section and must have a unique <*device*> instance name. At least one DEVICE_CLASS section is required for the configuration of the management agent.

The DEVICE_CLASS section that is used is determined by the value of the DEVICE_CLASS parameter in the CLIENT section of the profile for backup operation. For cloning operations, this value is determined by the DEVICE_CLASS parameter in the CLONING section of the profile. The same DEVICE_CLASS value cannot be specified in the CLIENT and CLONING sections at the same time.

During backup, the value of the DEVICE_CLASS parameter that is used is recorded in the IBM Spectrum Protect Snapshot repository. The same DEVICE_CLASS must be used when you are restoring the backup. Therefore, use caution when you delete or rename DEVICE_CLASS sections. If the appropriate section cannot be found, then the data that is backed up cannot be restored.

For each DEVICE_CLASS section, a password is required. This password is used by IBM Spectrum Protect Snapshot to authenticate to the management interface of the storage device that is represented by the DEVICE_CLASS section. Verify the password when you are configuring with the Configuration Wizard, or by using the following **fcmcli** command:

```
fcmcli -f password
```

OFFLOAD

The parameters and options in the OFFLOAD section determine how a snapshot is transferred to IBM Spectrum Protect server. The information is sent to the offload agent, (fcmcli -D).

When the offload agent is started, it connects to the management agent and queries for snapshot backups where the **TSM_BACKUP** or the **TSM_BACKUP_FROM_SNAPSHOT** parameters indicate that a tape_backup of the snapshot is requested. If such a snapshot backup is found, the offload agent mounts the snapshot on a backup server and calls IBM Spectrum Protect for Enterprise Resource Planning to initiate a backup to an IBM Spectrum Protect server. In this case, the OFFLOAD section is required and must include the **PROFILE** parameter.

CLONING

The CLONING section contains the parameters that are used for cloning operations. The section is ignored for all other operations.

Examples

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

```
# 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
  ....

<<<
```

GLOBAL

The profile parameters in the GLOBAL section contain basic configuration information. Examples of the type of information that is specified by the parameters are the port that is used by IBM Spectrum Protect Snapshot and the location of log files. The parameters are independent of the storage solution, and database application.

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

ACS_DIR

Path to the IBM Spectrum Protect Snapshot configuration directory. This parameter is required. The following sub-directories are included in this directory:

logs The subdirectory contains all log and trace information for IBM Spectrum Protect Snapshot.

shared The subdirectory contains information that is shared among all IBM Spectrum Protect Snapshot components.

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

Default

<*instance_owner_$HOME*>/acs

Advanced mode only

Yes

ACSD

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

This parameter must be identical on all systems where IBM Spectrum Protect Snapshot is installed for a database instance. While the parameter must be identical, each database instance can be managed by an individual management agent.

Default

localhost 57328

Advanced mode only
Yes

ENFORCE_TLS12
IBM Spectrum Protect Snapshot uses the security suite, IBM Global Security Kit (GSKit) for Secure Socket Layer / Transport Layer Security (SSL/TLS) TCP/IP connections. GSKit is able to provide SP800-131 compliant encryption by using the TLS protocol V1.2. To enforce the use of this protocol, select the option YES, otherwise the TLS version 1.0 and 1.1 is enabled by default.

Default
NO

Advanced mode only
Yes

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

Only use this parameter when advised to do so by IBM Support.

Default
NO

Advanced mode only
Yes

ACSD

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

ACS_REPOSITORY
This parameter denotes the directory of the IBM Spectrum Protect Snapshot repository. This directory is used for all operations, and must be in a secure location. If the repository is lost, all backups become unavailable to IBM Spectrum Protect Snapshot even if they remain in the storage device.

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

<ACS_DIR>/acsrepository

Before you configure IBM Spectrum Protect Snapshot, the path to the **ACS_REPOSITORY** is set, but the directory does not exist. The **ACS_REPOSITORY** directory is created during the configuration process. If the directory specified for the **ACS_REPOSITORY** parameter exists, an error is reported.

Default
<ACS_DIR>/acsrepository.

Advanced mode only
Yes.

REPOSITORY_LABEL

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

```
[a-z]
[A-Z]
[0-9]
```

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

Default

TSM

Advanced mode only

Yes.

SYNCHRONOUS_RECONCILE

This parameter is used to configure IBM Spectrum Protect Snapshot to synchronously reconcile and delete snapshot backups. The following options are possible for this parameter.

NO Specify this option when you do not want to start a synchronous delete and reconcile operation.

YES Use this option to start a synchronous delete and reconcile process as part of a backup, restore, and delete operation. This process is useful for storage systems that delete snapshot backups during an IBM Spectrum Protect Snapshot backup or cloning operation. SAN Volume Controller and Storwize family storage systems can delete backups during a restore operation.

RESTORE_AND_DELETE

Use the `RESTORE_AND_DELETE` option to start a synchronous delete and reconcile process as part of a restore and delete operation. This option is useful for storage systems that can delete snapshot backups during an IBM Spectrum Protect Snapshot restore process. For example, the Storwize family and SAN Volume Controller storage systems can delete backups during a restore and delete operation. The `RESTORE_AND_DELETE` option is also useful if you manually delete snapshot backups and use the force option `(-f)` on DS8000, SAN Volume Controller, or Storwize family storage systems.

Default

The default for this parameter is `RESTORE_AND_DELETE`.

Advanced mode only

YES

CLIENT

IBM Spectrum Protect Snapshot uses the Oracle specific parameters to configure Oracle backup and restore operations. These parameters are defined in the client section of the IBM Spectrum Protect Snapshot `profile` configuration file.

Oracle databases

When using Oracle databases, in addition to the `CLIENT` section, an `ORACLE` section is included in the profile configuration file. For more information about the `ORACLE` section, see "`ORACLE`" on page 120.

APPLICATION_TYPE
This parameter specifies the environment. There is only one option:

ORACLE
Use as an Oracle system.

ORACLE_SID
This parameter identifies a protected database. Its value is the same as the environment variable ORACLE_SID for the database.

Default
None

Advanced mode only
No

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

```
DEVICE_CLASS <list_of_device_classes> [<conditions>]
```

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

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

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

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

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

By configuring the product with the Configuration Wizard, additional **DEVICE_CLASS** sections are added to the IBM Spectrum Protect Snapshot profile with the addition of more instances of the **DEVICE_CLASS** parameter.

Default
STANDARD

Advanced mode only
No

OFFLOAD_SECTION_NAME
This parameter names the OFFLOAD section to be used for offload operations of databases to an IBM Spectrum Protect server. Only a single instance of this parameter is allowed within each client section of the profile.

Default
Not applicable.

Advanced mode only
No.

ORACLE_SECTION_NAME

This parameter denotes the ORACLE section that is used to describe the database that is protected. Only a single instance of this parameter is allowed within each client section of the profile.

Default

Not applicable.

Advanced mode only

No.

ENHANCED_PARTITIONING

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

YES

Use this option to ensure that IBM Spectrum Protect Snapshot processes all symbolic links of files or directories.

NO Use this option to ensure that IBM Spectrum Protect Snapshot does not process symbolic links of files or directories.

Default

YES

Advanced mode only

Yes.

LVM_FREEZE_THAW

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

YES

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

NO Do not freeze the file system. To set this parameter to NO, a licensed version of IBM Spectrum Protect Snapshot is needed and a backup server is required for mounting the snapshot to ensure file system consistency.

The value NO is required if at least one file system that does not support freeze or thaw actions, such as JFS, is involved.

AUTO

If the **TARGET_DATABASE_SUSPEND** parameter is set to YES, then this parameter is set with the following option: **LVM_FREEZE_THAW** YES. If the file system does not support freeze actions, the AUTO value sets the parameter to **LVM_FREEZE_THAW** NO.

For more information, see "Interdependency of **LVM_FREEZE_THAW** and **TARGET_DATABASE_SUSPEND**" on page 148.

Default

AUTO

Advanced mode only
Yes

MAX_VERSIONS
This parameter specifies the number of snapshot versions to store for each device class. The following list identifies the possible options:

```
MAX_VERSIONS ADAPTIVE
MAX_VERSIONS 2
MAX_VERSIONS 3 USE_FOR DC_TEST
```

ADAPTIVE
The maximum number varies depending on the available space. IBM Spectrum Protect Snapshot reuses the oldest target set as the target for the current backup.

n Where *n* is the maximum number of snapshot versions to be stored per device class. The amount of space that is required depends on the following factors:

- The number of snapshots.
- For each snapshot, the number of changes to the file system content since the snapshot was taken.

When this limit is reached, the oldest version is deleted.

Optional
When you use value `n` you can add a device class after it `USE_FOR <device class>` to specify that **MAX_VERSIONS** `n` is valid for that device class only.

Default
None

Advanced mode only
No

When you add another **MAX_VERSIONS** parameter, specify values based on the following criteria:

- **MAX_VERSIONS** with a specific value for a specific device class.
- **MAX_VERSIONS** with a default value for all device classes that have no **MAX_VERSIONS** already specified.
- **MAX_VERSIONS** with an `adpative` value. This value must be used only when there are no other values set for any **MAX_VERSIONS** for any device classes.

NEGATIVE_LIST
This parameter is used to control file processing. This processing occurs when files that are not associated with the database are stored within the same file system that is used for the backup and restore operations. This parameter is required. The following list identifies the possible options:

NO_CHECK
This is the default value, and it means that there are no checks for extra files. The operation ignores any additional files that are identified. When you use the default value and data is restored, all files on the file system or volume group are overwritten.

WARN
Use this option to receive a warning message for each file that is identified on the volume, but not part of the snapshot operation. The processing continues. When you use this option and data is restored, all files on the file system or volume group are overwritten.

ERROR
Use this option to receive an error message for each file that is discovered on the volume, but not part of the snapshot operation. The processing ends.

filename
Where *filename* is a name of a file that contains a list of fully qualified names of files and directories, each name requires a new line. Only files or directories that are not associated with the database but are stored within the file system that is used for backup operations are listed. Any file that is identified by IBM Spectrum Protect Snapshot that is not part of the database files or is not in the **NEGATIVE_LIST** file, causes processing to end. Any directory that is listed in the **NEGATIVE_LIST** file is processed recursively. For example, all files within the directory, including subdirectories, are processed during a backup or restore request.

When you are restoring data with remote mirroring, the value of this parameter is forced to *NO_CHECK*. This value is used because at the time after the takeover operation there are no file systems mounted on the takeover host.

Default
NO_CHECK

Advanced mode only
Yes

TARGET_DATABASE_SUSPEND
This parameter determines if the activity is suspended on the target database until the FlashCopy operation completes. The following list identifies the possible options:

Yes
This option suspends the target database until the FlashCopy operation completes. When there are many transactions processing, use this option.

NO This option means that the target database is available while FlashCopy operations run.

OFFLINE
All backups must be offline for the FlashCopy operations to run. When either acsora or acsutil is issued, the target database on the production system must be in a *startup mount* state. If the state is not *startup mount*, recovery is necessary to restore the database.

Default
Yes.

Advanced mode only
Yes.

For more information about the **TARGET_DATABASE_SUSPEND**, see "Interdependency of **LVM_FREEZE_THAW** and **TARGET_DATABASE_SUSPEND**" on page 148.

TIMEOUT_FLASH
This parameter specifies the maximum time, in seconds, that the database agent waits for a response to the management agent call during the *flash* phase. If the database agent does not receive a response within the specified time, an error message is displayed. This parameter allows the maximum time to be specified for a database to be suspended. This parameter also implies the

maximum time when JFS2 file systems can be frozen. When the timeout is reached, the file systems thaw, the database is resumed, and the backup operation ends with an error. If the **LVM_FREEZE_THAW** parameter is set to either AUTO or YES, the minimal value for **TIMEOUT_FLASH** is *5* seconds. In other scenarios, the minimal value is *1* second.

Default
The default value is *120* seconds.

Advanced mode only
Yes

TIMEOUT_<*PHASE*>
This parameter specifies the maximum time, in seconds, that the database agent waits for a response to the management agent call during a specific operation phase. If the database agent does not receive a response within the specified time, either the backup or restore operation ends and an error message is shown.

Specify one of the following phase values for a snapshot backup:

- **PARTITION**
- **PREPARE**
- **FLASH** (this parameter has a separate description)
- **VERIFY**
- **CLOSE**

For example, **TIMEOUT_PREPARE**.

Specify one of the following phase values for a snapshot restore:

- **PREPARERESTORE**
- **FLASHRESTORE**
- **COMPLETERESTORE**
- **CLOSE**

For example, **TIMEOUT_FLASHRESTORE**.

Default
The default value is *3600* seconds.

Advanced mode only
Yes

TSM_BACKUP
This parameter specifies whether to create an IBM Spectrum Protect backup from a snapshot. IBM Spectrum Protect Snapshot must be installed on a backup server. When the **TSM_BACKUP** parameter is set to YES, MANDATE, or LATEST, and after the offload agent runs, an IBM Spectrum Protect backup is created from the snapshot. The following list identifies the possible options:

YES
This option creates an IBM Spectrum Protect backup from a snapshot. If the IBM Spectrum Protect backup operation does not successfully complete, the target set can be reused.

MANDATE
This option creates an IBM Spectrum Protect backup from a snapshot. However, the target set cannot be reused until the IBM Spectrum Protect backup successfully completes.

LATEST
This option removes a backup request to IBM Spectrum Protect from a previous backup. When a new snapshot with **TSM_BACKUP** set to LATEST, YES, or MANDATE is created, IBM Spectrum Protect Snapshot removes any unsuccessful backup request that were previously created with the **TSM_BACKUP** option set to LATEST. This option prevents backup requests to IBM Spectrum Protect from queuing if they are not completed in time.

NO Keeps the snapshot backup but the snapshot is not used as a source for a subsequent tape backup operation.

TSM_ONLY
After the IBM Spectrum Protect backup is completed, during the unmount operation, the backup is automatically marked for deletion. This action occurs regardless of whether the backup is successful or not.

USE_FOR *<list of device classes>*
To create an IBM Spectrum Protect backup from snapshots that are run with particular device classes, as specified in the profile, combine this attribute with other options. When you list device classes, separate device classes with the space character. There is no limit of the number of device classes.

Default
None

Advanced mode only
No

VOLUME_MGR
The following list identifies the possible options:

ASM
When this option is selected, the option that is set for the **LVM_FREEZE_THAW** parameter is ignored. When this parameter is ignored, there is no file system, and the wizard does not query for data.

LVM
When this option is selected, the ASM-related options in the DEVICE_CLASS section is ignored and not queried by the wizard software.

Default
LVM

Advanced mode only
No.

ORACLE

The ORACLE section is an extension to the CLIENT and CLONING sections for ORACLE environments. The parameters do not depend on the storage device.

ORACLE_HOME
This parameter identifies the Oracle installation that is used by the corresponding database. Its value is the same as the environment variable ORACLE_HOME for the database.

Default
There is no default value. This parameter is automatically picked up by the ORACLE_HOME environment variable.

Advanced mode only
No.

CATALOG_DATABASE_CONNECT_STRING

The recovery catalog connect string. This parameter specifies the connect string of the Recovery catalog database that is used to catalog backup information. This value corresponds to the value defined in the *<$ORACLE_HOME>*/network/admin/tnsnames.ora file.

Default

There is no default value. This parameter is specified by the user.

Advanced mode only

No.

CATALOG_DATABASE_USERNAME

This parameter sets the user name that has the Oracle system database administrator privileges on the Recovery catalog database.

Default

There is no default value. This parameter is specified by the user.

Advanced mode only

No.

TARGET_DATABASE_PARAMETER_FILE

This parameter specifies the fully resolved path and file name of the Oracle parameter file for the target database. This file is a text-based Oracle parameter file (PFILE) and not a binary Oracle Server Parameter File (SPFILE).

Default

<$ORACLE_HOME>/dbs/init<$ORACLE_SID>.ora

Advanced mode only

Yes.

DATABASE_BACKUP_SCRIPT_FILE

Name of the RMAN backup script that contains the Data Protection for Oracle commands.

Default

There is no default value. For offload configuration, this parameter is required.

Advanced mode only

No.

DATABASE_CONTROL_FILE_RESTORE

This parameter specifies whether to restore Oracle control files after snapshot restore processing completes. There are two options:

- YES: restores Oracle control files and you complete the incomplete recovery up to the point when the control files were backed up.
- NO: does not restore Oracle control files. A full snapshot recovery up to the current image is completed, using the existing control files in the system.

Default

NO

Advanced mode only

Yes.

ASM_INSTANCE_USER

This parameter specifies the user that owns the Oracle Grid Infrastructure installation. A setting of AUTO, refers to the default value grid.

Default
AUTO

Advanced mode only
Yes

ASM_INSTANCE_ID

This parameter is deprecated. The ORACLE_SID of the ASM instance is automatically determined from the environment of the user that is specified in the **ASM_INSTANCE_USER** value.

Default
AUTO

Advanced mode only
Yes

ASM_ROLE
This parameter specifies the role that is used when connecting to the ASM instance. There are two options:

- sysasm: This option is the default role for connections to the ASM instance.
- sysdba: This role is supported for Oracle 11gR1, but is deprecated.

Default
sysasm

Advanced mode only
Yes.

CLONING

The CLONING section of the IBM Spectrum Protect Snapshot profile contains parameters that are used for cloning operations. The parameters are independent of the storage device or application.

The following lists provide the parameters, a description of each parameter, and default values for the CLONING section.

The following parameters apply to Oracle databases:

ORACLE_SID
This parameter identifies a protected database. Its value is the same as the environment variable ORACLE_SID for the database.

Default
None

Advanced mode only
No

CLONE_TARGET_DATABASE_TYPE
This parameter identifies the installation type that is on the clone system. For Oracle, specify AUTO.

AUTO
With this value, it is assumed that the clone system is of the same type as the production system. For example, if the production system is configured for Oracle RAC then *AUTO* for this parameter tells IBM Spectrum Protect Snapshot that the clone system is an Oracle RAC installation. AUTO is the default value for this parameter.

RAC
The clone system is configured for Oracle RAC with one node even if the production system is not configured for RAC.

NON_RAC
The clone system is not configured for RAC. Use this setting if you clone a RAC production database to a clone system that was not configured for RAC.

You cannot clone from non-RAC Oracle to a RAC configuration.

Default
AUTO.

Advanced mode only
Yes.

DEVICE_CLASS
This required parameter identifies the device class to use when you are cloning a database. The following code sample provides an example of how to specify options for this parameter:

```
DEVICE_CLASS <device class> USE_FOR_CLONING <list of clone database names>
```

There is an optional *conditions* statement that can be used. The following code sample includes an example of how to use the *conditions* statement. When you use the condition statement, use the following syntax:

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

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

```
DEVICE_CLASS <myClass1> USE_FOR_CLONING CL1 FROM 20:00 TO 23:59
DEVICE_CLASS <myClass2> USE_FOR_CLONING CL2 FROM 00:00 TO 06:00
```

If multiple **DEVICE_CLASS** statements are used, ensure that a unique 1-to-1 relation between the clone database name and the device class exists.

Default
Not applicable.

Advanced mode only
No.

ORACLE_SECTION_NAME
This parameter denotes the ORACLE section that is used to describe the database that is protected. Only a single instance of this parameter is allowed within each client section of the profile.

Default
Not applicable.

Advanced mode only
No.

ENHANCED_PARTITIONING
The **ENHANCED_PARTITIONING** parameter is used to control processing when extra file systems that are not database files are specified by the **FLASH_DIR_LIST** parameter in a cloning operation. When VOLUME_MGR is set to ASM, the

ENHANCED_PARTITIONING parameter is not evaluated by IBM Spectrum Protect Snapshot, and the default setting applies. IBM Spectrum Protect Snapshot fails, when a file system that is specified by the **FLASH_DIR_LIST** parameter contains symbolic links that point to a file system on a different volume group that is not part of the snapshot operation. Set the **ENHANCED_PARTITIONING** parameter to NO to ensure that symbolic links if present are not processed. You must manually add this parameter to the IBM Spectrum Protect Snapshot profile file. The following list identifies the possible options:

YES
Use this option to ensure that IBM Spectrum Protect Snapshot processes all symbolic links of files or directories that are specified in the **FLASH_DIR_LIST** profile parameter.

NO Use this option to ensure that IBM Spectrum Protect Snapshot does not process symbolic links of files or directories that are specified in the **FLASH_DIR_LIST** profile parameter.

Default
YES

Advanced mode only
Yes.

FLASH_DIR_LIST
This parameter is used to include files systems that are not part of the database files in the snapshot operation. For example, when you are cloning an SAP Advanced Business Application Programming and Oracle Java™ system, the Java instance is not part of the database files. A clone of the Java instance is created along with the clone of the database. In this scenario, use the **FLASH_DIR_LIST** parameter to include the Java instance directories. If VOLUME_MGR is set to ASM, the **FLASH_DIR_LIST** is ignored.

Inside the file, specify one fully qualified file or directory on each line. IBM Spectrum Protect Snapshot uses the snapshot function to snapshot the complete volume groups where the specified files or directories are located.

The default value is an empty list. This value prevents extra volumes from participating in the snapshot operation.

Default
By default, no file name is specified.

Advanced mode only
Yes.

DATABASE_SCHEMA
When a clone database is created from the production database, the database schema does not change. The clone database uses the database schema that is used by the production database. The **DATABASE_SCHEMA** parameter is used to specify the database schema. For Oracle databases, the **DATABASE_SCHEMA** parameter is required. The default database schema is determined by the `dbs_ora_schema` environment variable. This environment variable is set on the production database instance owner environment.

If these environment variables are not set, the default database schema value is *SAPR3*. The **DATABASE_SCHEMA** parameter is evaluated when the following conditions exist:

- A processing script is used with the **preproc_clone** or **postproc_clone** command.
- The **refresh_clone** command is entered with the `-X` or `-Y` cloning parameter.

- The **create_clone** command is entered with the **-Y** cloning parameter.

Default
The default value is determined by environment variables.

Advanced mode only
Yes.

NEGATIVE_LIST
The **NEGATIVE_LIST** parameter is used to control processing when files that are not associated with the database are stored within the same file system that is used for the backup and restore operations. This parameter is required. The following list identifies the options:

NO_CHECK
Use this option to not check for extra files. The operation ignores any additional files that are identified. When you use this option and data is restored, all files that are on the file system or volume group are overwritten.

WARN
Use this option to receive a warning message for each file that is identified on the volume, but not part of the snapshot operation. The processing continues. When you use this option and data is restored, all files that are on the file system or volume group are overwritten.

ERROR
Use this option to receive an error message for each file that is discovered on the volume, but not part of the snapshot operation. The processing ends.

filename
Use this option to back up and restore files that are not part of the database tablespace files. Using this option includes files in the snapshot operations. When you use this option, specify the fully qualified names of the files and directories. Use one line for each entry. When these files are identified, processing continues. When other files are identified, but not part of the database tablespace files or identified in the **NEGATIVE_LIST** file, processing ends. Any directory that is listed in the **NEGATIVE_LIST** file is processed recursively. For example, all files within the directory, including subdirectories, are processed during a backup or restore request.

Default
There is no default for this required parameter.

Advanced mode only
Yes.

TIMEOUT_FLASH
This parameter specifies the maximum time, in seconds, that the database agent waits for a response to the management agent call during the *flash* phase. If the database agent does not receive a response within the specified time, an error message is displayed. This parameter allows the maximum time to be specified for a database to be suspended. This parameter also implies the maximum time when JFS2 file systems can be frozen. When the timeout is reached, the file systems thaw, the database is resumed, and the backup operation ends with an error. The minimum value for **TIMEOUT_FLASH** is *5* seconds.

Default
The default value is *120* seconds.

Advanced mode only
Yes

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 cloning operation ends and an error message is displayed. The default value is *3600* seconds.

You can specify one of these phase values for a snapshot backup. For example: **TIMEOUT_PREPARE**

- **PARTITION**
- **PREPARE**
- **VERIFY**
- **CLOSE**

Advanced mode only
Yes.

The following parameters apply:

OVERWRITE_DATABASE_PARAMETER_FILE
This parameter is included in the OFFLOAD section of the configuration profile. The parameter specifies whether the database configuration file on the clone server is overwritten with the file from the production server. The parameter value in the OFFLOAD section is not applicable to cloning operations and is ignored.

To copy the database configuration file from the production system to the clone system, specify this parameter in the CLONING section of the configuration profile. The IBM Spectrum Protect Snapshot software 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 the scenario where the production system is <$ORACLE_SID>=P01 and the clone system is <$ORACLE_SID>=C01, the following 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 that is used in the snapshot operation on the clone system. The initC01.ora file is used to rename and start the clone database.

Specify one of the following values:

YES
Copy the database configuration file from the production system to the clone system. The following processes occur:

- 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. If the production database uses a binary Oracle Server Parameter file (SPFILE), then it is dumped to a temporary pfile and copied to the clone system.
- If the production database is configured to use a binary Oracle SPFILE, do not specify a value for the **TARGET_DATABASE_PARAMETER_FILE**

parameter. In this scenario, the default database configuration file name <$ORACLE_HOME>/dbs/init<$ORACLE_SID>.ora is used on the clone system.

- 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 to 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.

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 scenario, 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.

Default
YES

Advanced mode only
Yes.

TARGET_DATABASE_PARAMETER_FILE
This parameter is included in the ORACLE section of the configuration profile.

The parameter specifies the database configuration file name. 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 for the production database. By default, the file name of the Oracle parameter file for the production database is *initSID*.ora. This file must be a text-based Oracle parameter file (PFILE) and not a binary Oracle SPFILE. The default value is *<$ORACLE_HOME>/dbs/init<$ORACLE_SID>.ora*. If the production database is configured to use a binary Oracle SPFILE, this file is automatically detected and this parameter must not be specified.

Default
<$ORACLE_HOME>/dbs/init<$ORACLE_SID>.ora

Advanced mode only
Yes.

VOLUME_MGR

LVM
This input is the default value.

Default
LVM

Advanced mode only
No.

DEVICE_CLASS *device*

The IBM Spectrum Protect Snapshot profile can contain one or more DEVICE_CLASS sections. The device class section configures IBM Spectrum Protect Snapshot for use with a particular storage or file system solution. The parameters do not depend on the database that is protected.

Use care when you rename or delete a DEVICE_CLASS section from the profile, as you cannot access backups that were taken with the original DEVICE_CLASS section. Therefore, first remove backups and clones that are associated with the DEVICE_CLASS before you rename or delete the DEVICE_CLASS section.

A *device* refers to supported IBM XIV Storage System , IBM Storwize family, IBM System Storage SAN Volume Controller, and IBM System Storage DS8000 series.

For more information about setting different device class **MAX_VERSIONS**, see Backup version retention.

Updating DEVICE_CLASS *device* for mirroring

To use the mirroring technologies, a DEVICE_CLASS section specific to the storage solution used for mirroring needs to be added to the profile configuration file. There is one exception to this statement: If remote backups are run, the existing DEVICE_CLASS section for the device is sufficient. No additional DEVICE_CLASS section is needed.

About this task

When creating a DEVICE_CLASS section for the storage solution used for mirroring, the section includes the same parameters as the device class for the local site, specific values for the remote site, and the parameters that are required to connect and send requests to the remote cluster. The parameters required to connect and send requests to the remote cluster are identified in the following list:

COPYSERVICES_REMOTE
The option set for this parameter determines if the backup is taken at the remote site. The options are YES and NO. The default option is set to NO.

COPYSERVICES_REMOTE_SERVERNAME
This parameter specifies the IP address or hostname for the secondary cluster. If the **COPYSERVICES_REMOTE** parameter is set to YES, the parameter is required. If the **COPYSERVICES_REMOTE** parameter is set to NO, the **COPYSERVICES_REMOTE_SERVERNAME** parameter cannot be used.

COPYSERVICES_REMOTE_USERNAME
This parameter specifies the user name used to connect to the secondary cluster. The default option is superuser. If the **COPYSERVICES_REMOTE** parameter is set to NO, the **COPYSERVICES_REMOTE_USERNAME** parameter cannot be used.

TAKEOVER_HOST_NAME
This parameter is required when restoring a remote mirroring backup after a takeover procedure on the remote side. The value for this parameter is the host name of the takeover host and is only used in combination with the secondary cluster defined by the **COPYSERVICES_REMOTE_SERVERNAME** parameter. The value specified for this parameter needs to match the value defined in the storage system. If the values do not match, an error occurs.

The following DEVICE_CLASS parameters need to be common to both clusters:

- **COPYSERVICES_COMMPROTOCOL**

- **COPYSERVICES_CERTIFICATEFILE**
- **COPYSERVICES_SERVERPORT**

DEVICE_CLASS IBM XIV Storage System Storage System parameters

The parameters that are defined in the device class section of the IBM Spectrum Protect Snapshot profile, configure IBM Spectrum Protect Snapshot for use with the IBM XIV Storage System.

BACKUP_HOST_NAME

This parameter specifies the name of the backup host that is used during offloaded tape backups only. The following list identifies the possible options:

backup_server_hostname

Enter the host name or cluster name of the backup server as configured on the IBM XIV Storage System.

None

This option is used if you do not have a backup server.

Default

None

Advanced mode only

No.

CLONE_DATABASE

This parameter indicates whether the device class is used for cloning. The following list identifies the possible options:

YES

Use the device class for cloning. When the parameter is set to YES, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning.

The following example shows the **CLONE_DATABASE** parameter that is specified in the DEVICE_CLASS section for DEVICE_CLASS STANDARD.

```
>>> DEVICE_CLASS STANDARD
CLONE_DATABASE YES
COPYSERVICES_HARDWARE_TYPE XIV
PATH_TO_XCLI /home/xivtest/XCLI
COPYSERVICES_SERVERNAME nextra
COPYSERVICES_USERNAME admin
# RECON_INTERVAL 12
# USE_WRITABLE_SNAPSHOTS AUTO
BACKUP_HOST_NAME acsback5
<<<
```

Default

NO

Advanced mode only

No.

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

XIV

Specify the XIV option, when the database is stored on the IBM XIV Storage System.

On the console, any notifications that refer to IBM XIV Storage System operations and **COPYSERVICES_HARDWARE_TYPE** are displayed as COPYSERVICES_HARDWARE_TYPE=GENERIC. Similarly, when you view the log or trace files in the ACS_DIR/logs directory, any references that are related to the **COPYSERVICES_HARDWARE_TYPE** for the IBM XIV Storage System are displayed as COPYSERVICES_HARDWARE_TYPE=GENERIC.

Default
Not available.

Advanced mode only
No.

COPYSERVICES_SERVERNAME

This parameter identifies the TCP/IP host name of the storage system where the data to protect is located.

Default
None

Advanced mode only
No.

COPYSERVICES_USERNAME

This parameter identifies the user name. Use the *XIV user* name that you use to log on to the IBM XIV Storage System.

Default
superuser

Advanced mode only
No.

LVM_MIRRORING

Set this parameter to YES if your volume groups use AIX Logical Volume Manager mirroring.

Default
No.

Advanced mode only
Yes.

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default
12

Advanced mode only
Yes.

PATH_TO_XCLI

This parameter specifies the path where the IBM XIV command-line interface, XCLI, is installed. There is no default value. This parameter is only valid when **COPYSERVICES_HARDWARE_TYPE** specifies XIV.

Default
None.

Advanced mode only
No.

USE_WRITABLE_SNAPSHOTS
This parameter determines whether writable snapshots are used. Writable snapshots are required in LVM mirrored environments. The following list identifies the options:

YES Writable snapshots are used.

NO Writable snapshots are not used.

AUTO Based on the environment, the value is automatically selected.

Default
AUTO

Advanced mode only
Yes

Storwize family and SAN Volume Controller Storage System parameters

DEVICE_CLASS parameters for static target allocation:

The device class parameters for static target allocation are defined in the **DEVICE_CLASS** section of the IBM Spectrum Protect Snapshot profile. These parameters configure IBM Spectrum Protect Snapshot to use static target allocation with the IBM Storwize family or IBM System Storage SAN Volume Controller storage systems.

CLONE_DATABASE
This parameter indicates whether the device class is used for cloning. The following list identifies the possible options:

YES Use the device class for cloning. When the parameter is set to YES, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning.

Default
No

Advanced mode only
No

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

SVC
Specify the SVC option, when the database is stored on either the SAN Volume Controller or the Storwize family storage system.

Tip: You must manually create backup target volumes in advance on the storage system.

Default
Not available

Advanced mode only
No

COPYSERVICES_USERNAME

This parameter identifies the user name. Use the *SVC user* name that you use to log on to the SAN Volume Controller master console or cluster. For Storwize family, use the *Storwize V7000 user* name that you use to log on to the Storwize family.

Default

superuser

Advanced mode only

No

RECON_INTERVAL

This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default

12

Advanced mode only

Yes

LVM_MIRRORING

Set this parameter to YES if your volume groups use AIX Logical Volume Manager mirroring.

Default

No.

Advanced mode only

Yes.

COPYSERVICES_COMMPROTOCOL

This parameter identifies the protocol to be used for communication with the CIM Agent. The options are HTTP, for communication in a non-secure mode, and HTTPS, for communication in a secure mode.

Default

HTTPS

Advanced mode only

Yes

COPYSERVICES_CERTIFICATEFILE

When **COPYSERVICES_COMMPROTOCOL** is set to HTTPS, there are two options:

certificate_filename

Name of a certificate file that is created for secure communication between the CIM Client and the CIM Agent.

NO_CERTIFICATE

Select for null trust provider mode.

By default, the CIM Agent for IBM Storwize family or IBM System Storage SAN Volume Controller requires communication in secure mode. For this scenario, clients such as IBM Spectrum Protect Snapshot must connect by using HTTPS instead of HTTP. This connection requires that the CIM Client obtain the public key that is used for encryption from the *truststore* certificate in the CIM Agent. After the client obtains the public key, the CIM Client is authenticated by using the user name and password.

To enable the HTTPS protocol, the IBM Spectrum Protect Snapshot profile parameter **COPYSERVICES_COMMPROTOCOL** must specify HTTPS. For this scenario, the **COPYSERVICES_CERTIFICATEFILE** parameter can define a certificate file name, and IBM Spectrum Protect Snapshot exports the certificate by using this file.

The CIM Agent also provides another communication mode that is known as *null trust provider*. In this scenario, the CIM Agent does not verify that the certificate passed by the client matches a known certificate. Rather, it accepts any certificate from the client, including a null string for the file name. To enable this mode, the value of **COPYSERVICES_CERTIFICATEFILE** must be NO_CERTIFICATE. This mode is used only if the production system, backup or clone systems, and the storage system are protected by a firewall. If NO_CERTIFICATE is used, the cimom.properties parameter **DigestAuthentication** must be set to false.

Default

NO_CERTIFICATE

Advanced mode only

Yes

COPYSERVICES_PRIMARY_SERVERNAME

This parameter identifies the server name or address that defines the TCP/IP address of the host that is running the CIM Agent. This host manages the SAN Volume Controller master console or the embedded CIM Agent in the Storwize family storage system.

For SAN Volume Controller, the **COPYSERVICES_PRIMARY_SERVERNAME** parameter, if specified, must point directly to the SAN Volume Controller cluster with the embedded CIM server. For Storwize family, the **COPYSERVICES_PRIMARY_SERVERNAME** parameter must point to the Storwize family cluster.

Default

localhost

Advanced mode only

No

COPYSERVICES_SERVERPORT

This parameter identifies the server port number on the CIM Agent. This information is used to manage the primary and secondary Copy Services servers of the SAN Volume Controller master console or the embedded CIM Agent on the Storwize family storage system.

Default

The default port number depends on the settings of **COPYSERVICES_HARDWARE_TYPE** and **COPYSERVICES_COMMPROTOCOL**:

COPYSERVICES_HARDWARE_TYPE	COPYSERVICES_COMMPROTOCOL	Default Port
SVC	HTTPS	5989
	HTTP	5988

Advanced mode only

Yes

COPYSERVICES_TIMEOUT

This parameter identifies the maximum length of time, in minutes, that the CIM Client waits for a response to a call put to the CIMOM (CIM Agent). If the CIM Client does not receive a response within this time, an error message is displayed.

Default
6

Advanced mode only
Yes

FLASHCOPY_TYPE
This parameter specifies whether the storage solution does a bit-level copy of data from one logical volume to another. This parameter applies to any FlashCopy storage system. The following options are available:

COPY Directs the storage system to run a bit-level copy of the data from one physical volume to another. Specify this value when the following conditions are true:
- A fast snapshot restore of a backed-up database is required.
- A complete copy of the database data on the target volume is required.

NOCOPY Directs the storage system to run a bit-level copy of a track if the data is modified after the initial FlashCopy request. This technique is typically referred as copy-on-write. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:
- A complete copy of the source volumes that contain the database files is not required on the target volumes.
- Backup time constraints are a concern.

INCR This option is similar to the COPY option but the INCR option copies only those tracks that were modified since the previous incremental FlashCopy was created. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:
- IBM Spectrum Protect backups are taken from disk copies. This type of backup creates less burden on the storage system than for the COPY option.
- A snapshot restore operation of the backed up database is to be completed.
- More frequent backups for the database are scheduled.

The **SVC_COPY_RATE** parameter is forced to *0* when the **FLASHCOPY_TYPE** parameter is specified as NOCOPY.

Default
COPY

Advanced mode only
No

RESTORE_FORCE

This parameter specifies whether to force a restore. During a rerun of a snapshot restore, the message FMM0200E can be generated. This problem occurs if the background copy process of the previous snapshot restore is still running and the **RESTORE_FORCE** parameter is set to NO. There are two ways to resolve the issue that is identified by the message:
- Wait until the background copy process ends.
- Set the **RESTORE_FORCE** parameter to YES in the profile and try the snapshot restore again. This option withdraws all existing source and target

relationships, and creates new source and target relationships. A full copy is completed. If you want to set **RESTORE_FORCE** to YES for a specific restore, you can create a temporary profile.

Default
NO

Advanced mode only
Yes

TARGET_SETS

This parameter indicates how target volumes are specified. The following options are available:

VOLUMES_FILE
This parameter specifies that a file is used to specify the target volumes. The name of the file must be specified in the **VOLUMES_FILE** parameter.

list_of target_set_names
A list of target set names. For example: TARGET_SETS 1 2 3

To define the naming convention for the target volumes, specify the **TARGET_NAMING** parameter. For example: TARGET_NAMING *string_with_wildcards_%SOURCE_and_%TARGETSET*

This parameter and option define the naming convention for target volumes. When a backup volume is required, IBM Spectrum Protect Snapshot determines the name of the target set for the operation and the name of the source volume to be backed up. The name of the target volume that stores the backup is the name that is specified after the following strings are replaced with the respective values in the operation: *%SOURCE_and_%TARGETSET*.

Default
None

Advanced mode only
No

VOLUMES_FILE

Specify **VOLUMES_FILE** if the target sets are passed in a target volumes file (.fct). Its actual name must be given in parameter **VOLUMES_FILE**. Specify the fully qualified file name.

Default
None

Advanced mode only
No

ALLOW_NOCOPY_FLASHCOPY

Use this parameter with the **CLONE_DATABASE** parameter. The following list identifies the possible options:

YES Create an IBM Spectrum Protect Snapshot clone on space-efficient targets. For this device class, use space-efficient targets and set **FLASHCOPY_TYPE** to NOCOPY. FlashCopy backups cannot be stored on the same source volumes.

NO Do not create an IBM Spectrum Protect Snapshot clone on space-efficient targets. If both backup and cloning must be completed

on the same source volumes, cloning is completed to full targets and the **ALLOW_NOCOPY_FLASHCOPY** parameter is set to NO.

Default
NO

Advanced mode only
Yes

ALLOW_ALL_FLASHCOPY_TYPES

Use this parameter when IBM Spectrum Protect Snapshot is configured with **FLASHCOPY_TYPE** COPY, or **FLASHCOPY_TYPE** INCR. Use the parameter when the source volumes are fully allocated and the target volumes are space efficient. The following list identifies the available options:

YES Allows IBM Spectrum Protect Snapshot to be configured to use **FLASHCOPY_TYPE** COPY, or **FLASHCOPY_TYPE** INCR when the source volumes are fully allocated and the target volumes are space efficient.

NO If the source volumes are fully allocated and the target volumes are space efficient, you can set the parameter **FLASHCOPY_TYPE** to NOCOPY only.

Default
NO

Advanced mode only
Yes

SVC_CLEAN_RATE

This parameter specifies the cleaning rate for the FlashCopy mapping. A value from 1 to 100 can be entered.

Default
None

Advanced mode only
Yes

SVC_COPY_RATE

This parameter specifies the priority that the SAN Volume Controller or Storwize family gives to the FlashCopy background process for the current backup or restore. A value from 0 to 100 can be entered.

A value of 100 indicates the highest priority, but places the greatest burden on the responsiveness of the storage system. A value of 0 indicates the lowest priority, but suppresses the background copy process and forces the **FLASHCOPY_TYPE** parameter to have the NOCOPY option.

Default
50

Advanced mode only
No

SVC_GRAIN_SIZE

This parameter specifies the grain size, in KB, for FlashCopy mapping for space-efficient virtual disks on SAN Volume Controller or Storwize family. The grain size of the space-efficient virtual disk must match the grain size of the FlashCopy. The options for this parameter are 64, and 256.

After the parameter is set, the value cannot be changed until the backup is deleted with the option `-F` to remove the mappings.

Default
`256`

Advanced mode only
Yes

DEVICE_CLASS parameters for dynamic target allocation:

The device class parameters for dynamic target allocation are defined in the **DEVICE_CLASS** section of the IBM Spectrum Protect Snapshot profile. These parameters configure IBM Spectrum Protect Snapshot to use dynamic target allocation with IBM Storwize family or IBM System Storage SAN Volume Controller storage systems.

CLONE_DATABASE
This parameter indicates whether the device class is used for cloning. The following list identifies the possible options:

YES Use the device class for cloning. When the parameter is set to `YES`, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning.

Default
No

Advanced mode only
No

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

SVCDTA
Specify the `SVCDTA` option when the storage system is SAN Volume Controller or Storwize family and you require the target volumes to be dynamically allocated during the backup process.

Default
None

Advanced mode only
No

COPYSERVICES_SERVERNAME
Defines the TCP/IP host name of the storage system where the application data to protect is allocated.

Default
None

Advanced mode only
No

COPYSERVICES_USERNAME
Identifies the user name. Specify the user name that is used to log on to the SAN Volume Controller cluster. For Storwize family, specify the Storwize family user name.

Default
`superuser`

Advanced mode only
No

SVC_SSHKEY_FULLPATH
Specifies the path and the file name to the private SSH key file. The key file is used to authenticate to the storage system with the user name that is specified for the **COPYSERVICES_USERNAME** parameter.

Default
<$HOME>/.ssh/svc_sshkey

Advanced mode only
Yes

SVC_REMOTE_SSHKEY_FULLPATH
This parameter specifies the second SSH key file to be used for authentication on the remote site storage device. The key file is used to authenticate to the storage system with the user name that is specified for the **COPYSERVICES_REMOTE_USERNAME** parameter. If you do not want to create a new key pair for the remote site, one key can be shared for both storage sites.

Default
`<$HOME>/.ssh/svc_sshkey`

Advanced mode only
Yes

SSH_DIR
Specifies the path to the Secure Shell protocols and executable files.

Default
/usr/bin

Advanced mode only
Yes

SVC_COPY_RATE
Specifies the priority that the storage system gives to the FlashCopy background process for the current backup or restore operation. Enter a value from the range 1 - 100.

The **SVC_COPY_RATE** parameter applies only for full copy backups (FLASHCOPY_TYPE COPY). For space-efficient backups (FLASHCOPY_TYPE NOCOPY), the copy rate is implicitly set to 0.

Default
0

Advanced mode only
Yes

LVM_MIRRORING

Set this parameter to `YES` if your volume groups use AIX Logical Volume Manager mirroring.

Default
No.

Advanced mode only
Yes.

FLASHCOPY_TYPE

Specifies whether the storage solution does a bit-level copy of data from one logical volume to another. This parameter applies to any FlashCopy storage system. The following options are available:

COPY Directs the storage system to run a bit-level copy of the data from one physical volume to another. Specify this value when the following conditions are true:

- A fast snapshot restore of a backed-up database is required.
- A complete copy of the database data on the target volume is required.

NOCOPY Directs the storage system to run a bit-level copy of a track if the data is modified after the initial FlashCopy request. This technique is typically referred as copy-on-write. Specify this value when the following conditions are true:

- A complete copy of the source volumes that contain the database files is not required on the target volumes.
- A fast snapshot restore of a backed-up database is required.
- Backup time constraints are a concern.

INCR This option is similar to the `COPY` option but the `INCR` option copies only those tracks that were modified since the previous incremental FlashCopy was created. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:

- IBM Spectrum Protect backups are taken from disk copies. This type of backup creates less burden on the storage system than for the `COPY` option.
- A snapshot restore operation of the backed up database is to be completed.
- More frequent backups for the database are scheduled.

Default

`NOCOPY`

Advanced mode only

No

SVC_GRAIN_SIZE

Specifies the grain size, in KB, for FlashCopy mapping for space-efficient virtual disks on SAN Volume Controller or Storwize family. The grain size of the space-efficient virtual disk must match the grain size of the FlashCopy. The options for this parameter are `64`, and `256`.

After the parameter is set, the value cannot be changed until the backup is deleted with the option `-F` to remove the mappings.

Note: When you are migrating from the SVC adapter with static target allocation, you must ensure that the grain size for the new SVCDTA device classes is set to the same value as it was for the device classes for SVC.

Default

`256`

Advanced mode only

Yes

SVC_POOLNAME

This parameter specifies the name of the storage pool that is used to create target volumes for the FlashCopy backups. A value must be assigned if a source volume has two copies in the SVC, and these copies are in two different storage pools. If the DEVICE_CLASS is configured for remote site backup **COPYSERVICES_REMOTE** YES, the specified pool name is related to the remote site storage device.

Default

Name of the storage pool where the source volume is located.

Advanced mode only

Yes

SVC_IOGROUP

Specifies the name of the input and output (IO) group, which is used to create target volumes for the FlashCopy backups. If the DEVICE_CLASS is configured for remote site backup COPYSERVICES_REMOTE YES, the specified IO group is related to the remote site storage device.

Default

Name of the IO group on the source volume where the FlashCopy relationship is established.

Advanced mode only

Yes

SVC_MOUNT_POOLNAME

Specifies the name of the storage pool that is used to create temporary duplicates of the target volumes of a FlashCopy backup, which then mounts to a host. If the DEVICE_CLASS is configured for remote site backup COPYSERVICES_REMOTE YES, the specified pool name is related to the remote site storage device.

Default

Name of the storage pool that is used to create target volumes.

Advanced mode only

Yes

SVC_MOUNT_IOGROUP

Specifies the name of the IO group, which is used to create duplicate volumes for the mount operation. If the DEVICE_CLASS is configured for remote site backup COPYSERVICES_REMOTE YES, the specified IO group is related to the remote site storage device.

Default

Name of the IO group on the storage system that is used to create target volumes.

Advanced mode only

Yes

SVC_TARGET_VOLUME_REAL_SIZE

Specify the percentage of the source volume size to allocate, which is used to create the actual target volumes during the backup operation.

The **SVC_TARGET_VOLUME_REAL_SIZE** parameter applies only to **FLASHCOPY_TYPE NOCOPY**.

Default

10

Advanced mode only
Yes

RECON_INTERVAL
This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between 0 and 24 inclusive.

Default
12

Advanced mode only
Yes

DEVICE_CLASS DS8000 Storage System parameters

The parameters that are defined in the device class section of the IBM Spectrum Protect Snapshot profile, configure IBM Spectrum Protect Snapshot for use with the IBM System Storage DS8000.

BACKUP_HOST_NAME
This parameter specifies the name of the backup host that is used during offloaded tape backups only. The following list identifies the possible options:

PREASSIGNED_VOLUMES
Specify this option when the target volumes are preassigned to a specific backup server.

None
This option is used if you do not have a backup server.

Default
None.

Advanced mode only
No.

CLONE_DATABASE
This parameter indicates whether the device class is used for cloning. The following list identifies the possible options:

YES Use the device class for cloning. When the parameter is set to YES, the device class is unavailable for non-cloning backup or restore operations. The device class is ignored during backup expiration and reconciliation processing.

NO Do not use the device class for cloning.

Default
No

Advanced mode only
No

COPYSERVICES_HARDWARE_TYPE

This parameter is required. Only one device can be specified.

DS8000
Specify the DS8000 option, when the database is stored on any supported IBM DS8000 storage device.

Default
None.

Advanced mode only
No.

COPYSERVICES_USERNAME
This parameter identifies the user name, use the *cim user* of the CIM Agent for DS Open API. The CIM Agent for DS Open API manages the primary and secondary copy services servers of the DS8000 cluster.

Default
`superuser`

Advanced mode only
No.

RECON_INTERVAL
This parameter specifies the interval, in hours, between two subsequent reconciliation operations. The options are whole numbers between `0` and `24` inclusive.

Default
`12`

Advanced mode only
Yes

LVM_MIRRORING

Set this parameter to `YES` if your volume groups use AIX Logical Volume Manager mirroring.

Default
No.

Advanced mode only
Yes.

COPYSERVICES_COMMPROTOCOL
This parameter identifies the protocol to be used for communication with the CIM Agent. The options are `HTTP`, for communication in a non-secure mode, and `HTTPS`, for communication in a secure mode.

Default
`HTTPS`

Advanced mode only
Yes.

COPYSERVICES_CERTIFICATEFILE
When **COPYSERVICES_COMMPROTOCOL** is set to `HTTPS`, there are two options:

certificate_filename
Name of a certificate file that is created for secure communication between the CIM Client and the CIM Agent.

NO_CERTIFICATE
Select for null trust provider mode.

By default, the CIM Agent for DS8000, which is preinstalled on the HMC, requires communication in secure mode. For this scenario, clients such as IBM Spectrum Protect Snapshot must connect by using HTTPS instead of HTTP. This connection requires that the CIM Client obtain the public key that is used for encryption from the *truststore* certificate in the CIM Agent. After the client obtains the public key, the CIM Client is authenticated by using the user name and password.

To enable the HTTPS protocol, the IBM Spectrum Protect Snapshot profile parameter **COPYSERVICES_COMMPROTOCOL** must specify HTTPS. For this scenario, the **COPYSERVICES_CERTIFICATEFILE** parameter can define a certificate file name, and IBM Spectrum Protect Snapshot exports the certificate by using this file.

The CIM Agent also provides another communication mode that is known as *null trust provider*. In this scenario, the CIM Agent does not verify that the certificate passed by the client matches a known certificate. Rather, it accepts any certificate from the client, including a null string for the file name. To enable this mode, the value of **COPYSERVICES_CERTIFICATEFILE** must be NO_CERTIFICATE. This mode should not be used unless the production and backup systems, and the storage system, are protected by a firewall. If NO_CERTIFICATE is used, the cimom.properties parameter **DigestAuthentication** must be set to false.

Default

NO_CERTIFICATE

Advanced mode only

Yes.

COPYSERVICES_PRIMARY_SERVERNAME

This parameter identifies the server name or address that defines the TCP/IP address of the host that is running the CIM Agent for DS Open API. This host manages the primary and secondary copy services servers of the DS8000 cluster.

Default

localhost

Advanced mode only

No.

COPYSERVICES_SECONDARY_SERVERNAME

This parameter identifies the name of the backup Copy Services server that is located within a snapshot devices cluster. Specify either the IP address or the server DNS name. This parameter can be used only in environments with DS8000 in combination with the proxy CIM Agent.

Default

None

Advanced mode only

Yes.

COPYSERVICES_SERVERPORT

This parameter identifies the server port number of the host that is running the CIM Agent for DS Open API.

Default

The default port number depends on the settings of **COPYSERVICES_HARDWARE_TYPE** and **COPYSERVICES_COMMPROTOCOL**:

COPYSERVICES_HARDWARE_TYPE	COPYSERVICES_COMMPROTOCOL	Default Port
DS8000	HTTPS	6989
	HTTP	6988

Advanced mode only

Yes.

COPYSERVICES_TIMEOUT

This parameter identifies the maximum length of time, in minutes, that the

CIM Client waits for a response to a call sent to the CIMOM (CIM Agent). If the CIM Client does not receive a response within this time, an error message is sent.

Default
6

Advanced mode only
Yes.

FLASHCOPY_TYPE
This parameter specifies whether the storage solution does a bit-level copy of data from one logical volume to another. This parameter applies to any FlashCopy storage system. The following options are available:

COPY Directs the storage system to run a bit-level copy of the data from one physical volume to another. Specify this value when the following conditions are true:
- A fast snapshot restore of a backed-up database is required.
- A complete copy of the database data on the target volume is required.

NOCOPY Directs the storage system to run a bit-level copy of a track if the data is modified after the initial FlashCopy request. This technique is typically referred as copy-on-write. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:
- A complete copy of the source volumes that contain the database files is not required on the target volumes.
- Backup time constraints are a concern.

INCR This option is similar to the COPY option but the INCR option copies only those tracks that were modified since the previous incremental FlashCopy was created. This option applies only to FlashCopy devices. Specify this value when the following conditions are true:
- IBM Spectrum Protect backups are taken from disk copies. This type of backup creates less burden on the storage system than for the COPY option.
- A snapshot restore operation of the backed up database is to be completed.
- More frequent backups for the database are scheduled.

There must be only one target set specified in the target volumes file (.fct) for incremental snapshots. CIM errors might occur when more than one target set is specified. A successful backup of the database to the IBM Spectrum Protect server is possible even if the parameter is set to NOCOPY.

Default
COPY

Advanced mode only
No.

RESTORE_FORCE

This parameter specifies whether to force a restore. During a rerun of a snapshot restore, the message FMM0200E can be generated. This problem occurs if the background copy process of the previous snapshot restore is still running and the **RESTORE_FORCE** parameter is set to NO. There are two ways to resolve the issue that is identified by the message:

- Wait until the background copy process ends.
- Set the **RESTORE_FORCE** parameter to YES in the profile and try the snapshot restore again. This option withdraws all existing source and target relationships, and creates new source and target relationships. A full copy is completed. If you want to set **RESTORE_FORCE** to YES for a specific restore, you can create a temporary profile.

Default
NO

Advanced mode only
Yes

TARGET_SETS

This parameter indicates how target volumes are specified. The following list identifies the possible options:

VOLUMES_FILE
Specify **VOLUMES_FILE** if the **BACKUP_HOSTNAME** is set to PREASSIGNED_VOLUMES. The actual file name of the target volumes file (.fct) is specified in parameter **VOLUMES_FILE**.

Default
None.

Advanced mode only
No.

VOLUMES_FILE

This parameter specifies the name of the target volumes file (.fct). Specify the fully qualified file name.

Default
None.

Advanced mode only
No.

OFFLOAD

The OFFLOAD section of the profile configuration contains information that is related to IBM Spectrum Protect backups from a snapshot.

File names that are specified in the offload section typically point to files that are on a backup server. The offload section is optional for Oracle. The parameters do not depend on the storage device.

The following list provides the parameters, a description of each parameter, and default values applicable for Oracle.

BACKUP_METHOD
This parameter is preset during the configuration, and is set to ORACLE.

Default
Oracle.

Advanced mode only
Yes.

OFFLOAD Oracle parameters

The following list provides the parameters, a description of each parameter, and default values that are applicable in Oracle environments.

OVERWRITE_DATABASE_PARAMETER_FILE
This parameter specifies whether the database configuration file on the backup server is overwritten with the file from the production server. The database configuration file on the backup server is used to mount the database so that it can be offloaded to IBM Spectrum Protect. Specify one of the following values:

YES
Automatically copies the database configuration file to the backup system with the version that is defined on the production system.

NO Do not copy the production system database configuration file to the backup system.

If the production database is configured to use a text-based Oracle parameter file (PFILE), this setting requires that the default database configuration file <$ORACLE_HOME>/dbs/init<$ORACLE_SID>.ora is available and valid on the backup system. 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 ORACLE section, to specify the correct name of the configuration file. If the production database is configured to use a binary Oracle SPFILE, this setting requires that the database configuration file <Oracle_instance_owner_$HOME_directory>/acs/tempfiles/init<$ORACLE_SID>.ora_fromSPfile is available and valid on the backup system. If you need a modified version of the SPFILE from the production system, set **OVERWRITE_DATABASE_PARAMETER_FILE** YES to create this file automatically with a first backup and offload, then switch **OVERWRITE_DATABASE_PARAMETER_FILE** NO and modify this file for subsequent backups and offloads.

Default
YES

Advanced mode only
Yes.

DATABASE_BACKUP_INCREMENTAL_LEVEL
This parameter specifies the level of backup. Any numerical value can be entered. The following conditions apply:

- To complete a full backup, use option 0. A full backup must be completed before an incremental backup can be run.
- To complete an incremental backup, enter a numerical value greater than 0. Incremental backups are progressive. For example, a level 0 backup must complete before a level 1 backup can start. A level 1 backup must be complete before a level 2 backup can occur.

Default
0

Advanced mode only
No.

ASM_INSTANCE_USER
This parameter is used for the backup server. If this parameter is not specified for the OFFLOAD section, the value of this parameter, as specified in the ORACLE section, is used for the backup server.

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 has one of the following permissions: sysdba, sysasm, or sysadm.

AUTO
When this parameter is set to AUTO, the database user who is running the process is used.

Default
There is no default value.

Advanced mode only
Yes.

ASM_INSTANCE_ID
This parameter specifies the SID of the ASM instance. This parameter is used for the backup server. If this parameter is not specified for the OFFLOAD section, the value of this parameter, as specified in the ORACLE section, is used for the backup server.

You can have a SID for the ASM instance other than *+ASM*. In this scenario, this profile parameter specifies the ASM instance SID.

Default
0

Advanced mode only
Yes.

ASM_ROLE
Specify the role that is used when you are connecting to the ASM instance. When you use Oracle 11g, specify the sysasm role.

Default
0

Advanced mode only
Yes.

Changing profile parameters

Except for the GLOBAL and ACSD sections, changes to the profile take effect immediately and do not require restarting IBM Spectrum Protect Snapshot. Updates to the GLOBAL and ACSD sections require a restart of IBM Spectrum Protect Snapshot. The restart of corresponding daemons is done by the Configuration Wizard.

About this task

To change the GLOBAL, ACSD, or any other sections of the profile, complete the following steps:

Procedure

1. Start the Configuration Wizard with the following command.

```
cd <instance directory>
./setup_ora.sh
```

Press **Ctrl+A** when you are in a wizard panel to view and change parameters, and to edit default values.

2. Step through each of the Configuration Wizard panels as required to configure the product and update the profile.

   Choose which option you need to reconfigure whether it is for existing databases, a new database, or cloned databases.

Interdependency of LVM_FREEZE_THAW and TARGET_DATABASE_SUSPEND

The **LVM_FREEZE_THAW** and **TARGET_DATABASE_SUSPEND** parameters are interdependent.

These two IBM Spectrum Protect Snapshot profile parameters are interdependent in the following manner:

- If **LVM_FREEZE_THAW** is set to YES, the database must be suspended. Otherwise, write operations to the database might time out and leave the database in an inconsistent state. A specified value of YES for **TARGET_DATABASE_SUSPEND** prevents this situation.
- If **LVM_FREEZE_THAW** is set to NO, the user might want to suspend the database without freezing the file system. Also, if JFS is used, freeze and thaw are not supported.
- If **LVM_FREEZE_THAW** is set to AUTO, and the file systems support the freeze function, the effect of AUTO is described in the following table. If the file systems do not support the freeze function, the AUTO value resolves to NO.

For Oracle ASM environments, **TARGET_DATABASE_SUSPEND** is independent of **LVM_FREEZE_THAW**, and **LVM_FREEZE_THAW** is not allowed for ASM.

The following table summarizes the actions taken depending on the values of the two parameters:

Table 16. Actions taken depending on values of **LVM_FREEZE_THAW** *and* **TARGET_DATABASE_SUSPEND**

	Value of TARGET_DATABASE_SUSPEND		
Value of LVM_FREEZE_THAW	**YES**	**NO**	**OFFLINE**
YES	Suspend and freeze	Terminate with an appropriate error message. Conflicting parameters.	Offline with freeze
NO	Suspend, no freeze	No suspend, no freeze	Offline without freeze
AUTO	Treat as **LVM_FREEZE_THAW** YES	Treat as **LVM_FREEZE_THAW** NO	Offline with freeze

Target set and target volumes files

Snapshot backups on DS8000, SAN Volume Controller, and Storwize family with static target allocation, require a target set for each set of source volumes to be backed up. The target set is a set of target volumes, and several target sets can be defined for use in different snapshot backups. The target volumes file, with extension `.fct`, identifies the target volumes to be used for an IBM Spectrum Protect Snapshot backup.

The volumes in each target set that are used in a backup, must be specified in a separate target set. These target sets are specified in a target volumes file, the `.fct` file. The target set section name begins with the prefix **TARGET_SET** and is appended with a target set name. The target set name differentiates different target set sections. The target set name can be any alphanumeric value.

In the **TARGET_SET**, use the **TARGET_VOLUME** parameter for every target volume in the target set as shown in the following example:

```
>>> TARGET_SET 1
TARGET_VOLUME ...
    .
    .
    .
TARGET_VOLUME ...
<<<
```

To specify multiple target sets in the target volumes file, add the next target set section with a unique target set name as shown in this example:

```
>>> TARGET_SET 2
TARGET_VOLUME ...
    .
    .
    .
TARGET_VOLUME ...
<<<
```

Comments can be entered before the first target set section only, and are indicated by a # character in the first column of each line. Tab characters can be entered.

When **VOLUMES_FILE** is specified in the profile, the target volumes file can have any file name and does not conform to any naming convention.

Related concepts:

Appendix D, “Examples,” on page 187

Manage target volumes files for your storage system

Different storage systems require different methods of target volume mapping. Use the **VOLUMES_FILE** parameter to share a target volume file between multiple device classes.

DS8000 and SAN Volume Controller, and Storwize family storage systems, need the **TARGET_SETS** parameter to specify the target volumes file, **VOLUMES_FILE**. The details are shown in the following table:

Table 17. Managing target volume LUNs by storage system

DS8000	SAN Volume Controller and Storwize family
Manual target LUN creation with the target volumes file (`.fct`) that defines the **VOLUMES_FILE** parameter.	Manual target LUN creation with the target volumes file (`.fct`) that defines the **VOLUMES_FILE** parameter. Or, Naming convention that defines the **TARGET_NAMING** parameter.

For IBM Spectrum Protect Snapshot to associate a target volume to a source volume, the following criteria must be met:

The source volume and target volume must be in the same storage system.

The source volume and target volume must be the same size.

A target volume is selected for validation as a suitable target volume for the source volume depending on the value of the parameter **TARGET_SETS**.

VOLUMES_FILE

The **VOLUMES_FILE** parameter is used to share a target volume file between multiple device classes by restricting a target set to a specific `DEVICE_CLASS`. The target volume is validated as suitable for the source volume based on the value of the **TARGET_SETS** parameter. The following criteria must be in place for a valid target volume:

- A target volumes file, `.fct`, must be specified.
- A list of target volumes must be specified in the target volumes file. The source volumes and the size are optional.

This example shows the syntax of target volumes files that are specified by the **VOLUMES_FILE** parameter:

```
>>> TARGET_SET <target set name>

DEVICE_CLASS <device class name> # this parameter is optional and allows to
                         # restrict the use of this target set to a
                         # specific device class


TARGET_VOLUME <target> [<source>] [<size>]
[...]
<<<
[...]
```

If no source is specified in the **TARGET_SETS** parameter and a FlashCopy relation exists between target volumes and a source volume, IBM Spectrum Protect Snapshot checks for each of the specified target volumes. If a FlashCopy relation exists, it is reused for the next FlashCopy backup. However, if no FlashCopy relation exists to a source volume, a new relation between one source volume and the target is created with the next FlashCopy backup. In this case, the created source-target pairs are unpredictable because they depend on the order of the target volumes as listed in the target volumes file. There is also a dependency on the order of the source volumes as they occur in the operating system. If you want predefined source-target pairs, you must specify the dedicated source volume for

each of the target volumes in the target volumes file. Alternatively you can ensure that all FlashCopy relations exist in the storage system before the start of the FlashCopy backup.

Related reference:

"DS8000 target volume parameter settings"

"SAN Volume Controller and Storwize family target volume parameter settings" on page 152

"Target set handling for cloning" on page 153

Changing target set definitions system

You can extend an existing target set definition file by either adding a target set or by adding another target volume to an existing target set.

If you want to remove a volume from an existing target set, ensure that backups on the affected target set are deleted first. All FlashCopy relations of volumes in the target set must also be withdrawn. If you want to remove a target set from a target set definition file, ensure that backups on the affected target set are deleted first. All FlashCopy relations of volumes in the target set must be withdrawn.

DS8000 target volume parameter settings

Each target volume that is planned for use must be specified by its serial number for a DS8000 configuration.

A snapshot backup operation looks for either a source volume and target volume correlation, or a target-volume-only specification. A target set definition file contains a list of target volumes that are organized into target sets. IBM Spectrum Protect Snapshot attempts to match source volumes to suitable targets within a target set during backup.

Table 18. TARGET_VOLUME parameters

Parameter Name	Value

TARGET_VOLUME <*target volume serial number*> <*source volume serial number*> <*source volume size*>	Specify a source serial number with a target serial number in the target set definition file. This action determines source target relations. The relation between the source and target is required. Backup processing fails if one of the targets is unavailable for the specified source.
	
	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 or dashes can be entered in both fields as placeholders, as shown in the following example:
	`TARGET_VOLUME 75924811001 - -`
	
	Target volumes must meet the following requirements:
	• The size of the target volume must be the same as the size of the source volume.
	• The source and target volumes that are listed in one TARGET_SET must be in the same storage system.
	• The order of the parameters, target volume serial number, source volume serial number, and size of source volume must not be changed.

Related concepts:

"Target set and target volumes files" on page 149

Related reference:

"Target volumes file examples" on page 190

SAN Volume Controller and Storwize family target volume parameter settings

Each target volume that is used, must be specified by the corresponding virtual disk name. A snapshot backup operation looks for either a source volume and target volume correlation, or a target-volume-only specification.

Changing or deleting target volume or target set definitions

A target set definition file contains a list of target volumes that are organized into target sets. During the backup process, the IBM Spectrum Protect Snapshot software attempts to match source volumes to suitable targets within a target set.

Table 19. TARGET_VOLUME parameters (SAN Volume Controller and Storwize family)

Parameter Name	Value

TARGET_VOLUME
<target volume virtual disk name>
<source volume virtual disk name>
<source volume size>
	Specify a source virtual disk name with a target virtual disk name in the target set definition file. This action determines source target relations. The relationship between the source and target is required. 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 or dashes can be entered in both fields as placeholders, as shown in the following example:
	`TARGET_VOLUME svdftgt4 - -`
	
	Target volumes must meet the following requirements:
	• The size of the target volume must be the same or greater than the size 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.
	• The order of the parameters must not be changed.

For more information about the criteria that are used to associate a target volume to a source volume, see "Target set and target volumes files" on page 149.

The following actions are possible with target sets:

- Change the **FLASHCOPY_TYPE** value of an existing target set.
- Remove a target volume from an existing target set.
- Remove a complete target set.

To complete these types of changes, use the sequence of commands that are described in "Deleting snapshot backups" on page 163 with the `force` option.

For SAN Volume Controller 6.1 or later and Storwize family, with IBM Spectrum Protect Snapshot software you can delete FlashCopy mappings that are not dependent on other FlashCopy mappings. Only the source and target FlashCopy mappings of the oldest backup can be deleted. If multiple backup generations are used and you want to delete a backup that is not the oldest backed up version, the background operation that deletes the mappings is delayed until all older backups are deleted or are reused by a new backup request.

The following example presents a typical Multiple Target FlashCopy (MTFC) cascade:

```
S->T4->T3->T2->T1

S = Source volume
T1-T4 = Snapshots taken at t1, t2, t3, t4 where T1 is the oldest,
        T4 the most recent snapshot

T1 depends on T2,T3,T4,S
T2 depends on T3,T4,S
and so on...
```

Following the path from *S* to *T4* is called *downstream*. The opposite direction is called *upstream*.

Example 1: T2 is restored
All upstream snapshot mappings are stopped: *T3,T4*

Example 2: T2 is overwritten by a new backup
All downstream snapshot mappings are stopped: *T1*

Related reference:

"SAN Volume Controller and Storwize family target volumes file example" on page 190

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 snapshot 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. Each name that is specified in the list must be separated by a space. In this situation, the target set must be used by those clone databases only that are 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. When a backup volume is required at backup time, IBM Spectrum Protect Snapshot determines 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 that stores the backup is the name that is 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. Each name that is specified in the list must be separated by a space. In this situation, only the target set must be used by those clone databases that are 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: For SAN Volume Controller and Storwize family, 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 snapshot backup of the same database, must not be on the same cluster. If you are cloning databases in an AIX Logical Volume Mirroring (LVM) environment, use FlashCopy cloning on one of the clusters, and FlashCopy backup on the other cluster. Avoid space-efficient target volumes for cloning. If space-efficient target volumes are used, the profile parameter ALLOW_NOCOPY_FLASHCOPY YES must be specified in the cloning device class section of the profile.

Target volumes file (.fct) cloning examples

The target volumes file (specified by the VOLUMES_FILE parameter) must have the following syntax for 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]
 [...]
<<<
[...]
```

IBM Spectrum Protect Snapshot password file

To access the storage system where the database volumes are stored, IBM Spectrum Protect Snapshot requires a password file.

The password file contains a *master password* that is required by the application agents or offload agents when they are authenticating or connecting to the Management Agent. When IBM Spectrum Protect Snapshot agents are running in a distributed environment across multiple servers, separate password file instances can be used for different nodes. In a distributed environment, you must ensure that each local password file instance contains all the passwords that are needed

by the agents that are running on the node. The master password must be included in all instances. When backup and clone servers are set up with the Configuration Wizard the passwords are automatically made available on all servers.

A password file is created during the IBM Spectrum Protect Snapshot configuration process. An example of the path to the password file is `<ACS_DIR>/shared/pwd.acsd` where, *<ACS_DIR>* is the value of the **ACS_DIR** parameter in the profile. In basic mode, the master password is not prompted as it is generated automatically if it is not set earlier. A generated password is available as the default password in advanced mode.

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

Option files used by Data Protection for Oracle

When you are using Data Protection for Oracle, the following IBM Spectrum Protect option files are used:

- Client system options (`dsm.sys`)
- Client user options (`dsm.opt`)
- Data Protection for Oracle options (`tdpo.opt`)
- RMAN backup script

Example 1 shows you how to configure the system options file (`dsm.sys`) to point to the same IBM Spectrum Protect.

In the following examples, the client user options file `dsm.opt`, stored in the `/usr/tivoli/tsm/client/ba/bin` and `/usr/tivoli/tsm/client/api/bin` directories, includes a server with the following TCP/IP address: *arrow.la.xyzcompany.com*. The `servername` option in the `dsm.opt` and `dsm.sys` files define the server stanza names only. The `tcpserveraddress` option indicates which server is contacted.

For the `dsm.opt` file that is stored in the `/usr/tivoli/tsm/client/ba/bin` directory, use the following example:

```
servername tdphdw
```

For the `dsm.sys` file that is stored in the `/usr/tivoli/tsm/client/ba/bin` directory, use the following example:

```
servername          tdphdw
   commmethod       tcpip
   tcpport          1500
   tcpserveraddress arrow.la.xyzcompany.com
   passwordaccess   generate
   schedmode        prompted
   nodename         hdworc1
```

For the `dsm.opt` file that is stored in the `/usr/tivoli/tsm/client/api/bin` directory, use the following example:

```
servername tdporc
```

For the `dsm.sys` file that is stored in the `/usr/tivoli/tsm/client/api/bin` directory, use the following example:

```
servername          tdporc
   commmethod       tcpip
   tcpport          1500
   tcpserveraddress arrow.la.xyzcompany.com
   passwordaccess   prompt
   nodename         hdworc1
```

Example 2 shows you how to configure multiple server stanzas in the system options file (`dsm.sys`).

To configure multiple server stanzas in the system options file (`dsm.sys`), copy the option settings from the IBM Spectrum Protect for Databases: Data Protection for Oracle `dsm.sys` file to the IBM Spectrum Protect Snapshot `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 B. Commands and scripts

A list of various commands and scripts that are used with IBM Spectrum Protect Snapshot operations is provided.

About this task

You can issue various commands for example to trigger a snapshot backup or snapshot restore. In addition, administrative tasks such as to start or stop IBM Spectrum Protect Snapshot can be issued from the command line.

Backup, restore, cloning commands, and utilities

You can issue commands to trigger a snapshot backup or snapshot restore, and to inquire and delete snapshot backups in the IBM Spectrum Protect Snapshot repository. You can create and manage database clones from the command-line interface.

The acsora user interface for Oracle

Use the production system user interface, acsora, to issue commands in an Oracle database environment.

The acsora syntax follows:

```
acsora [-p <profile>] -f <function> [-B <backupID>] [-F] [-s <device_class> ]
[-U <client_section_name>]
where <function> is one of:
        backup
        restore
        delete
        inquire
        inquire_detail
```

Table 20. Parameters for Oracle databases

Option	Description	Default
`-p <profile>`	Full path and name of the profile	*<ACS_DIR>*`/profile`
`-B <backupID>`	The 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.	

Table 20. Parameters for Oracle databases (continued)

Option	Description	Default
`-U`	When the profile contains more than one CLIENT section, the name must be listed and passed through the command line.	
`-s <device_class>`	The name of the `DEVICE_CLASS` section in the profile that is used for the backup operation.	As specified in the profile.

The return code of acsora is *0* if it finishes the request without an error. The return code *1* indicates one or more issues occurred during the process. Although not considered critical, resolve these minor issues to prevent potential critical issues later. 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 -U A01 -s STANDARD
```

-f restore

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

The Oracle database is available for immediate use after a snapshot restore and a rollforward recovery. However, for DS8000 and SAN Volume Controller, background copy processing from the target volumes to the source volumes might require more time to complete, especially if **FLASHCOPY_TYPE COPY** is specified. Although the database is available, you cannot perform another IBM Spectrum Protect Snapshot backup or restore until background copy processing completes.

Example (restore specified backup):

```
acsora -f restore -U A01 -B A0FZ36AY8G
```

-f inquire

This command lists the details for the snapshot backup that is denoted by the backup ID, if specified by using the `-B` option, or all backups.

Example (list all backups):

```
acsora -f inquire -U A01
```

-f inquire_detail

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

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

-f delete

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

Example (deleted specified backup):

```
acsora -f delete -U A01 -B A0FZ36AY8G
```

acsutil Snapshot Object Manager for Oracle

The Snapshot Object Manager for Oracle, acsutil, provides a snapshot backup query and restore interface for Oracle and Oracle in an SAP environment environments.

Functions of the acsutil command

The Snapshot Object Manager for Oracle, acsutil, provides an interface for acsora to show available backups, run restore operations, and delete unwanted backups. It communicates with acsora through input and output files.

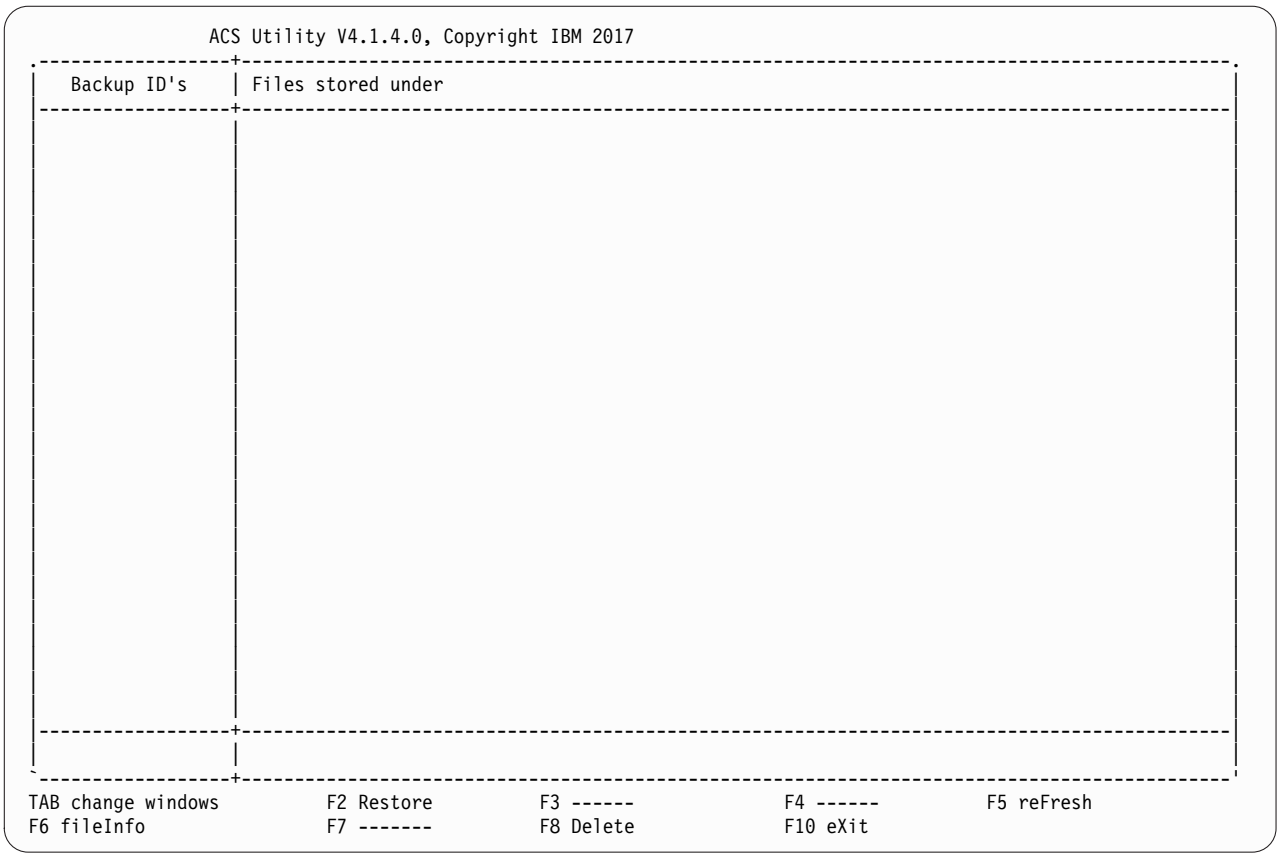
Syntax of the acsutil command

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

Where -p profile is the path and name of the IBM Spectrum Protect Snapshot profile. The default value is *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.



If you mark the backup ID you are interested in and then press the Tab key, all file names that belong to the marked backup ID are displayed.

Tab - Switch window side
Move the cursor between the 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

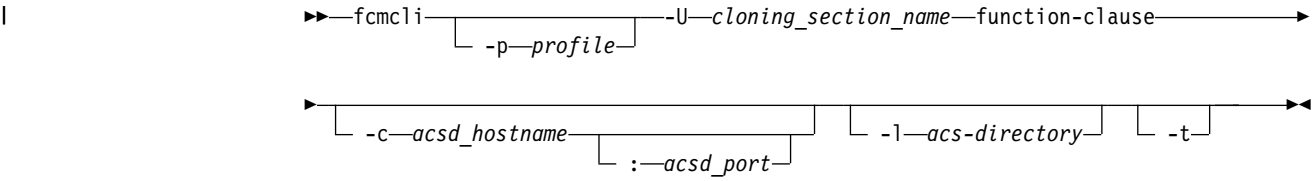
ENTER - Mark/unmark backup ID
Mark or unmark the backup ID.

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 must confirm the deletion operation. The backup ID and all included files are deleted.

For each restore, a log file is created.

Cloning commands

You can use the IBM Spectrum Protect Snapshot command-line interface, fcmcli, to create and manage clones of component databases.



Syntax for obtaining version or help information:

fcmcli help

Where:

-p *profile*
Full profile name. Default value: <*instance directory*>/profile

-U *cloning_section_name*
If there is one CLIENT and one CLONING section this can be omitted. For profiles with multiple CLIENT and CLONING sections, -U must be defined.

-c *acsd_hostname*
Name of the server where the management agent (acsd) is running. Default value: *localhost*.

acsd-port
TCP/IP port number or service name on which the management agent (acsd) is listening. Default value: *57328*.

-l *acs-directory*
Directory where the logs and shared directories are located. Default value: *ACS_DIR*.

-t Start trace on. Default value: Trace off.

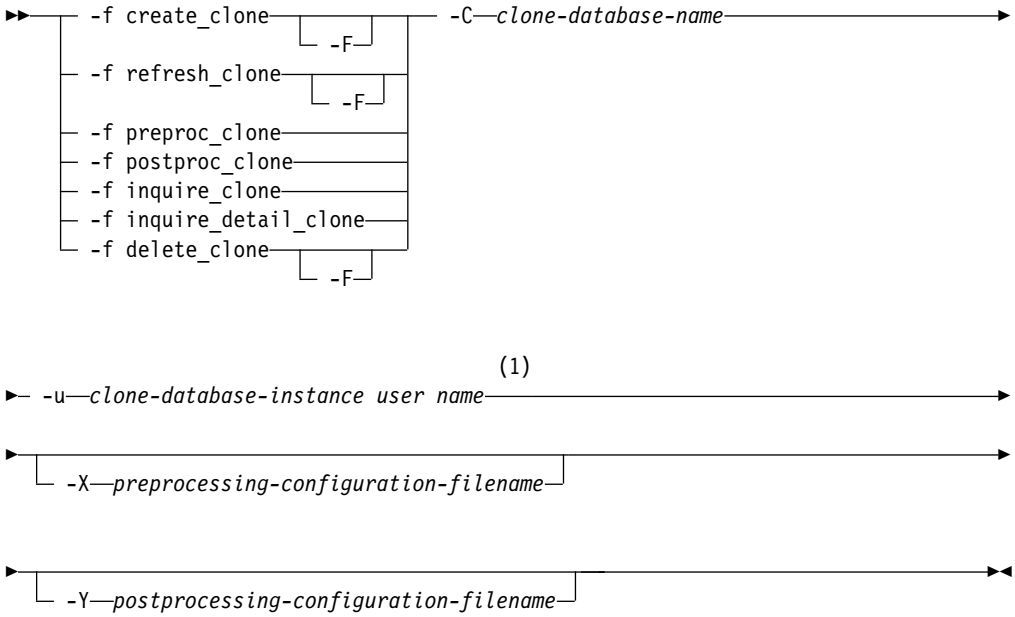
-v Show version.

-h Show help text.

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

FlashCopy cloning function-clauses

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



Notes:

1 This option is not required for **-f inquire_clone** or **-f inquire_detail_clone** commands.

Where:

-F The force command option it optional. Depending on the cloning command, the following results are possible:

- **delete_clone**: The force option causes the clone to be unmounted, marked as deleted, and also deletes the FlashCopy relationships. Otherwise, the **delete_clone** function unmounts the clone and marks it as deleted in the FlashCopy Manager repository.
- **create_clone**, **refresh_clone**: The force option deletes all backup versions that are older than the clone targets that are reused for the new or refreshed clone. Otherwise, a failure can occur when there are backup versions older than the clone targets that are reused for the new or refreshed clone.

  This option is valid for Storwize family and SAN Volume Controller Version 5.1, or later.

-C *clone-database-name*
The name of the cloned database on the clone system. This option must be specified for all cloning functions.

Specify a valid database name. The *clone database name* can be the name of the production database or you can specify an alternative name.

-u *clone-database-instance user name*
Specify the user name of the clone instance owner. This option is required when the following functions are issued:

- **create_clone**

- **delete_clone**
- **refresh_clone**
- **preproc_clone**
- **postproc_clone**

-X ***preprocessing-configuration-filename***
The name of the configuration file to be used with the preprocessing script. The preprocessing configuration file must be on the clone server.

-Y ***postprocessing-configuration-filename*****.**
The name of the configuration file to be used with the postprocessing script. The postprocessing configuration file must be on the clone server.

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 occur which are not critical but must be checked to prevent major issues later. Return code `2` indicates that an error occurred during the command execution.

Issue cloning-related commands on the production system as the production database instance owner. The cloning commands must be issued from the instance directory where the IBM Spectrum Protect Snapshot product files are located. The **fcmcli** command identifies the name of the production database.

- For Oracle databases, the production database is identified by the value set for **ORACLE_SID** in the CLIENT section of the profile that is referenced with the `-U` option.

Deleting snapshot backups

IBM Spectrum Protect Snapshot snapshot backups can be deleted from the snapshot repository.

Before you begin

Optionally, you can delete snapshot backups on DS8000 and SAN Volume Controller storage subsystems that contain a dedicated set of target volumes in one or more target sets. With IBM XIV Storage System solutions you can create as many snapshot backups as needed, and old backups are manually deleted. Old backups can also be deleted automatically by using the **MAX_VERSIONS** (**MAX_SNAPSHOT_VERSIONS**) parameter.

About this task

Manually delete an IBM Spectrum Protect Snapshot snapshot backup by following the procedure.

Procedure

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

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

2. Based on the use of this target set, any existing source, and target snapshot relationships (such as `INCR` or `NOCOPY`) must be withdrawn. Run the following command:

```
acsora -f delete -F -B <backupID>
backint -f delete -F -B <backupID>
```

Results

Note: For IBM XIV Storage System, these commands delete the snapshot backup in the IBM Spectrum Protect Snapshot snapshot repository, and the snapshot on the storage system is also deleted.

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

Deleting a target volume or target set

To remove a target volume from a target set or to remove a complete target set, run the following steps to free up the target volumes:

Procedure

1. Run the following command to unmount the file systems and export the volume groups on a backup system. If the backup is not mounted, do not run this step.

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

   This method is used when the backup that is using this target set is mounted
2. Based on the use of this target set, any existing source, and target FlashCopy relationships (such as INCR or NOCOPY) must be withdrawn. Run the following command:

   ```
   acsora -f delete -F -B <backupID>
   ```

Results

The withdrawal of the source and target FlashCopy relationship is done by the IBM Spectrum Protect Snapshot generic device agent, acsgen, as a background operation. This process can take up to 10 minutes. Do not try to reuse the target volumes before the actual process completes successfully.

Snapshot backup status in the repository

Ensure that you routinely check the status of the IBM Spectrum Protect Snapshot repository.

To check the status of snapshot backups in the IBM Spectrum Protect Snapshot repository, use one of the following commands:

For Oracle, `acsora -f inquire[_detail]`

or, `acsutil`

For Oracle in an SAP environment, `backint -f inquire[_detail] -t volume|file -p <SAP Backint profile (.utl)>`

or, `acsutil`

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

```
Type Partition Backup-ID TSM Backup-ID State
DevClass TargetSet Background Copy BytestobeFlashcopied
#BACKUP NODE0000 C01__A0FY303K6B IN-PROGRESS MIRROR1 1 3.000GB of 3.000GB
3.000GB
UsabilityStates :
REMOTELY_MOUNTABLE,REPETITIVELY_RESTORABLE,SWAP-RESTORABLE,PHYSICAL_PROTECTION,
FULL_COPY,TAPE_BACKUP_PENDING
```

Administrative commands

You can use commands to administer IBM Spectrum Protect Snapshot.

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

- Start, stop, or configure IBM Spectrum Protect Snapshot.
- Mount or unmount a snapshot backup on a secondary system.
- Create a backup to IBM Spectrum Protect from a snapshot if you have IBM Spectrum Protect configured in your environment

To use the commands to automate operations for IBM Spectrum Protect Snapshot, add entries to the cron table (crontab) file. Because there are so many ways to implement IBM Spectrum Protect Snapshot software, there are no templates. To automate operations, either specify the commands in the crontab file, or create scripts and add the scripts to the crontab file.

Configuration commands

Use configuration commands to maintain IBM Spectrum Protect Snapshot passwords, and query the amount of storage space that is used for backups. To configure backup and clone servers, use configuration commands to run the setup script.

Configuration Wizard and setup_ora.sh

When you run the Configuration Wizard, you provide the details for the configuration of the product. The `setup_ora.sh` script is used to call the IBM Spectrum Protect Snapshot Configuration Wizard at any time to update your configuration, update the profile, or reconfigure the product.

The configuration of IBM Spectrum Protect Snapshot uses the following command syntax:

`setup_`*`ora`*`.sh -a action -d <`*`Instance owner $HOME directory`*`>`

For configuring IBM Spectrum Protect Snapshot for Oracle, the following command is used.

- `setup_ora.sh`

You can use the Configuration Wizard for the following purposes:

- Upgrade of IBM Spectrum Protect Snapshot for one instance-specific installation, as root user:

  `setup_`*`ora`*`.sh –a install –d <`*`Instance owner $HOME directory`*`>`

  Run the configuration from the installation directory.
- Initial configuration and reconfiguration. Run this command as the database instance owner to launch the Configuration Wizard:

setup_*ora*.sh

- Stopping an activated instance:

  setup_*ora*.sh –a stop –d <*Instance owner $HOME directory*>

  The command must run as the database instance owner.
- Starting an activated instance:

  setup_*type*.sh –a start –d <Instance owner $HOME directory>

  The command must be run as the database instance owner.
- Disabling a stopped instance:

  setup_*type*.sh –a disable –d <*Instance owner $HOME directory*>

  The command must be run as the database instance owner.

For a typical configuration, these commands are run on a production system. There are some scenarios where these commands need to be run on a backup system. If you are running the commands on both systems, when you stop or disable IBM Spectrum Protect Snapshot, run the command on the production system before the backup system.

The setup script can be used to install IBM Spectrum Protect Snapshot on multiple backup nodes from the production server. As a prerequisite, Open Secure Shell (OpenSSH) must be installed on all of the nodes in the backup server. NFS shares between the production server and backup server nodes are not required for this type of remote installation. OpenSSH is the preferred method for IBM Spectrum Protect Snapshot.

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

- (Oracle) *Instance owner $HOME directory*/acs/

The default action, setup, is run and the instance is configured.

If the script is called without parameters, it can be issued as the instance owner. The script creates a profile or changes an existing profile, and updates the daemon jobs according to the current profile (production system) or user preference (backup system).

If IBM Spectrum Protect Snapshot cannot be stopped, stop IBM Spectrum Protect Snapshot on the production system before you launch the Configuration Wizard with the -a install -d <*Instance owner $HOME directory*> options.

setup_ora.sh values

You can run the following operations with setup_ora.sh.

Use setup_ora.sh to launch the Configuration Wizard to configure IBM Spectrum Protect Snapshot for Oracle.

The following values are available for action. The instance directory name -d option, is required for all explicit actions.

disable

Issue this call as the root or instance owner. It stops IBM Spectrum Protect Snapshot and removes all daemon jobs. To reactivate IBM Spectrum Protect Snapshot, run the setup_ora.sh command; this launches the Configuration Wizard.

If IBM Spectrum Protect Snapshot cannot be stopped, stop IBM Spectrum Protect Snapshot on the production system before running `setup_type.sh –a install -d <Instance owner $HOME directory>`.

install

This call needs to be issued with the root user ID. When issued, the following actions are completed:

1. Stops IBM Spectrum Protect Snapshot (`setup_ora.sh –a stop -d <Instance owner $HOME directory>`).
2. Copies all binary files from the IBM Spectrum Protect Snapshot installation directory to the instance-specific installation directory *<instance directory>*.
3. Sets the appropriate access rights for the binary files.
4. Restarts IBM Spectrum Protect Snapshot (`setup_ora.sh –a start -d <Instance owner $HOME directory>`).

The steps to start and stop IBM Spectrum Protect Snapshot are skipped if it is not configured.

If IBM Spectrum Protect Snapshot cannot be stopped, stop IBM Spectrum Protect Snapshot on the production system before running `setup_type.sh –a install -d <Instance owner $HOME directory>`.

start

This call can be issued as the root or instance owner. The call starts a previously installed and configured version of IBM Spectrum Protect Snapshot. This call starts the configured daemon jobs.

stop

This call can be issued as the root or instance owner. It stops the version of IBM Spectrum Protect Snapshot that is currently running. This call updates the configured daemon jobs and checks that IBM Spectrum Protect Snapshot is stopped successfully (a write lock can be acquired for the `.lock` file that is located in the instance-specific installation directory).

This call fails on the backup system in environments where the instance-specific installation directory is shared between the production and backup systems, if IBM Spectrum Protect Snapshot is running on the production system. To successfully stop IBM Spectrum Protect Snapshot in those environments, stop IBM Spectrum Protect Snapshot on the production system.

This option is not required for the default setup function.

Setting or changing passwords with the Configuration Wizard

You can set or change passwords with the Configuration Wizard.

Use the command in this example:

`setup_type.sh`

Run the without the `-a action` option proceeds through several tasks that are similar to the tasks described in Chapter 3, “Installing and setting up IBM Spectrum Protect Snapshot,” on page 27.

When this command is issued, the profile wizard starts. You can use the profile wizard to edit the profile, and to set or change passwords. Using this wizard to

administer passwords is preferred because the wizard updates changed passwords on the backup systems. To update passwords on the backup system, specify *YES* at the following prompt:

```
Select the backup system to update or delete:
1) acsback5
n) configure a new backup system
b) return to previous menu
q) quit configuration
Select one of the options.
1
The selected backup system is acsback5
The backup system on acsback5 is configured with the device class(es) DISK_ONLY.
Select the action you want to take on the backup system acsback5:
1) update IBM Spectrum Protect Snapshot installation
2) start IBM Spectrum Protect Snapshot services
3) stop IBM Spectrum Protect Snapshot
4) uninstall IBM Spectrum Protect Snapshot
5) setup the SSH key authentication
b) return to backup system selection
q) quit the configuration
Select one of the options.
1
Do you want to update the Backup System installation on acsback5? [y|n] [y]
```

Password administration

You can use the `setup_ora.sh` command on the production server when you are logged on as the database instance owner to call the Configuration Wizard to change passwords. Alternatively, you can use the `fcmcli -f password` command to change the IBM Spectrum Protect Snapshot passwords.

The `fcmcli -f password` command supports an interactive and a non-interactive mode. To use the interactive mode, do not enter a password when you issue the command and you are prompted to enter the following passwords:

- The master password, which is the password of the acsd management agent. By default, a 32 character password is automatically generated. However, you can enter an alternative password.
- The password for the `ORACLE` section if defined in the specified profile.
- The passwords for the disk storage subsystems that are referenced by the `DEVICE_CLASS` sections in the specified profile.

  If the specified profile contains multiple `DEVICE_CLASS` sections that reference the same physical disk storage subsystem, the password is queried one time by combining these `DEVICE_CLASS` sections.

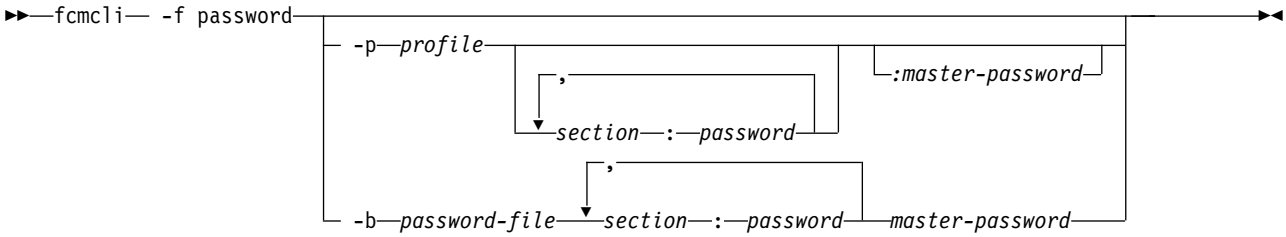
The interactive mode is the preferred method for setting passwords. Using this method, the passwords are verified by testing the connections to the corresponding storage devices, management agent, or database. For the non-interactive mode, the command syntax is verified but no additional validations are performed.

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

Tip: To ensure that backup servers are also updated by SSH if applicable, use the setup scripts to modify any passwords.

Use the following syntax to change the passwords for intercommunication between IBM Spectrum Protect Snapshot components, and communication to Oracle databases and to storage devices.

fcmcli command: -f password



Parameters

-p *profile*
Specify the full path and name of the profile that is used. If the path is not specified, the profile file in the current working path is used.

In interactive mode, the command searches the profile for the ORACLE, and DEVICE_CLASS sections and then requests you to enter the relevant passwords.

-b *password-file*
Specify the password file to be created or updated. By default, the shared/acsd.pwd password file is in the directory that is specified by the **ACS_DIR** parameter. This parameter is included in the GLOBAL section of the profile file. This information is read from one of the following profiles:

- When the -p option is not specified, the profile file in the current working directory is used.
- When the -p option is specified, the profile file that is specified by this option is used.

sectionname:*password*
Specify the password for the user account that is referenced by the ORACLE, and DEVICE_CLASS sections of the profile. To specify the password for the DEVICE_CLASS section, replace the *sectionname* variable with the DEVICE_CLASS:*device class name* variable for example, DEVICE_CLASS:STANDARD. Use this syntax when you specify the password: DEVICE_CLASS:*device class name*:*password*.

No spaces are allowed between the *sectionname*:*password* syntax.

:*masterpassword*
Specify the master password that is used to authenticate a library or agent to the acsd management agent. Alternatively, enter the value *auto* to enable IBM Spectrum Protect Snapshot to auto-generate a password. For example, issue the following command to auto-generate the master password:

```
./fcmcli -f password :auto
```

GSKit commands

If you are not using SSH for remote installation and configuration of IBM Spectrum Protect Snapshot on backup and cloning systems, use GSKit commands to manually import a self-signed certificate. If you decide to use a CA signed certificate, use GSKit commands to complete a manual setup.

Manually importing the self-signed certificate

The self-signed certificate is automatically created by IBM Spectrum Protect Snapshot. When the IBM Spectrum Protect Snapshot setup script is run on the production server, it automatically creates the `fcmselfcert.arm` file. It is stored on the production server in the default installation path. The `fcmselfcert.arm` file is automatically imported on the backup and cloning servers from the production server with the SSH remote deployment mechanisms of the setup script. When remote deployment is not used and you separately run the setup script on the backup or cloning server, the `fcmselfcert.arm` file if present is automatically imported to the local key database and then deleted. To use this automation, copy the `fcmselfcert.arm` file from the production server to either the backup or cloning server before you start the setup routines on the backup or cloning server.

Alternatively, you can import the self-signed certificate by using the following GSKit command. However, in most scenarios this step is not necessary as the file is automatically imported as part of the IBM Spectrum Protect Snapshot setup process.

```
gsk8capicmd_64 -cert -add -db fcmcert.kdb  -stashed -label "FCM server
certificate" -file <path to fcmselfcert.arm>  -format ascii
```

This command fails if the key database already contains a certificate with the label `FCM server certificate`. To remove the certificate with the label `FCM server certificate`, you can use the following command:

```
gsk8capicmd_64 -cert -delete -db fcmcert.kdb  -stashed -label "FCM server
certificate"
```

CA Certificate

You can use a CA signed certificate for IBM Spectrum Protect Snapshot. If the certificate that is assigned by a CA has no built-in GSKit support, import the CA root certificate into the key database file (`fcmcert.kdb`). Use the GSKit command-line utilities to update the file on the production system, the backup system, and the cloning system. The root certificate of a trusted CA certificate is in the key database. GSKit has the following trusted root certificates:

- Entrust.net Global Secure Server Certification Authority
- Entrust.net Global Client Certification Authority
- Entrust.net Client Certification Authority
- Entrust.net Certification Authority (2048)
- Entrust.net Secure Server Certification Authority
- VeriSign Class 3 Public Primary Certification Authority
- VeriSign Class 2 Public Primary Certification Authority
- VeriSign Class 1 Public Primary Certification Authority
- VeriSign Class 4 Public Primary Certification Authority - G2
- VeriSign Class 3 Public Primary Certification Authority - G2
- VeriSign Class 2 Public Primary Certification Authority - G2
- VeriSign Class 1 Public Primary Certification Authority - G2

- VeriSign Class 4 Public Primary Certification Authority - G3
- VeriSign Class 3 Public Primary Certification Authority - G3
- VeriSign Class 2 Public Primary Certification Authority - G3
- VeriSign Class 1 Public Primary Certification Authority - G3
- Thawte Personal Premium CA
- Thawte Personal Freemail CA
- Thawte Personal Basic CA
- Thawte Premium Server CA
- Thawte Server CA
- RSA Secure Server Certification Authority
- Secure Server Certification Authority

The following example shows the command to request that a CA signed certificate is included:

```
gsk8capicmd_64 -certreq -create -db fcmcert.kdb -stashed -label "FCM server
certificate request" -dn dist_name  -target fcmservcertreq.arm
```

For SP800-131 compliance, when the **ENFORCE_TLS12** parameter is set to YES in the IBM Spectrum Protect Snapshot profile, ensure that the certificate meets the minimum requirement by adding the following two options:

- `-size` *2048* (or higher)
- `-sigalg` *sha224* (or higher)

Note: IBM Spectrum Protect Snapshot creates a self-signed certificate that is signed with SHA512, and the size is 4086 bits.
The **label** parameter can have any value except `FCM server certificate`. This value is already used by the self-signed certificate in the key database.

When you use a certificate that is signed by a CA that has no built-in GSKit support, you must import the CA root certificate. This task must be completed before the certificate is received or imported. The CA root certificate must be imported into the key database (KDB) files on the production system. The CA root certificate must also be imported into the KDB files on the backup and cloning servers. Issue the following command to import the root certificate:

```
gsk8capicmd_64 -cert -add -db fcmcert.kdb  -stashed -label "FCM server certificate
request" -file path to CARootCertificate.arm
```

Issue the following command to import a signed certificate when it is received from a CA:

```
gsk8capicmd_64 -cert -receive -file fcmservcertsigned.arm -db fcmcert.kdb
 -stashed
```

Rename the CA signed certificate label to `FCM server certificate`. Usually, the key database still contains the self-signed certificate, it must be deleted before the CA signed certificate can be renamed. To remove the self-signed certificate from the key database, issue the following command:

```
gsk8capicmd_64 -cert -delete -db fcmcert.kdb  -stashed -label "FCM server
 certificate"
```

To rename the CA signed certificate issue the following command:

```
gsk8capicmd_64 -cert -rename -db fcmcert.kdb -stashed -label
"FCM server certificate request" -new_label "FCM server certificate"
```

The file `fcmselfcert.arm` is used to export the self-signed certificate. When you use a CA certificate, the `.arm` file is obsolete and must be deleted on the production system. The self-signed certificate is automatically removed from the key database on the backup or cloning system during the next remote update with the setup script. If remote deployment is not used, you can manually remove the self-signed certificate from the key database on the backup and cloning servers. To remove the self-signed certificate, issue the following command:

```
gsk8capicmd_64 -cert -delete -db fcmcert.kdb -stashed -label "FCM server
 certificate"
```

Monitoring the expiry date of certificates

When a self-signed certificate is created, an expiry date can be specified. The expiration time of the certificate is specified in days. The default is 365 days. The duration is 1-7300 days (20 years). The IBM Spectrum Protect Snapshot setup script creates the self-signed certificate for the production, backup, and cloning servers. The expiration time of all self-signed certificates that is generated by the setup script is 20 years. If you are using CA signed certificates, the expiration date is set by the certificate authority. You must monitor certificates for expiry and remove any expired certificates. If the key database does not contain a valid certificate with the label `FCM server certificate` and the setup script is rerun, a new self-signed certificate is generated. The`.kdb`, `.rdb`, `.arm` and `.sth` files are rewritten.

Related information:


ftp://ftp.software.ibm.com/software/webserver/appserv/library/v80/GSK_CapiCmd_UserGuide.pdf

Query managed capacity

Use the **managed_capacity** command to display information about IBM Spectrum Protect Snapshot managed capacity and licensing.

When you run the **managed_capacity** command, an XML managed capacity and licensing report is printed to the ACS directory or to another specified directory:

The report that is generated lists the capacity value that is calculated from source disks that are protected by IBM Spectrum Protect Snapshot for which a FlashCopy or snapshot backup was created. If a volume contains multiple backups, that volume is counted once during the query. Identify the repository from which to list backups by specifying the profile that is associated with the source volume. The output displays the total managed capacity for all source volumes.

The **fcmcli -f managed_capacity** syntax is as follows:

```
fcmcli -f managed_capacity [-p profile] [-c] [-o <output_directory>]
```

-p Specify the name of the IBM Spectrum Protect Snapshot profile that is associated with the backups on the volume.

-c Specify this option to display the output as comma-separated values.

-o Specify this option to print the report to a specified directory as an XML report to view in your browser. When you do not specify a **-o** directory, the report is printed to *ACS_DIR*/capacity_reports.

Tip: Ensure to regularly delete old copies of managed capacity reports from the output directory.

Example output

This command displays capacity for the profile in /orc/S01/acs:

```
fcmcli -f managed_capacity -p /orc/S01/acs/profile
```

Output:

```
FMM0461I Created tracefile '/orc/S01/acs/logs/fmquery.trace' for process ID
        '31634'.
FMM1498I Front-End Capacity Report: Total protected size: 108.723 MB
FMM1497I Front-End Capacity Report: Number of managed objects: 1
FMM1496I Back-End Capacity Report: Total protected size: 217.445 MB
FMM1493I Back-End Capacity Report: Number of managed objects: 2
FMM1495I Logical Unit (LUN) Capacity Report: Total protected size: 768.000 MB
FMM1494I Logical Unit (LUN) Capacity Report: Number of managed objects: 2
```

This command displays all volumes for the profile that is in /orc/S01/acs as comma-separated values:

```
fcmcli -f managed_capacity -p /orc/S01/acs/profile -c
```

Output:

```
...
tsm_sur_capacity,0
tsm_sur_objects,0
fcm_be_capacity,0
fcm_be_objects,0
fcm_lun_capacity,8589934592
fcm_lun_objects,4
tsm,no
```

For more information about front-end and back-end capacity and how to measure them, see the latest User's Guide at this site ftp://public.dhe.ibm.com/storage/tivoli-storage-management/front_end_capacity_measurement_tools/

Background daemons

For IBM Spectrum Protect Snapshot to work, background daemon processes are required. Background daemon processes are started directly when you complete configuring IBM Spectrum Protect Snapshot for Oracle with the Configuration Wizard. The Configuration Wizard starts and stops daemons as required when you configure or reconfigure your setup.

To support high availability environments where the /etc/inittab cannot be used, add ACSD and ASGEN -d to the high availability scripts to provide you with the exact commands that must be added to your high availability scripts instead of adding entries to /etc/inittab.

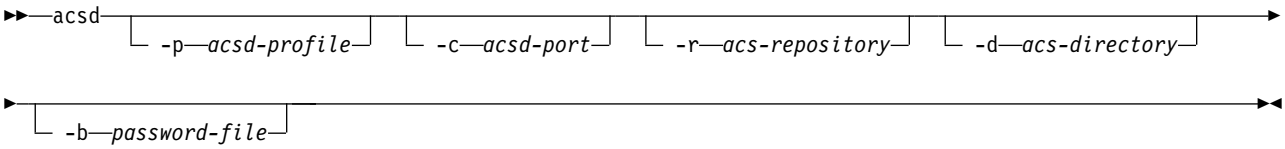
Management agent acsd

The management agent, acsd, coordinates the snapshot backup operation. It is a background daemon process that starts automatically.

The management agent, acsd, controls the backup flow and mediates between the other agents. The acsd agent provides access to the snapshot backup repository, which contains information about the valid snapshot backups and their relationships to snapshot capable storage devices.

If you must deviate from the standard installation, the management agent offers the following command options for customization:

acsd management agent



Syntax for obtaining version or help information:

acsd management agent help

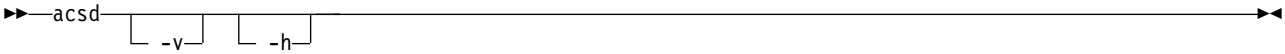


Table 21. Options for starting the management agent, acsd, as a daemon process

Option	Description	Default	Overrides profile parameter
`-p acsd-profile`	Full path and name of the profile that is used by the management agent. The management agent uses the `GLOBAL` and acsd sections of the configuration profile.	<*instance directory*>`/profile`	
`-c acsd-port`	TCP/IP port number or service name on which the management agent is listening	*57328*	**ACSD** (port number or service name)
`-r acs-repository`	Directory name where the snapshot backup repository is located	None	**ACS_REPOSITORY**
`-d acs-directory`	Name of IBM Spectrum Protect Snapshot directory	`ACS_DIR`	
`-b password-file`	File in which the IBM Spectrum Protect Snapshot management agent password is stored (in encrypted form). See notes.	*ACS_DIR*`/shared/pwd.acsd`	No corresponding profile parameter.
`-v`	Display version and help information	None	N/A
`-h`	Display help information only	None	N/A

All parameters override the values that are specified in the acsd profile or the corresponding default values. The `shared` and `logs` directories are automatically created in `ACS_DIR`. If no parameters are entered, acsd starts with the default profile and uses the default parameter values where applicable, or an error message is shown if this profile does not exist.

When acsd is started for the first time, or with a new **ACS_DIR** parameter, the following actions occur:

- Create the subdirectories `shared` and `logs`
- Create a password file `pwd.acsd` in the `shared` subdirectory
- Generate a master password

When the snapshot backup library uses the same `ACS_DIR`, it can authenticate itself to acsd with the password provided in the `pwd.acsd` file. If the snapshot backup library uses a different `ACS_DIR`, the default password file `pwd.acsd` must be copied to that directory so that they can read the master password from that directory.

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

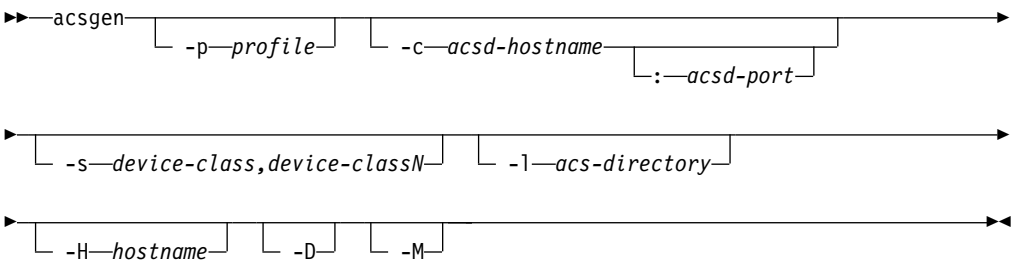
Generic device agent: acsgen

The generic device agent, acsgen, is the component that uses adapters to start snapshot commands on snapshot-compatible devices.

The generic device agent, acsgen, is started as a background daemon so you are not required to manually start it.

If you must deviate from the standard installation, the generic device agent, acsgen, offers the following command options for customization:

acsgen generic device agent



Syntax for obtaining version or help information:

acsgen generic device agent help

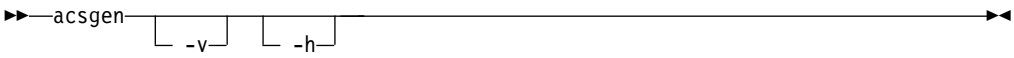


Table 22. Options for starting the generic device agent, acsgen. Description of acsgen options with default values if applicable.

Option	Description	Default
`-p profile`	Full profile name.	`<instance_directory>/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*

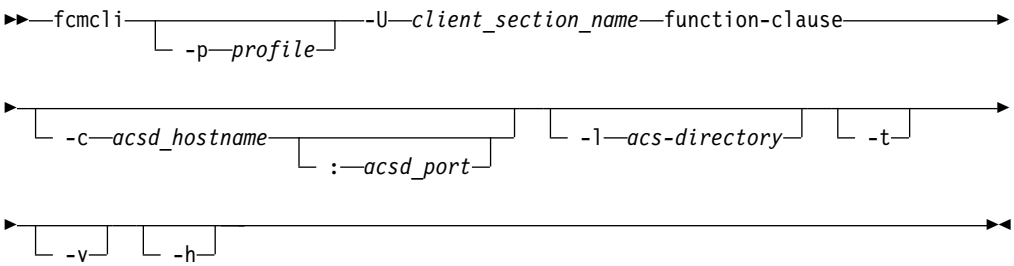
Table 22. Options for starting the generic device agent, acsgen (continued). Description of acsgen options with default values if applicable.

Option	Description	Default
`-s device-class`	Section in the profile that pertains to the device class. Specify multiple device classes by separating each device class by a space.	*STANDARD*
`-l acs-directory`	Directory where the `logs` and `shared` directories can be found.	*<ACS_DIR>*
`-D`	Start as daemon. The `-a` option defines the usability states that the device agent responds to. Valid only when started from the following path: `/etc/inittab`	Run and end.
`-H hostname`	The host name where the process is running. The primary use is by the launchpad component to check its partitions in a DB2 multi-partition environment.	The system host name that is displayed by the **hostname** command.
`-M`	Start the device agent as a mount agent. This agent is called for mounting or unmounting the target volumes on the backup system when any of the following situations exist: • An offloaded backup to IBM Spectrum Protect is requested • Database files on JFS file systems • Database files on AIX LVM mirrored volumes • The database is not suspended • Cloning databases A mount verifies the consistency of the associated file systems.	Start as the monitoring agent.
`-v`	Display version and help information.	None
`-h`	Display help information only.	None

Mounting and unmounting snapshots on a secondary system

IBM Spectrum Protect Snapshot commands are available to mount or unmount a snapshot backup on a secondary system.

fcmcli command



Where:

-p *profile*
Full profile name. Default value: <*instance directory*>/profile

-U *client_section_name*
If there is one CLIENT and one CLONING section this can be omitted. For profiles with multiple CLIENT and CLONING sections, -U must be defined.

-c *acsd-hostname*
Name of the server where the management agent (acsd) is running. Default value: *localhost*

acsd-port
TCP/IP port number or service name on which the management agent (acsd) is listening. Default value: *57328*

-l *acs-directory*
Directory where the logs and shared directories are located. Default value: *ACS_DIR*

-t Start with trace on. Default value: off.

-v Show version.

-h Show help text.

The return code of the **fcmcli** command is *0* if it finishes the request without an error or if there were no candidates for the request. Return code *1* indicates one or more minor issues occurred that are not critical but can be checked to prevent major issues later. Return code *2* indicates that an error occurred during the command execution.

-f mount

This command mounts a snapshot backup on a backup system.

Mounting a backup means the following occurs:

1. Configure the target volumes, which might need to be assigned to the offload system (see the profile parameter **BACKUP_HOST_NAME** in "DEVICE_CLASS *device*" on page 128 for details).
2. Import the volume groups from the target volumes.
3. Mount all file systems within the volume groups.

The mount is done by one mount agent for each backup server. As a result, a mount agent is started by the launchpad daemon that runs on the respective backup server. Specifying `-B <backup-id>` to identify a snapshot backup for mounting on the offload system.

If no backup with the usability state TAPE_BACKUP_PENDING exists, the **-B** parameter is mandatory. Here are two examples. The first one is generic:

```
fcmcli -f mount -U <client_section_name> -B <backup-id>
```

Here is a specific example for Oracle:

```
fcmcli -f mount -U OR1 -B A0IFZH2OKH
```

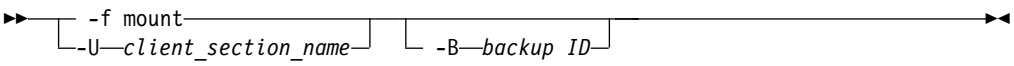
.

Note: If the option `-B` is omitted, the oldest backup still in state *tape_backup_pending* is selected implicitly.

To reflect whether a snapshot backup is being mounted or is mounted, the usability states **MOUNTING** and **MOUNTED**, are set for those backups in the snapshot backup repository. These two state values prevent a duplicate mount request for a backup that is being mounted, or is already mounted, on the backup system. If multiple snapshot backups of a database are candidates to be mounted, IBM Spectrum Protect Snapshot picks the one with the most recent snapshot backup ID.

Syntax

-f mount function-clauses



Where:

-f mount
Mount snapshot target set.

-F Force a reset of **TAPE_BACKUP_IN_PROGRESS** usability states for the specified snapshot backup during the unmount force function. This parameter also requires the following `-B backup-id` argument.

-B *backup ID*
The Backup ID as displayed by `fcmcli -f inquire [_detail]` command.

-f unmount

This command releases all resources on the offload server that were used by the mount command.

For *normal mode*, the unmount is completed by one mount agent for each backup server. A mount agent is started by the launchpad daemon that runs on the respective backup server. The following steps are completed by the software:

1. Unmount the file system that belongs to the target volumes.
2. Export the assigned volume group.
3. Remove the devices, `vpath/hdisk`, from the offload system.

When extra options, which are known as filter arguments, are specified, a specific snapshot backup can be selected for unmounting from the offload system. Use -B to identify the specific backup as follows:

```
-B <backup-id>
```

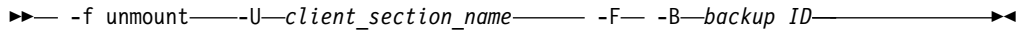
If the unmount does not succeed because of problems that are related to the device agent, the usability state of the backup remains **MOUNTED** in the snapshot backup repository. After resolving the problems on the backup system, the **fcmcli unmount** command must be issued again. The command is issued again to finalize the unmount of the file systems and update the usability state of the backup in the snapshot backup repository. If an off-loaded tape backup is running, the usability state **TAPE_BACKUP_IN_PROGRESS** is set and those backups are not be picked by IBM Spectrum Protect Snapshot for unmounting.

Unexpected system failures with offloaded tape backups can lead to an incorrect state of the backup reflected in the snapshot backup repository. The state **TAPE_BACKUP_IN_PROGRESS** is set. A built-in force option, **-F**, for the **fcmcli unmount** function is used to return the system to a usable state. Besides the normal unmount function, the unmount force option picks backups in the **TAPE_BACKUP_IN_PROGRESS** state as candidates to be unmounted and to reset the **TAPE_BACKUP_IN_PROGRESS** usability state for those backups. The **-B** option is specified to uniquely identify the backup that is involved.

Syntax

The following functions are supported by the **fcmcli** command option **-f** function for forced unmount:

-f unmount function-clause with force option



Where:

-f unmount
Unmount snapshot target set.

-F Force a reset of **TAPE_BACKUP_IN_PROGRESS** usability states for the specified snapshot backup during the unmount force function. This parameter also requires the following **-B** backup-id argument.

-U client_section_name If there is one CLIENT and one CLONING section this value can be omitted. For profiles with multiple CLIENT and CLONING sections, -U must be defined.

-B *backup ID*
The Backup ID as displayed by fcmcli **-f** inquire [_detail] command.

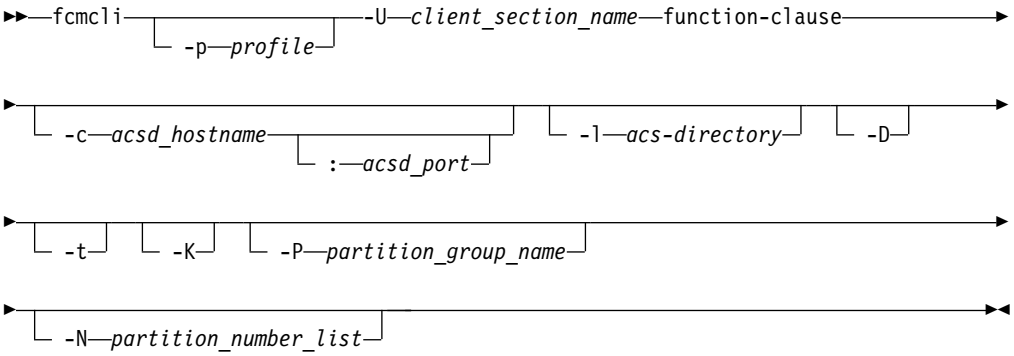
Integration with IBM Spectrum Protect

If IBM Spectrum Protect is set up and configured in your environment, you can create a backup to IBM Spectrum Protect from a snapshot.

The fcmcli offload agent

The offload agent is a daemon process that manages offloaded backups to IBM Spectrum Protect. The agent also provides a command line interface offering functions for managing IBM Spectrum Protect backups.

fcmcli command



Where:

-p *profile*
Full profile name. Default value: <*instance directory*>/profile

-U *client_section_name*
If there is one CLIENT and one CLONING section this can be omitted. For profiles with multiple CLIENT and CLONING sections, -U must be defined.

-c *acsd_hostname*
Name of the server where the management agent (acsd) is running. Default value: *localhost*.

acsd-port
TCP/IP port number or service name on which the management agent (acsd) is listening. Default value: *57328*.

-l *acs-directory*
Directory where the logs and shared directories are located. Default value: *ACS_DIR*.

-D Run as daemon process. Valid only when started from /etc/inittab. Default value: Run and end.

-t Start trace on. Default value: Trace off.

-K In a multi-partition environment, the partitions remain mounted when all participating partitions are successfully offloaded to IBM Spectrum Protect. The offload agent unmounts all partitions after the last partition is successfully offloaded. Default value: Off. The unmount operation is part of every IBM Spectrum Protect backup operation.

-P *partition_group_name*
The name of a partition group as specified in the profile with the **PARTITION_GROUP** parameter.

-N *partition_number_list*
A single number or list of numbers that are separated by a comma that specifies the partitions to apply the action against. When not specified, the action is applied to all partitions.

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

-f tape_backup:

This offload agent command backs up data to tape storage.

Note: IBM Spectrum Protect for Enterprise Resource Planning must be installed on the production and backup server if you use IBM Spectrum Protect Snapshot in an SAP environment with Oracle. IBM Spectrum Protect for Databases: Data Protection for Oracle as well as Oracle must be installed on the production and backup server if you use IBM Spectrum Protect Snapshot to protect an Oracle non-SAP environment.

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. This setting applies to all backups. The management agent updates the usability state with **TAPE_BACKUP_PENDING**. The IBM Spectrum Protect Snapshot offload agent then picks up all snapshot backups in the state **TAPE_BACKUP_PENDING** and backs them up to tape. The `fcmcli -f backup` operation must be issued from the production system.

To start the offload backup to tape, enter the command:

```
fcmcli -f tape_backup
```

By specifying additional options or filter arguments such as

```
-i instance-name
-d database-name
```

the appropriate backup for the given instance and or database can be selected for offloading to tape. The `-B backup-id` option cannot be specified in conjunction with `-f tape_backup`. The backups should be processed in chronological order. The tsm4acs backs up the oldest snapshot eligible for transfer to IBM Spectrum Protect.

By specifying the `-D` option for the offload agent, it acts as a daemon process that periodically checks for outstanding tape backup requests. Furthermore, the offload agent, running as a daemon, tries to offload a snapshot backup to tape only one time. If the first attempt fails for some reason, the snapshot backup is marked accordingly and is not be picked a second time by the tsm4acs daemon for offloading to tape. This type of backup must be offloaded to tape manually by issuing the following command:

```
fcmcli -f tape_backup filter_arguments
```

If multiple snapshot backups of a database are candidates for offloading to tape, the IBM Spectrum Protect Snapshot 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 IBM Spectrum Protect 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 Spectrum Protect Snapshot 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 IBM Spectrum Protect from queuing if they cannot be completed in time.

The tsm4acs **tape_backup** function internally does the following steps:

1. Mount the file systems on the offload system if they were not previously mounted using fcmcli with the 'mount' function or by a forced mount request. If all necessary file systems were mounted, this step is skipped.
2. Update the usability state to **TAPE_BACKUP_IN_PROGRESS** for all partitions that have the usability state **TAPE_BACKUP_PENDING** set.
3. Back up these partitions to tape.
4. Update usability states: For those partitions for which the backup succeeded, reset the usability state **TAPE_BACKUP_PENDING** and set **TAPE_BACKUP_COMPLETE**. For those partitions where the backup failed, set the usability state **TAPE_BACKUP_FAILED**. For all participating partitions, reset the usability state **TAPE_BACKUP_IN_PROGRESS**.
5. Unmount the file systems from the offload system.

When the usability state for a partition is **TAPE_BACKUP_IN_PROGRESS**, any request to restart the offload of that partition to tape is refused.

If a backup to IBM Spectrum Protect fails, the IBM Spectrum Protect Snapshot software can try the backup operation again.

-f update_status:

This offload agent command updates the usability state of a specified snapshot backup.

The usability state of a specified snapshot backup can be updated to either offload a snapshot to IBM Spectrum Protect (TSM_BACKUP=yes), or to not offload a snapshot (TSM_BACKUP=no). It is possible to offload a snapshot backup to IBM Spectrum Protect even though the TSM_BACKUP or TSM_BACKUP_FROM_SNAPSHOT profile parameter was deactivated during the snapshot backup operation. If there is no longer a need to offload the snapshot backup that was run with the parameter TSM_BACKUP or TSM_BACKUP_FROM_SNAPSHOT activated, the usability state can be reset.

To identify the backup whose state is to be modified, these parameters must also be specified using the **-f update_status** command:

```
-d database-name
-i instance-name
-B backup-id
```

Appendix C. IBM Global Security Kit configuration

IBM Spectrum Protect Snapshot uses the security suite IBM Global Security Kit (GSKit), for Secure Socket Layer (SSL) and Transport Layer Security (TLS) TCP/IP connections. GSKit supports Federal Information Processing Standards (FIPS140-2) and also incorporates the security standards as defined in the Special Publications 800131 (SP 800-131). GSKit is automatically installed by IBM Spectrum Protect Snapshot.

This security standard requires longer key lengths, stronger cryptographic algorithms, and incorporates TLS Protocol version 1.2.

During the installation, IBM Spectrum Protect Snapshot automatically creates a new key pair and a self-signed certificate if no default certificate exists. The key pair is stored in the local key database file. The self-signed certificate is created from the key pair and automatically distributed to all backup and cloning servers during the configuration process with the Configuration Wizard.

If you do not use the SSH remote deployment capabilities of IBM Spectrum Protect Snapshot, you must complete the following steps:

1. Globally install GSKit on each server by activating the instance. The required installation files are available in the `gskit_install` subdirectory of the IBM Spectrum Protect Snapshot instance directory.
2. Manually copy the `fcmselfcert.arm` file to the backup and cloning servers. The manually copied certificate is imported automatically when you run the Configuration Wizard on the backup or cloning servers.

   To install or reinstall GSKit separately, enter the command, `./setup_ora.sh -a install_gskit -d <instance directory>`

Alternatively, use a CA-signed certificate. The signed certificate can be from an internal or external certificate authority (CA). When SP800-131 encryption is enforced by setting the **`ENFORCE_TLS12`** profile parameter to `YES` in the IBM Spectrum Protect Snapshot profile, the signed certificate must comply with the standard as defined by the National Institute of Standards and Technology (NIST) SP800-131 standard encryption. This standard requires a minimum key size = 2048 bits and a signature algorithm = RSA with SHA-224 or higher. Import the CA-signed certificate to the key database on the production server.

If you use a standard CA-signed certificate, you do not need to handle `fcmselfcert.arm` files. You must import the CA-signed certificate manually into the production server key ring. Use the GSKit command-line utilities to import the certificate to the production server. If the CA-signed certificate is not a standard certificate that GSKit has a root certificate for, you must import the certificate to all sites. No further action is necessary on the auxiliary servers.

The following GSKit files are installed by IBM Spectrum Protect Snapshot:

- A key database file, `fcmcert.kdb`, is in the instance directory.

  The KDB file on the production server contains a new key pair and a self-signed certificate. On the backup and cloning servers, the KDB file contains the public part of the self-signed certificate.
- A request database file, `fcmcert.rdb`, is in the instance directory.

The request database file is used to store certificate requests that are associated with the key database. This file is automatically created when IBM Spectrum Protect Snapshot creates a key database file.

- An encrypted stash file, `fcmcert.sth`.

  The password that is protecting the key database file is generated automatically and is stored in the encrypted stash file.

- An ASCII encoded binary file, `fcmselfcert.arm`.

  This file is used to export the public part of the self-signed certificate. It is also used to import the public part of the self-signed certificate to the backup and cloning servers.

  When you install backup and clone servers separately without the use of SSH, the installation process installs and sets up IBM GSKit. In this scenario, after IBM GSKit installation, manually copy `fcmselfcert.arm` file to the backup and cloning servers.

- A certificate revocation list file, `fcmcert.crl`.

  This file contains a list of revoked certificates.

The `.kdb`, `.rdb`, `.crl`, and the `.sth` files contain critical security parameters and these parameters must be protected against unauthorized access by the operating system. It is advisable to back up the key database files regularly, especially if you are using a CA-signed certificate.

Enforcing SP800-131 compliant encryption

The files that are needed for IBM GSKit are automatically installed during the installation. To enforce SP800-131 compliant encryption, during the configuration of IBM Spectrum Protect Snapshot, you must set the **ENFORCE_TLS12** parameter to `YES` in the IBM Spectrum Protect Snapshot profile file. You must use the advanced mode during the configuration to specify this parameter. Otherwise, TLS Protocol version 1.0 and 1.1 is enabled as the default value for the **ENFORCE_TLS12** parameter is `NO`.

Any existing self-signed certificates that were created by a previous version of IBM Spectrum Protect Snapshot must be deleted to allow IBM Spectrum Protect Snapshot to create new self-signed certificates. To remove any existing self-signed certificates, go to the IBM Spectrum Protect Snapshot instance directory and enter the following command:

```
rm fcmcert.*
```

Note: Do not delete certificates signed by certificate authority (CA). However, if the CA-signed certificate does not meet the minimum SP800-131 criteria, you must manually replace it with a new one.

Uninstall GSKit

GSKit must not be uninstalled unless you are sure that no product on the system is using it. When you uninstall GSKit, you remove the entire global GSKit installation from the system.

If required, you can uninstall GSKit with the following steps.

1. Log in with the root user ID.
2. Change to the IBM Spectrum Protect Snapshot instance directory.
3. Run the setup script to uninstall GSKit, as follows.

```
./setup_ora.sh -a uninstall_gskit -d <instance_directory>
```

Appendix D. Examples

Refer to these IBM Spectrum Protect Snapshot examples when you are configuring, updating, or following product tasks.

Oracle overall disk layout example

Refer to this example when configuring the disk layout in a Oracle environment.

The following figure shows file systems involved in a sample disk layout.

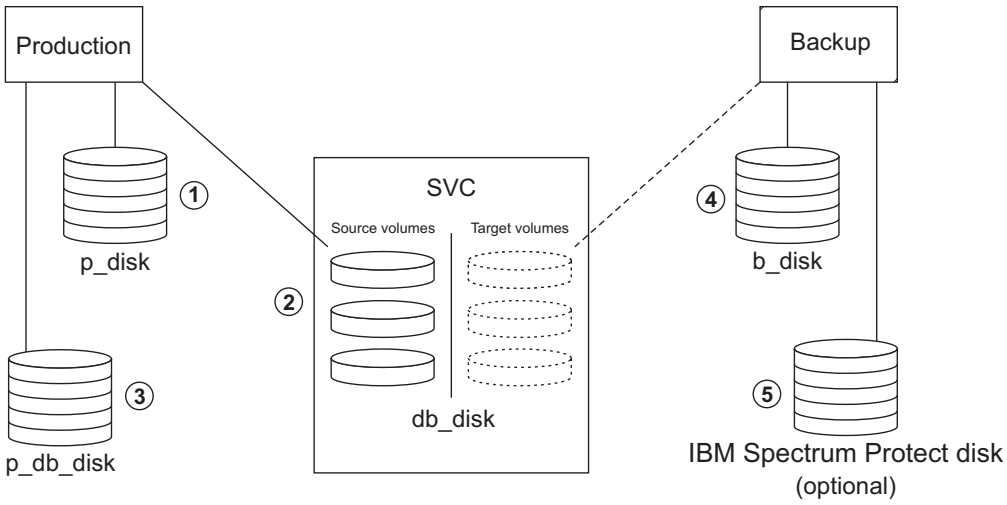


Figure 13. Example overall disk layout for a Oracle environment

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.

Oracle profile example

The profile file provides parameters that customize how IBM Spectrum Protect Snapshot works within a particular environment. Use this example to verify that the configuration of the profile is correct for your Oracle environment.

The following sample profile is provided for when IBM Spectrum Protect Snapshot software backups up Oracle databases:

```
>>> CLIENT A10
ORACLE_SID A10
APPLICATION_TYPE ORACLE        #
TARGET_DATABASE_SUSPEND YES   # YES | NO | OFFLINE
TSM_BACKUP YES                # 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>
ORACLE_SECTION_NAME A10       # Name of corresponding ORACLE section
OFFLOAD_SECTION_NAME V122     # Name of corresponding OFFLOAD section
DEVICE_CLASS STANDARD         #
<<<
>>> OFFLOAD A10
BACKUP_METHOD ORACLE                        #
# OVERWRITE_DATABASE_PARAMETER_FILE YES    # YES | NO
# DATABASE_BACKUP_INCREMENTAL_LEVEL 0      #
<<<
>>> ORACLE V122
ORACLE_HOME /oracle/ora12cR2/app/product/12.2.0/dbhome_1
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*

DATABASE_CONTROL_FILE_RESTORE NO           # YES | NO
<<<
>>> ACSD
ACS_REPOSITORY /oracle/A10/acs/acsrepository  # *mandatory parameter*
<<<
>>> DEVICE_CLASS STANDARD
COPYSERVICES_HARDWARE_TYPE SVCDTA     # *mandatory parameter* SVC | SVCDTA | DS8000 | XIV
COPYSERVICES_HARDWARE_TYPE GENERIC
COPYSERVICES_ADAPTERNAME svc/SvcAdapter.jar
COPYSERVICES_SERVERNAME svc01.ibm.com
COPYSERVICES_USERNAME superuser
SVC_SSHKEY_FULLPATH /home/A10/.ssh/id_rsa
FLASHCOPY_TYPE COPY
BACKUP_HOST_NAME  backhost
<<<
```

Oracle ASM profile example

The profile file provides parameters that customize how IBM Spectrum Protect Snapshot works within a particular environment. Use this example to verify that the configuration of the profile is correct for your Oracle with ASM environment.

The following example shows a sample IBM Spectrum Protect Snapshot Oracle ASM profile:

```
>>> CLIENT A10
ORACLE_SID A10
APPLICATION_TYPE ORACLE          #
TARGET_DATABASE_SUSPEND YES      # YES | NO | OFFLINE
TSM_BACKUP YES                   # 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 DC_SVC01            #
ORACLE_SECTION_NAME A10          # Name of corresponding ORACLE section
OFFLOAD_SECTION_NAME V122        # Name of corresponding OFFLOAD section
VOLUME_MGR ASM               # ASM|LVM
<<<
>>> OFFLOAD A10
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 V122
ORACLE_HOME /oracle/ora12cR2/app/product/12.2.0/dbhome_1
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*
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*
<<<
>>> DEVICE_CLASS DC_SVC01
COPYSERVICES_HARDWARE_TYPE SVCDTA          # *mandatory parameter* SVC | DS8000 | XIV
COPYSERVICES_HARDWARE_TYPE GENERIC
COPYSERVICES_ADAPTERNAME svc/SvcAdapter.jar
COPYSERVICES_SERVERNAME svc01.ibm.com
COPYSERVICES_USERNAME superuser
SVC_SSHKEY_FULLPATH /home/A10/.ssh/id_rsa
FLASHCOPY_TYPE COPY
BACKUP_HOST_NAME  backhost
<<<
```

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.

RMAN backup script example

Refer to this example when you are 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. The example shows the required syntax of the RMAN backup script. The keyword backup must be entered on a single line of text without any other text as shown in this example. There must be a line break after the backup keyword.

```
run
{
    allocate channel 'c1' type 'sbt_tape' parms 'ENV=(TDPO_OPTFILE=/home/oracle/tdpo.opt)';
    backup
    (database);
    release channel c1;
}
```

Target volumes file examples

Refer to this example when you are editing the target volumes file for a DS8000 storage subsystem configuration.

The following file is an example of a VOLUMES_FILE `.fct` file that includes the target set configuration that is used for cloning:

```
#
#************************* First sample ****************************#
#

#=====================================================================#

>>> TARGET_SET 1
TARGET_VOLUME 13ABCTA0111 - -
TARGET_VOLUME 13ABCTA0112 - -
TARGET_VOLUME 13ABCTA0113 - -
<<<
<<<

#=====================================================================#
```

SAN Volume Controller and Storwize family target volumes file example

Refer to this example when you are editing the target volumes file for an SAN Volume Controller or Storwize family storage system configuration.

```
#************************* First sample ****************************#
#

#=====================================================================#

>>> TARGET_SET VOLUMES_SET_1
TARGET_VOLUME svdftgt1 svdrsrc2 -
TARGET_VOLUME svdftgt2 svdfsrc3 -
TARGET_VOLUME svdftgt3 svdfsrc4 -
TARGET_VOLUME svdftgt4 svdfsrc5 -
TARGET_VOLUME svdftgt5 svdfsrc6 -
<<<

#=====================================================================#
```

The following sample profile is an example of a profile in a non-mirrored environment. Create three space-efficient disk-only backups and one dual backup, at midnight, per day.

```
>>> CLIENT
...
TSM_BACKUP LATEST USE_FOR DISK_TSM
DEVICE_CLASS DISK_ONLY FROM 5:30 TO 23:59
DEVICE_CLASS DISK_TSM FROM 0:00 TO 05:29
<<<
>>> DEVICE_CLASS DISK_ONLY
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS 1 2 3
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS DISK_TSM
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS DUAL
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
```

This scenario illustrates a profile in a mirrored environment. On MIRROR_1, two space-efficient FlashCopy backups are created on Monday, Wednesday, and Friday. The backup that is created at midnight is copied to IBM Spectrum Protect. The backup that is created at noon is retained only on disk. The backup that is created on Monday is retained until the target sets are reused on Wednesday. On MIRROR_2, only one incremental FlashCopy backup was created on Sunday, Tuesday, Thursday, and Saturday. This backup is also copied to IBM Spectrum Protect. The backup is retained until the next incremental backup is started.

```
>>> CLIENT
...
TSM_BACKUP LATEST USE_FOR MIRROR_1_DISK_TSM MIRROR_2
DEVICE_CLASS MIRROR_1_DISK_ONLY USE_AT Mon Wed Fri FROM 5:30 TO 23:59
DEVICE_CLASS MIRROR_1_DISK_TSM USE_AT Mon Wed Fri FROM 0:00 TO 05:29
DEVICE_CLASS MIRROR_2 USE_AT SUN Tue Thu Sat
<<<
>>> DEVICE_CLASS MIRROR_1_DISK_ONLY
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS DO
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS MIRROR_1_DISK_TSM
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS DT
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS MIRROR_2
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE INCR
TARGET_SETS 1
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
```

This example is like the previous example, but the example does not create IBM Spectrum Protect backups from MIRROR_1. Rather, the example retains the space-efficient FlashCopy images for one week (same schedule).

```
>>> CLIENT
...
TSM_BACKUP LATEST USE_FOR MIRROR_1_DISK_TSM MIRROR_2
DEVICE_CLASS MIRROR_1_DISK_ONLY USE_AT Mon Wed Fri
DEVICE_CLASS MIRROR_2 USE_AT Sun Tue Thu Sat
<<<
>>> DEVICE_CLASS MIRROR_1_DISK_ONLY
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE NOCOPY # space efficient targets
TARGET_SETS 1A 1B 3A 3B 5A 5B
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
>>> DEVICE_CLASS MIRROR_2
COPYSERVICES_HARDWARE_TYPE SVC
FLASHCOPY_TYPE INCR
TARGET_SETS 1
TARGET_NAMING %SOURCE_%TARGETSET
...
<<<
```

Appendix E. Accessibility features for the IBM Spectrum Protect product family

Accessibility features assist users who have a disability, such as restricted mobility or limited vision, to use information technology content successfully.

Overview

The IBM Spectrum Protect family of products includes the following major accessibility features:

- Keyboard-only operation
- Operations that use a screen reader

The IBM Spectrum Protect family of products uses the latest W3C Standard, WAI-ARIA 1.0 (www.w3.org/TR/wai-aria/), to ensure compliance with US Section 508 (www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards) and Web Content Accessibility Guidelines (WCAG) 2.0 (www.w3.org/TR/WCAG20/). To take advantage of accessibility features, use the latest release of your screen reader and the latest web browser that is supported by the product.

The product documentation in IBM Knowledge Center is enabled for accessibility. The accessibility features of IBM Knowledge Center are described in the Accessibility section of the IBM Knowledge Center help (www.ibm.com/support/knowledgecenter/about/releasenotes.html?view=kc#accessibility).

Keyboard navigation

This product uses standard navigation keys.

Interface information

User interfaces do not have content that flashes 2 - 55 times per second.

Web user interfaces rely on cascading style sheets to render content properly and to provide a usable experience. The application provides an equivalent way for low-vision users to use system display settings, including high-contrast mode. You can control font size by using the device or web browser settings.

Web user interfaces include WAI-ARIA navigational landmarks that you can use to quickly navigate to functional areas in the application.

Vendor software

The IBM Spectrum Protect product family includes certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for accessibility information about its products.

Related accessibility information

In addition to standard IBM help desk and support websites, IBM has a TTY telephone service for use by deaf or hard of hearing customers to access sales and support services:

TTY service
800-IBM-3383 (800-426-3383)
(within North America)

For more information about the commitment that IBM has to accessibility, see IBM Accessibility (www.ibm.com/able).

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Product Number: 5725-X22
5608-AB8

Printed in USA