

Dell EMC Solutions Enabler TimeFinder SnapVX

CLI User Guide

9.1

Notes, cautions, and warnings

 **NOTE:** A NOTE indicates important information that helps you make better use of your product.

 **CAUTION:** A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

 **WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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Preface

As part of an effort to improve its product lines, Dell EMC periodically releases revisions of its software and hardware. Therefore, some functions described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features.

Contact your Dell EMC representative if a product does not function properly or does not function as described in this document.

NOTE: This document was accurate at publication time. New versions of this document might be released on Dell EMC Online Support (<https://www.dell.com/support/home>). Check to ensure that you are using the latest version of this document.

Purpose

This document is part of the Dell EMC Solutions Enabler documentation set, and describes how to use TimeFinder SnapVX.

Audience

This document is intended for use by advanced command-line users and script programmers to manage various types of control operations on arrays and devices using the SYMCLI commands of the Dell EMC Solutions Enabler software.


Related documentation


The following documents provide additional Solutions Enabler information:


Dell EMC Solutions Enabler, VSS Provider, and SMI-S Provider Release Notes	Describes new features and any known limitations.
Dell EMC Solutions Enabler Installation and Configuration Guide	Provides host-specific installation instructions.
Dell EMC Solutions Enabler Array Controls and Management CLI User Guide	Describes how to configure array control, management, and migration operations using SYMCLI commands for arrays running HYPERMAX OS and PowerMaxOS.
Dell EMC Solutions Enabler CLI Reference Guide	Documents the SYMCLI commands, daemons, error codes and option file parameters provided with the Solutions Enabler man pages.
Dell EMC Solutions Enabler SRDF Family CLI User Guide	Describes how to configure and manage SRDF environments using SYMCLI commands.
EMC Solutions Enabler TimeFinder Family (Mirror, Clone, Snap, VP Snap) CLI User Guide	Describes how to configure and manage TimeFinder Mirror, Clone, Snap and VP Snap environments using SYMCLI commands.
Dell EMC Solutions Enabler	Provides Storage Resource Management (SRM) information related to various data objects and data handling facilities.

Special notice conventions used in this document

Dell EMC uses the following conventions for special notices:

 **NOTE:** Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING:** Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION:** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

 **NOTE:** Addresses practices not related to personal injury.

 **NOTE:** Presents information that is important, but not hazard-related.

Typographical conventions

Dell EMC uses the following type style conventions in this document:

Table 1. Typographical conventions used in this content

Bold	Used for names of interface elements, such as names of windows, dialog boxes, buttons, fields, tab names, key names, and menu paths (what the user specifically selects or clicks)
<i>Italic</i>	Used for full titles of publications referenced in text
Monospace	Used for: <ul style="list-style-type: none">• System code• System output, such as an error message or script• Pathnames, filenames, prompts, and syntax• Commands and options
<i>Monospace italic</i>	Used for variables
Monospace bold	Used for user input
[]	Square brackets enclose optional values
|	Vertical bar indicates alternate selections - the bar means "or"
{ }	Braces enclose content that the user must specify, such as x or y or z
...	Ellipses indicate nonessential information omitted from the example

Where to get help

Dell EMC support, product, and licensing information can be obtained as follows:

Product information Dell EMC technical support, documentation, release notes, software updates, or information about Dell EMC products can be obtained at <https://www.dell.com/support/home> (registration required) or <https://www.dell.com/en-us/documentation/vmax-all-flash-family.htm>.

Technical support Dell EMC offers a variety of support options.

- Support by Product — Dell EMC offers consolidated, product-specific information on the Web through the Dell EMC Online Support site.

The Support by Product web pages (<https://www.dell.com/support/home>) then select **Product Support**) offer quick links to Documentation, White Papers, Advisories (such as frequently used Knowledgebase articles), and Downloads, as well as more dynamic content, such as presentations, discussion, relevant Customer Support Forum entries, and a link to Dell EMC Live Chat.

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- Dell EMC Live Chat — Open a Chat or instant message session with an Dell EMC Support Engineer.

To activate your entitlements and obtain your VMAX license files, visit the Service Center on Dell EMC Online Support (<https://www.dell.com/support/home>), as directed on your License Authorization Code (LAC) letter emailed to you.

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- If you are missing a LAC letter, or require further instructions on activating your licenses through the Online Support site, contact Dell EMC's worldwide Licensing team at licensing@emc.com or call:
 - North America, Latin America, APJK, Australia, New Zealand: SVC4EMC (800-782-4362) and follow the voice prompts.
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Solve Online and Solve Desktop

Solve provides links to customer service documentation and procedures for common tasks. Visit <https://solveonline.emc.com/solve/products>, or download the Solve Desktop tool from <https://www.dell.com/support/home> and search for Solve Desktop. From Solve Online or Solve Desktop, load the *PowerMax and VMAX* procedure generator.

 **NOTE: You need to authenticate (authorize) the Solve Desktop tool. After it is installed, familiarize yourself with the information under Help.**

Your comments

Your suggestions help us improve the accuracy, organization, and overall quality of the documentation. Send your comments and feedback to: VMAXContentFeedback@emc.com

Introduction to TimeFinder SnapVX

This chapter introduces Dell EMC Solutions Enabler TimeFinder SnapVX and the `symsnapvx` command.

Topics:

- [TimeFinder SnapVX overview](#)
- [SnapVX CLI overview](#)
- [SnapVX backward compatibility to legacy TimeFinder products](#)
- [SnapVX supported configurations](#)
- [SnapVX operating modes](#)
- [Secure snaps](#)
- [Consistent SnapVX snapshots](#)
- [Expired snapshot rules](#)
- [Geometry Compatible Mode flag set issue with SnapVX controls](#)

TimeFinder SnapVX overview

Dell EMC TimeFinder SnapVX creates and manages point-in-time snapshots of critical data that can be used for backups, decision support, and to refresh data warehouse, test, and development environments. SnapVX snapshots do not require target volumes. SnapVX snapshots share back-end allocations with the source volume and other snapshots on the source volume.

TimeFinder SnapVX is supported on arrays running HYPERMAX OS 5977 and higher, and snapshots are always consistent. Consistency across multiple arrays is achieved when source devices are in a composite group.

SnapVX reduces the steps to create and use point-in-time copies using two distinct activities:

- **Create snapshot** — SnapVX creates snapshots by storing changed tracks (deltas) directly in the Storage Resource Pool (SRP) of the source device. There is no need to specify a target device and source/target pairs to create a snapshot. A single source volume is allowed up to 256 snapshots. Each snapshot can be assigned a user-defined name and (optional) expiration date, both of which can be modified. One command creates a snapshot of single volume or an entire storage group.
- **Link to target** — Access SnapVX snapshots by linking them to a host accessible volume (target). Up to 1024 target volumes can link to snapshot(s) on a single source volume. The 1024 limit can consist of 1024 links to the same snapshot on a source volume or multiple links to multiple snapshots on the source volume.

Snapshots can be cascaded from linked targets and targets can be linked to snapshots of linked targets.

If there are multiple snapshots and an application needs to find a particular one, you can link and relink until the correct snapshot is located.

NOTE: SnapVX technology, along with FAST.X, is used to encapsulate devices on Dell EMC Data Domain systems for Dell EMC ProtectPoint, and allows for direct backup from VMAX arrays running HYPERMAX OS to Data Domain systems. Encapsulated Data Domain devices are fully recognized by VMAX arrays running the HYPERMAX OS, appear in `symsnapvx list` command displays, and can be used as a filter when listing devices. For a description of Dell EMC ProtectPoint backup and restore operations with VMAX arrays running the HYPERMAX OS, refer to the product guide in the EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS and Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS . See Dell EMC ProtectPoint documentation for instructions on setting up, configuring, and using the integrated ProtectPoint/VMAX3 and All Flash array solution.

NOTE: ProtectPoint has been renamed to Storage Direct and it is included in PowerProtect, Data Protection Suite for Apps, or Data Protection Suite Enterprise Edition software.

zDP snapshots

Solutions Enabler V9.1 with arrays running PowerMaxOS 5978 Q2 2019 SR supports reporting all the snapshots on a device, including Automated Snapset Creation with Data Protector for z Systems (zDP) snapshots. Snapsets created by zDP are not visible to previous versions of Solutions Enabler. To overcome this, a manual snapshot is created in PowerMaxOS when a pre-9.1 version of Solutions Enabler requests snapshot data for devices against which there are new type of zDP snapsets. This snapset will be in a state that trips the interaction rules of concern ensuring that the older Solutions Enabler will not perform dangerous operations on these devices.

When a device is the target of new zDP snapset the system returns one dummy link target record with the correct source and target devices for the actual link. The link dummy record will have the same “copy/nocopy” state as the actual Automated snapset record. If a device is ‘link –nocopy’ target then all NDM and SRDF control actions are blocked on that device. Manufactured snapshots are reported with the snapshot name “_Automated_Snapshot”.

SnapVX CLI overview

The `symsnapvx` command performs the following operations:

- Creates snapshots
- Creates secure snapshots. Please read [Secure snaps](#) on page 12 before creating secure snapshots for important information on terminating these snapshots.
- Converts regular snapshots to secure snapshots
- Names or renames snapshots
- Sets snapshots to automatically terminate in a specified number of days and hours
- Creates links from snapshot data to host mapped target devices
- Automatically unlinks existing links and relinks to a different snapshot
- Unlinks a snapshot without relinking it to a different snapshot
- Removes snapshot from the system
- Restores snapshots by copying point-in-time data from a snapshot back to the original source device
- Verifies whether one or more devices are in the requested state
- Lists snapshots

SnapVX backward compatibility to legacy TimeFinder products

SnapVX can be used “as is” with scripts that run legacy TimeFinder products (TimeFinder Clone, Mirror, and VP Snap). SnapVX transparently interprets legacy commands, allowing customers to use existing commands and scripts. The following restrictions apply:

- Legacy commands (commands used for TimeFinder Clone, Mirror, Snap, and VP Snap) provide TimeFinder functions and features for Engenuity 5876. TimeFinder Clone, Mirror and VP Snap are also supported on HYPERMAX OS 5977. SnapVX scalability and storage group operations are not supported.
- Legacy TimeFinder sessions and SnapVX snapshots cannot coexist on the same device. EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS, and Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS provide more information.
- Solutions Enabler V9.1 and higher allows users to create both the legacy modes and SnapVX on the same source device on arrays running PowerMaxOS 5978.444.444 and higher. Both SnapVX and legacy modes on a SnapVX or legacy emulation target device is not allowed. Mixing during cascading is not allowed, for example, SnapVX snapshots cannot be created from a Clone.

For details and SYMCLI commands for legacy TimeFinder products, refer to EMC Solutions Enabler TimeFinder Family (Mirror, Clone, Snap, VP Snap) CLI User Guide.

SnapVX supported configurations

SnapVX is supported on VMAX3, VMAX All Flash and PowerMax systems.

Local operations will act upon the selected device itself, remote operations will act on the device's remote partner, and two hop operations will act on the device's remote-remote partner.

SnapVX operating modes

SnapVX supports the following modes of operation:

- Single device
- Device list
- Device ranges
- DG group mode — uses STD device as source and TGT device as link targets.
- CG group mode — uses STD device as source and TGT device as link targets.
- SG group mode — only selects devices that are not gatekeepers.

Display examples throughout this chapter show how to execute SYMCLI commands using each mode of operation.

Secure snaps

For arrays running HYPERMAX OS Q2 2017 or higher, secure snapshots is an optional setting for SnapVX targetless snapshots that prevent accidental or intentional deletion of snapshots. Terminating a secure snapshot while the retention period is in effect is not allowed. When the retention time is reached the snapshot is automatically terminated only if there are no existing links or restore sessions. Extending the retention period is allowed but reducing it is not allowed. A traditional snapshot can be converted to a secure snapshot, but a secure snapshot may not be converted to a traditional snapshot. All SnapVX operations and rules for traditional snapshots regarding restores, linked target operations, and automatic expiration also apply to secure snapshots.

CAUTION:

When implementing secure snaps a user should determine how many snapshots on an array must be secure. The user should consider using secure snaps only on certain critical volumes, or only on a subset of the snapshots, to capture particular points-in-time that are critical to the business. Length of retention time should also be considered as part of the secure snapshot implementation. As always, proper planning and system sizing is crucial, no matter the types or number of snapshots that will exist in an environment.

Secure snapshots may only be terminated after they expire or by customer-authorized Dell EMC Support. Refer to Knowledgebase articles 498316 and 499975 for additional information.

Secure snapshots rules and allowable Solutions Enabler operations:

- The secure expiration time is available at the snapshot level.
- If the secure expiration time expires and the snapshot has no links or restore session, the snapshot is automatically deleted by the system.
- If the secure expiration time expires and the snapshot has link to a device or has a restore session, the snapshot is automatically deleted by the system only after the linked target is unlinked or the restore session is terminated.
- If the secured snapshot expiration time expires and the snapshot is linked to a device or has a restore session, the snapshot is no longer secured and is identified as expired.
- A regular snapshot can be converted to secure snapshot by specifying a secure expiration time.
- A secure expiration time can only be extended forward in time and not set back in time from the current setting.
- A secure snapshot can be restored, renamed, linked, unlinked, set copy mode, and terminate a restore.
- A secure snapshot that fails can be terminated.

Solutions Enabler operations not allowed on secure snapshots:


- Terminating the snapshot if it is activated.
- Setting time to live (TTL) on the snapshot
- Setting the secure expiration time back in time from the current setting

Secure snapshot rules and restrictions on VMAX arrays running HYPERMAX OS5977 Q217SR or higher (applies to FBA and CKD devices):

- New secure snapshots cannot be created when the SRP (Storage Resource Pool) is above the RC (Reserve Capacity).
- Secure snaps are unique in the handling of host writes and snapshots when SRP or Replication Data Pointer Cache limits are reached. Secure snaps are intended for use in cases where protecting specific point-in-time images are considered the highest priority. When Reserved Capacity of an SRP is reached and a host write to a source volume requires a new allocation in the SRP, secure snaps (unlike traditional snaps) are allowed to grow past the Reserved Capacity limit of the SRP. Preserving the secure snaps also takes priority over host writes to those source volumes in the event the entire SRP runs out of available capacity. This is the intent of secure snapshots. For example, in the event of an intentional attack or a runaway application on a system, that is using up all of the available capacity, preserving the secure snaps allows the user to restore from the secure snaps once the situation has been resolved.

Consistent SnapVX snapshots

By default, all SnapVX snapshots are consistent with the database when created and established. Depending on the state of the devices at the time of the snapshot, SnapVX pauses I/O to ensure there are no writes to the source device while the snapshot is created. When the activation completes, writes are resumed and the target device contains a consistent production database copy of the source device at the time of activation.

 **NOTE: Snapshots on a composite group are consistent across the entire group, even if the composite group spans devices across multiple VMAX3 and VMAX All Flash arrays.**

Source device requirements for consistent snapshots:

- All devices must be R1 or R2; a mixture of R1 and R2 devices is not supported.
- A mixture of R1 and non-SRDF devices is allowed. The R1 devices can be a mixture of RW and NR on the SRDF link.
- A mixture of R2 and non-RDF devices is allowed if the R2 devices are NR on the SRDF link.
- A mixture of R1 and R21 devices is allowed if the R1->R21 is NR on the SRDF link.
- A mixture of R2 and R21 devices is allowed, if the following criteria is met:
 - R1->R2 and R1->R21 devices are all RW on the SRDF link.
 - R1->R2 and R1->R21 are all NR on the SRDF link.

If the source devices do not meet these criteria then the snapshot cannot be created unless a force flag is used. Using a force flag forces the snapshot to be created; however, the consistency of the snapshot cannot be guaranteed.

Expired snapshot rules

The following rules apply to both regular and secure expired snapshots.

Allowable Solutions Enabler operations:

- TTL can be set to a future date or to NONE (removes TTL).
- Secure expiration time can be set to a future date.
- Unlink and terminate restore operations are allowed on the snapshot.
- A regular snapshot can be converted to secure snapshot by specifying a secure expiration time.

Solutions Enabler operations not allowed:

- Running the restore, rename, link, relink, set copy mode operations.

Geometry Compatible Mode flag set issue with SnapVX controls

Because TimeFinder requires that source and target devices be the same size, the GCM (Geometry Compatible Mode) flag can get automatically set on the target device during SnapVX operations. This flag should be cleared on the device before mapping it to a host, otherwise, in order to clear the flag it must be unmapped from the host, which results in a data outage.

The `symdev`, `symdg`, `symcg`, `symsg` commands have the `set/unset -gcm` option to set or unset GCM for a device or group. Refer to the *Solutions Enabler CLI Reference Guide* for more information on using these commands with the `-gcm` attribute.

Performing TimeFinder SnapVX Operations

This chapter describes how to perform Timefinder SnapVX operations.

Topics:

- Establish SnapVX snapshot
- Rename SnapVX snapshot
- Set SnapVX snapshot time to live (TTL)
- Convert SnapVX snapshot to secure snapshot
- Link a SnapVX snapshot
- Change SnapVX snapshot link mode
- Unlink SnapVX snapshot
- Relink SnapVX snapshot
- Restore SnapVX snapshot
- Terminate SnapVX snapshot

Establish SnapVX snapshot

Description

The `symssnapvx establish` command creates and activates a SnapVX snapshot.

Options

-name <SnapshotName>

Snapshot name - case sensitive, maximum length of 32 alphanumeric character, dash (-) and underscore (_) are legal characters.

-ttl

Sets the time to live (TTL) for a snapshot either as a number of days plus hours or hours from the current host time, or to an absolute date and time in the future. When the TTL expires a snapshot is identified as expired. Only snapshots without links or restore sessions can be terminated. If the snapshot has links or restore sessions, it is terminated when the last link is unlinked or the restore session is terminated. TTL is set using the following options:

(i) NOTE: Refer to the examples in [Set SnapVX snapshot time to live \(TTL\) on page 17](#) for TTL formatting rules.

- `-delta Days[:hours]` — Sets TTL to 1 – 400 days plus 0 –23 hours from current host time. Day Format is days:hh (for hours, only whole numbers are valid and 0 value is optional).
- `-absolute Date[:hour]` — Sets TTL to an absolute date in the future, up to a date 400 days from current host date, plus 0 –23 hours. Date format is MM/DD/YYYY:HH (for hours, only whole numbers are valid and 0 value is optional).
- `-delta NONE` - Removes TTL.

-secure

Creates a secure snapshot with a secure expiration time for a snapshot either as a number of days plus hours, or hours from the current host time, or an absolute date and time in the future. Use extreme caution with this option. When the secure expiration time expires a snapshot is identified as expired. Only snapshots without links or restore sessions can be terminated. If the snapshot has links, it is terminated when the last link is unlinked. Secure expiration time is set using the following options:

(i) NOTE: Refer to the examples in [Set SnapVX snapshot time to live \(TTL\) on page 17](#) for formatting rules for setting expiration time.

- `-delta Days[:hours]` — Sets secure expiration time to 1 – 400 days plus 0 –23 hours from current host time. Day format is days:hh (for hours, only whole numbers are valid and 0 value is optional).
- `-absolute Date[:hour]` — Sets secure expiration time to an absolute date in the future, up to a date 400 days from current host date, plus 0 –23 hours. Date format is MM/DD/YYYY:HH (for hours, only whole numbers are valid and 0 value is optional).

-both_sides

Valid with DG, SG, or CG. Performs SnapVX operation on both local and remote snapshots. The following rules apply when using this option:

- A mixture of R1 and R2 devices is not allowed.
- All the RDF devices in the SG must be in same RDF group.
- RDF pairs must be in Synchronous RDF mode and in Synchronous state, or in Active RDF mode and in ActiveActive or ActiveBias state.

-preaction <ScriptFile>

Executes the specified script before a snapshot is established.

-postaction <ScriptFile>

Executes the specified script after a snapshot is established, using the following options:

- `-delta Days` — Executes the specified script after 1 to 400 days.
- `-absolute Date` — Executes the specified script after a date that is up to 400 days in the future.

Examples

To establish a snapshot named 600am for the source devices specified in `Storage Group1`, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -name 600am establish
```

To establish a snapshot named 600am for source device 55, enter:

```
symsnapvx -sid 001 -dev 55 -name 600am establish
```

To establish a snapshot named 600am and automatically terminate it in 2 days 23 hours, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -name 600am establish -ttl -delta 2:23
```

To establish a secure snapshot named 600am and automatically terminate it at noon on June 1 2017, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -name 600am establish -secure -absolute 06/01/2017:12
```

Snapshot generations

Each time a new snapshot with the same name is created (on the same source device), the new snapshot becomes generation 0, and all of the previous generation numbers are incremented. SnapVX supports up to 256 snapshots per source device.

Rename SnapVX snapshot

 **NOTE:** An expired secure or regular snapshot cannot be renamed.

Syntax

To rename a snapshot, use the following syntax:

```
symsnapvx -g <DgName> -snapshot_name <SnapshotName> rename -name <NewSnapshotName>
```


Examples

To rename a snapshot named 400am to 600am, enter:

```
symsnapvx -sid 001 -g DeviceGroup1 -snapshot_name 400am rename -name 600am
```

Set SnapVX snapshot time to live (TTL)

Description

Use the `set ttl` option to set the time to live for a regular snapshot either as a number of days from set time or an absolute date in the future. Only snapshots without links or restore sessions can be terminated. If the snapshot has links it will be terminated when the last link is unlinked.

 **NOTE:** Once the TTL is set for snapshot it can only be extended forward in time and not set back in time. Refer to Examples below for invalid TTL values.

Options

`set ttl`

Sets the TTL to the specified days, date or removes TTL, using the following options:

- `-delta Days[:hours]` — Sets TTL to 1 – 400 days plus 0 –23 hours from current host time. Day Format is days:hours (for hours, only whole numbers are valid and 0 value is optional).
- `-absolute Date[:hour]` — Sets TTL to an absolute date in the future, up to a date 400 days from current host date, plus 0 –23 hours. Date format is MM/DD/YYYY:hours (for hours, only whole numbers are valid and 0 value is optional).
- `-delta NONE` - Removes TTL.

`-snapshot name <SnapshotName>`

Specifies the snapshot name.

Examples

To set the TTL for snapshot named 600am and automatically terminate it after 3 days 6 hours, enter:

```
symsnapvx set ttl -nop -dev 3b5 -snapshot_name 600am -sid 476 -delta 3:6
```

```
SetTimeToLive operation execution is in progress for the device range(s). Please wait...
```

```
  Polling for SetTimeToLive.....Started.
  Polling for SetTimeToLive.....Done.
```

```
SetTimeToLive operation successfully executed for the device range(s)
```

To set the TTL for snapshot named 600am and automatically terminate it at noon on June 1 2017, enter:

```
symsnapvx set ttl -nop -dev 3b5 -snapshot_name 600am -sid 476 -absolute 06/01/2017:12
```

```
SetTimeToLive operation execution is in progress for the device range(s). Please wait...
```

```
  Polling for SetTimeToLive.....Started.
  Polling for SetTimeToLive.....Done.
```

```
SetTimeToLive operation successfully executed for the device range(s)
```

TTL command fails if attempting to set a secure snapshot back in time from the current setting (noon on June 1 2017):

 **NOTE:** Setting TTL back in time is allowed for regular snapshots.

```
symsnapvx set ttl -nop -dev 3b5 -snapshot_name 600am -sid 476 -absolute 06/01/2017:0
Invalid option value entered: 6/01/17:0
```

TTL command fails if attempting to set both days and hours to 0:

```
symsnapvx set ttl -nop -dev 3b5 -snapshot_name 600am -sid 476 -delta 0:0
The time to live is invalid
```

TTL command fails if both days and hours are not set:

```
symsnapvx set ttl -nop -dev 3b5 -snapshot_name 600am -sid 476 -delta :5
Invalid option value entered: :5
```

```
symsnapvx set ttl -nop -dev 3b5 -snapshot_name 600am -sid 476 -delta 5:
Invalid option value entered: 5:
```

Convert SnapVX snapshot to secure snapshot

Description

Use the `set secure` option to convert a regular snapshot to a secure snapshot with a secure expiration time. The secure expiration time is set as either as a number of days plus hours, or hours, from the current host time, or to an absolute date and time in the future. Only snapshots without links or restore sessions can be terminated. If the snapshot has links it will be terminated when the last link is unlinked. If the snapshot has a restore session it will be terminated when the restore session is terminated.

Also use this command to reset a secure snapshot either from a previous `set secure` or `establish -secure` operation, however a subsequent `set secure` operation must set a time greater than current expiration time setting.

Options

`set secure`

Creates a secure snapshot with a secure expiration time for a snapshot either as a number of days from the current day/time or an absolute date in the future. When the secure expiration time expires a snapshot is identified as expired.

 **NOTE:** Refer to the examples in [Set SnapVX snapshot time to live \(TTL\) on page 17](#) for formatting rules for setting expiration time.

- `-delta Days[:hours]` — Sets secure expiration time to 1 – 400 days plus 0 –23 hours from current host time. Day format is days:hh (for hours, only whole numbers are valid and 0 value is optional).
- `-absolute Date[:hour]` — Sets secure expiration time up to a date 400 days from current host date plus 0 –23 hours. Date format is MM/DD/YYYY:HH (for hours, only whole numbers are valid and 0 value is optional).

`-snapshot name <SnapshotName>`

Specifies the snapshot name.

Examples

To set the secure expiration time for snapshot named `600am` and automatically terminate it after 3 days 6 hours, enter:

```
symsnapvx set secure -nop -dev 3b5 -snapshot_name 600am -sid 476 -delta 3:6
```


To set the secure expiration time for snapshot named 600am and automatically terminate it at noon on June 1 2017, enter:

```
symsnapvx set secure -nop -dev 3b5 -snapshot_name 600am -sid 476 -absolute 06/01/2017:12
```

Link a SnapVX snapshot

Description

To access a point-in time-copy, create a link from the snapshot data to a host mapped target device. SnapVX supports up to 1,024 linked targets per source device. Links can be a permanent copy on a target device, or a temporary copy that no longer retains the point-in-time copy of the data once the link is removed.

 **NOTE:** An expired secure or regular snapshot cannot be linked.

Syntax

To create a link from snapshot data, use the following syntax:

```
symsnapvx -sid <SymmID> -sg <SgName> -lnsg <SgName>  
          -snapshot_name <SnapshotName>  
            [-generation <GenerationNumber>]  
            link [-copy [-remote]] [-exact]
```

Options


-lnsg	Specifies a SG name for target devices.
-copy	Specifies copy mode for link operation which performs a background copy to the target device. SnapVX uses Copy mode to create full-volume copies of the data by copying it to the target device's SRP. If Copy mode is not specified when linking the snapshot, the NoCopy link is the default.
-remote	Data is propagated to the remote mirror of the RDF device. Not allowed on a NoCopy linked target.
-exact	Pairs source and link devices by their ordinal positions in the selection. If not set, pairs source and link devices by best match.

Examples

To create a Copy mode link to generation 5 of the 600am snapshot, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg StorageGroup2  
-snapshot_name 600am -gen 5 link -copy
```

If the number of source devices in a storage group changes, a snapshot (or a generation of a snapshot) might not exist for that device for a particular point-in-time. Linking from a source device that does not have the specified snapshot, makes the corresponding target device not ready. This is because there is no data on that target for that time, and the application should not be using that device. [SnapVX behavior when adding source devices](#) on page 29 provides additional details.

 **NOTE:** If using Dell EMC ProtectPoint Data Domain systems, before ProtectPoint can be used to backup the production database, the TimeFinder SnapVX link copy command must be run between the production and the backup devices. Full instructions are contained in the Dell EMC ProtectPoint documentation set.

Restrictions

The following restrictions apply when linking to a target:

- When linking to devices do not use devices that are the target of another link copy or another TimeFinder session.
- Devices with persistent track allocations cannot be used as link targets, this includes restores.
- Any pre-existing data that was exclusive to the target is lost during a link or relink.
- The target device must be of equal or greater size than the source device.

i **NOTE:** By default, SnapVX allows the target device to be larger than the source device. If necessary, this setting can be disabled. The *Dell EMC Solutions Enabler CLI Command Reference* contains information on changing the Option file parameters.

Change SnapVX snapshot link mode

i **NOTE:** An expired secure or regular snapshot cannot be set to copy mode.

`set mode <copy | nocopy>`

Sets the mode of an existing link. Copy mode creates a full-volume copy of the data by copying it to the target device's SRP. Nocopy mode does not retain the point-in-time data once the link is removed.

Examples

To set the link mode to NoCopy for generation 5 of the 600am snapshot, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name 600am -gen 5 set mode nocopy
```

Unlink SnapVX snapshot

Description

The `symsnapvx unlink` command unlinks a snapshot without relinking to a different snapshot.

i **NOTE:** Allows the unlink of a link nocopy session when the session is defined and the target device is the source of another snapshot. The data is guaranteed as long as the define is complete at the time of the unlink operation.

Options

`-symforce`

Forces the operation to execute when normally it is rejected. If used when a link is copy in progress or when a restore is restore in progress, causes an incomplete copy and data on the copy target is not usable.

Example

To unlink generation 6 of the 600am snapshot, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg StorageGroup2 -snapshot_name 600am -gen 6 unlink
```

Relink SnapVX snapshot

Description

An existing snapshot can be unlinked and relinked to a different snapshot from the same source device. To relink a snapshot, a link must already exist on at least one of the targets. Relinking can also be used on the same snapshot, which has the effect of refreshing the point-in-time copy on the link target if it has been modified by host writes.

 **NOTE: An expired secure or regular snapshot cannot be relinked.**

Options

-lmsg	Specifies a SG name for target devices.
-copy	Specifies copy mode for relink operation which performs a background copy to the target device. If the relink is in Copy mode, the copy is differential between the original linked snapshot and the newly linked snapshot.
-remote	Data is propagated to the remote mirror of the RDF device. Not allowed on a NoCopy linked target.
-exact	Pairs source and link devices by their ordinal positions in the selection. If not set, pairs source and link devices by best match.

Examples

To relink (in Copy mode) to generation 6 of the 600am snapshot, enter:

```
symssnapvx -sid 001 -sg StorageGroup1 -lmsg StorageGroup2  
-snapshot_name 600am -gen 6 relink -copy
```

Restore SnapVX snapshot

Use the `symssnapvx restore` command to restore a snapshot's point-in-time data back to the original source device. SnapVX restore operations are inherently differential, so only the changed tracks are copied back to the source device. An expired secure or regular snapshot cannot be restored.

 **NOTE: A restore session must be terminated before terminating the original snapshot session.**

Options

-preaction <ScriptFile>	Executes the specified script before a snapshot is restored.
-postaction <ScriptFile>	Executes the specified script after a snapshot is restored.
-remote	Specifies data will be copied to the remote mirror of the RDF device. Not allowed on nocopy linked target.

Examples

To restore generation 5 of the 6:00 AM snapshot, enter:

```
symssnapvx -sid 001 -sg StorageGroup1 -snapshot_name 600am -gen 5 restore
```

If a source device is added to a storage group, the added device is missing snapshots that were created before the new device was added. If a restore is requested for a snapshot that is missing for a newly added device, this new device is made Not Ready, and the application should not be using this device. [SnapVX behavior when adding source devices](#) on page 29 provides additional details.

Terminate SnapVX snapshot

Description

Terminating a snapshot removes it from the system. To terminate a snapshot it must have no linked devices or restore sessions. To unlink a snapshot refer to [Unlink SnapVX snapshot](#) on page 20.

Options

-restored

Terminates restores.

-symforce

Forces the operation to execute when normally it is rejected.

Examples

To terminate generation 5 of the 600am snapshot, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name 600am -gen 5 terminate
```

To terminate the restore of generation 5 of the 600am snapshot, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name 600am -gen 5 terminate -restored
```

TimeFinder SnapVX snapshot reporting

This chapter describes how display and verify Timefinder SnapVX snapshot status.

Topics:

- [Display SnapVX snapshot status](#)
- [Verify SnapVX snapshot status](#)

Display SnapVX snapshot status

Description

The `symsnapvx list` command displays the state of all snapshots and links on individual devices, a device file, device ranges, device group, composite group, or storage group or on the entire VMAX3 or VMAX All Flash array. To display link status for a group, devices must be associated with the group.

NOTE: When using the `symsnapvx list` command in environments with ProtectPoint Data Domain systems, if a link is in a force failed state due to non-supported configuration, the Failed flag column contains an “F”, as shown in the examples below.

NOTE: From Solutions Enabler V9.1 the `offline` option, that specifies that the Symmetrix data connection is offline and the operation will use the host in-memory database, is not supported with `symsnapvx list` reports. You can get the report on demand from the array.

Syntax

To display snapshots information, use the following syntax:

```
symsnapvx -sid <SymmID> list [ -bgdefinprog | -secured | -linked [-by_tgt] | -restored | -manual]
```

Options

-detail

Expanded display that provides all snapshot information.

-failed

Displays only failed snapshots or links.

-last_n

Displays only the specified generations for each device.

-linked

Displays the links associated with the selected devices. Requires `-sid` option when requesting all linked targets in the array.

-restored

Displays only restored snapshots. Requires `-sid` option when requesting all restored targets in the array.

-by_tgt

Displays all snapshots ordered by link target device and links on individual devices, a device file, device ranges, device group, composite group, or storage group.

-bgdefinprog

Displays only the snapshots that were created on a target device when background define process was in progress and the define is not complete yet. This is available on PowerMaxOS. Using this option on earlier systems returns the message "No snapshot was found".

-manual

Reports only manual snapshots.

-secured

Displays only snapshots with secured attribute.

-summary

Displays the summary for the specified snapshots.

Examples

To display the snapshots for devices on array 476, enter:

```
symsnapvx list -sid 476
```

To display the snapshot detail for device 3AA on array 476, enter:

```
symsnapvx list -dev 3AA -sid 476 -detail
```

To display the snapshot for device 28AA with a zDP snapshot on array 56, enter:

```
symsnapvx list -sid 56 -dev 28aa
```

To display only the snapshots with the secured attribute on array 476, enter:

```
symsnapvx list -sid 476 -secured
```

To display the links associated with the device 140 on array 86, enter:

```
symsnapvx -sid 86 list -dev 140 -linked
```

Sample output

To list all snapshots on array:

```
Symmetrix ID           : 000196801476      (Microcode Version: 5977)

-----
Sym      Num  Flags
Dev      Snapshot Name      Gens FLRG TSEB Last Snapshot Timestamp
-----
...
003AA Monday                4 S... ...X Mon Jul 13 14:42:45 2017
...

Flags:
(F)ailed      : X = General Failure, . = No Failure
              : S = SRP Failure, R = RDP Failure, I = Establish in progress
              : M = Mixed Failure
(L)ink        : X = Link Exists, . = No Link Exists
(R)estore     : X = Restore Active, . = No Restore Active
(G)CM         : X = GCM, . = Non-GCM
(T)ype        : Z = zDP snapshot, . = manual snapshot

(S)ecured     : X = Secured, . = Not Secured
(B)ackground: X = Background define in progress, . = No Background define
```


To list snapshots for a device on an array:

```
Symmetrix ID          : 000197600056      (Microcode Version: 5978)

-----
Sym          Num    Flags
Dev  Snapshot Name  Gens FLRG TSEB Last Snapshot Timestamp
-----
028AA _Automated_Snapshot      1 ... .. Fri Aug 31 07:55:19 2018

Flags:
  (F)ailed      : X = General Failure, . = No Failure
                  : S = SRP Failure, R = RDP Failure, I = Establish in progress
                  : M = Mixed Failure
  (L)ink        : X = Link Exists, . = No Link Exists
  (R)estore     : X = Restore Active, . = No Restore Active
  (G)CM         : X = GCM, . = Non-GCM
  (T)ype       : Z = zDP snapshot, . = manual snapshot

  (S)ecured     : X = Secured, . = Not Secured
  (B)ackground : X = Background define in progress, . = No Background define
```

With -detail option for specified device:

```
Symmetrix ID          : 000196801476      (Microcode Version: 5977)

-----
Sym          Num    Flags
Dev  Snapshot Name  Gen  FLRG TSEB Snapshot Timestamp
-----
003AA Monday      0  .... ..X Mon Jul 13 14:42:45 2017
    Monday      1  .... .... Mon Jul 13 14:42:00 2017

-----
Snapshot  Total
Dev Size  Deltas      Non-Shared
(Tracks) (Tracks)    (Tracks)  Expiration Date
-----
      240      0      0      NA
      240      0      0      NA
      -----
              0      0

Flags:
  (F)ailed      : X = Failed, . = No Failure
  (L)ink        : X = Link Exists, . = No Link Exists
  (R)estore     : X = Restore Active, . = No Restore Active
  (G)CM         : X = GCM, . = Non-GCM
  (T)ype       : Z = zDP snapshot, . = normal snapshot
  (S)ecured     : X = Secured, . = Not Secured
```

With -secured option:

```
Symmetrix ID          : 000196801476      (Microcode Version: 5977)

-----
Sym          Num    Flags
Dev  Snapshot Name  Gens FLRG TSEB Last Snapshot Timestamp
-----
001BF Monday      2  ..X. .X.. Wed Oct 10 13:45:08 2016
```

003AA Monday 1 .X.. .X.. Mon Sep 26 11:28:09 2016

Flags:

(F)ailed : X = General Failure, . = No Failure,
S = SRP Failure, R = RDP Failure, M = Mixed Failure
(L)ink : X = Link Exists, . = No Link Exists
(R)estore : X = Restore Active, . = No Restore Active
(G)CM : X = GCM, . = Non-GCM
(T)ype : Z = zDP snapshot, . = normal snapshot
(S)ecured : X = Secured, . = Not Secured
(E)xpanded : X = Source Device Expanded, . = Source Device Not Expanded
(B)ackground: X = Background define in progress, . = No Background define

With -linked option:

Symmetrix ID : 000197100086 (Microcode Version: 5978)

Sym	Snapshot Name	Gen	Link	Flags	FCMDS	Snapshot	Timestamp
00140	Friday	0	00141	S....	Fri	Jul 21	08:24:52 2017
00140	Friday	0	00142	S....	Fri	Jul 21	08:24:52 2017

Flags:

(F)ailed : F = Force Failed, X = General Failure, . = No Failure,
S = SRP Failure, R = RDP Failure
(C)opy : I = CopyInProgress, C = Copied, D = Copied/Destaged, . = NoCopy Link
(M)odified : X = Modified Target Data, . = Not Modified
(D)efined : X = All Tracks Defined, . = Define in progress
(S)napshot : X = Has snapshot waiting for define to complete
. = No snapshot waiting for define to complete

Verify SnapVX snapshot status

Description

Use the `symsnapvx verify` command to verify snapshot and link states.

Options

-by_tgt

Verifies by link target.

-copyinprog

Verifies that link(s) are in the CopyInProgress state.

-copied

Verifies that link(s) are in the Copied state.

-defined

Use with `verify -linked`, `-restored` and `-restinprog` to wait until all tracks have been defined.

-destaged

Verifies that all tracks are written to the link target.

-established

Verifies that snapshot is in Established state.

-estinprog

Verifies that snapshot is in EstInProgress state.

-linked

Verifies that nocopy links are in Linked state.

-restored	Verifies that snapshots are in the Restored state.
-restinprog	Verifies that snapshots are in RestoreInProgress state.
--summary	Displays summary of snapshot

Example

To verify that generation 2 of snapshot is in restored state, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name snapshot -gen 2 verify -restored
```

```
All of the devices are in the restored state
```

TimeFinder SnapVX Configurations and Examples

This chapter describes various TimeFinder SnapVX configurations and describes common uses for SnapVX.

Topics:

- [Cascading SnapVX snapshots](#)
- [Modified SnapVX point-in-time copies](#)
- [SnapVX behavior when adding source devices](#)
- [Common uses for SnapVX snapshot configurations](#)

Cascading SnapVX snapshots

The target device of a snapshot can be used as the source device for additional snapshots.

The figure below shows Snapshot B cascading off of the target of Snapshot A, where the target of Snapshot A is the source for Snapshot B.

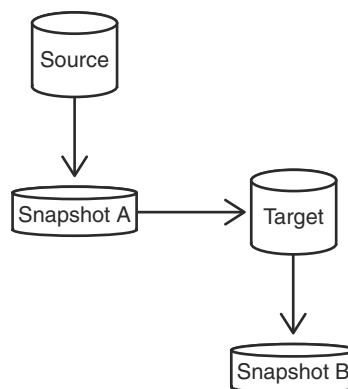


Figure 1. Cascading snapshots

There are no architectural restrictions on the number of cascading hops, and multiple targets can be linked from any of the snapshots.

If the linked target is in NoCopy mode, the cascading snapshot is considered a dependent snapshot. Target devices cannot be unlinked without removing dependent snapshots (in the reverse order of their creation). However, the copy mode is changed to Copy the target can be unlinked once link is fully copied.

A relink operation to a target with dependent snapshot is allowed, but if the relink is in NoCopy mode, the unlink is allowed only if there are no new snapshots off of that target device.

For HYPERMAX OS, a linked target must be fully defined before you can create snapshots off of it. When a target is first linked, all of the tracks are undefined. At this point the target does not know where in the SRP the track is located, and host access to the target must be derived from the SnapVX metadata. A background process eventually defines the tracks and updates the thin device to point directly to the track location in the source device's SRP. For PowerMaxOS, creating a snapshot off the link target if the link is not defined, or when restore is in progress and not defined yet is allowed, however these snapshots can only be used once they are fully defined.

Determine fully defined SnapVX snapshot

Examples

To display the linked targets for devices listed in file `snapvx_devices`, enter:

```
symsnapvx list -sid 001 -sg StorageGroup1 -linked
```

Sample output

The output lists only those snapshots that have fully defined linked targets. The (D) flag indicates if all of the tracks for a linked target are defined.

```
Device File Name      : snapvx_devices
Device's Symmetrix ID : 000197100001      (Microcode Version: 5977)
-----
Sym      Link  Flgs
Dev      Snapshot Name      Gen  Dev  FCMD  Snapshot Timestamp
-----
00123    Tuesday_account_400pm      1  01122 .C.X  Tue Feb 12 16:00:15 2013
00123    Tuesday_account_400pm      1  01126 .D.X  Tue Feb 12 16:00:15 2013
00124    Tuesday_account_400pm      1  01123 .IX.  Tue Feb 12 16:00:15 2013
00125    Tuesday_account_400pm      1  01124 .I..  Tue Feb 12 16:00:15 2013
Flgs:
(F)ailed   : X = Failed, . = No Failure
(C)opy     : I = CopyInProg, C = Copied, D = Copied/Destaged, . = NoCopy Link
(M)odified : X = Modified Target Data, . = Not Modified
(D)efined  : X = All Tracks Defined, . = Define in progress
```

Modified SnapVX point-in-time copies

Host writes to a linked target device do not change the point-in-time copy, so only the linked target device contains a modified point-in-time copy. To copy a modified point-in-time copy back the original source device, establish a snapshot from the target device and then create a Copy mode link of that snapshot back to the source device.

The figure below shows an example of copying a modified point-in-time copy back to the source by linking (in Copy mode) a snapshot of the linked target back to the source device.

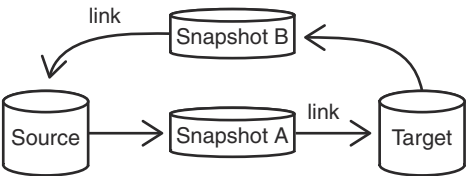


Figure 2. Copying a modified point-in-time back to the source

SnapVX behavior when adding source devices

Over time, an application may grow (or shrink) the number of devices that it uses. SnapVX automatically adjusts restore, link, and relink operations to accommodate extra or missing snapshot names and generations.

The figure below shows a storage group with three source devices. Source device 3 is added to the storage group after the first snapshot (Mon 12pm) was established, so that snapshot does not exist for that device.

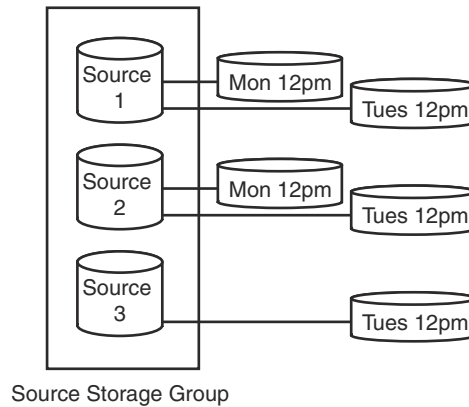


Figure 3. Storage group with two snapshots

SnapVX snapshot restore operations when adding source devices

As shown in the figure below, if the Mon 12pm snapshot is restored, the point-in-time data is copied back to source device 1 and source device 2, but source device 3 is marked NR because there is no data on that device for that point-in-time.

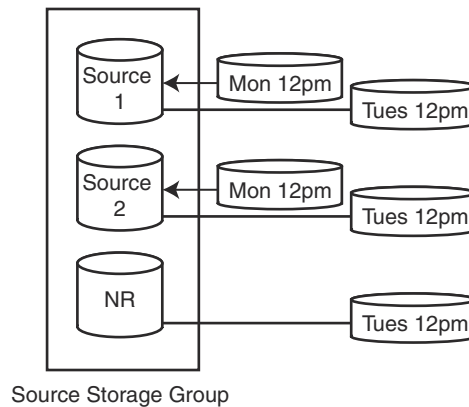


Figure 4. Source devices after a restore operation

SnapVX snapshot link operations when adding source devices

As shown in the figure below, if target devices are linked to the Mon 12pm snapshot, target device 1 and target device 2 are linked to the snapshot, but target device 3 is marked NR because there is no data on that target for that point-in-time.

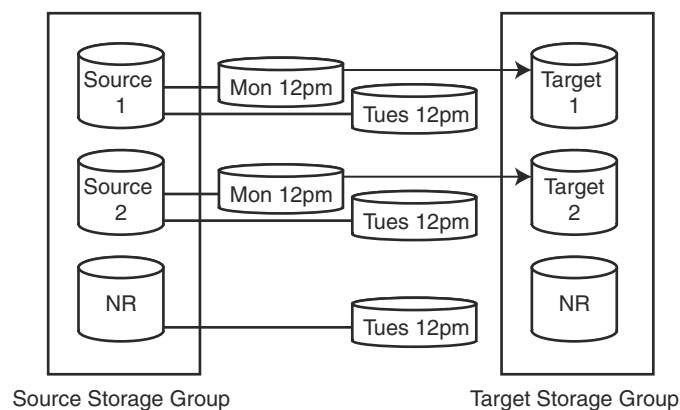


Figure 5. Target devices after a link operation

NOTE: The link command can only be used when there are no links to any of the targets. If linking in Copy mode, the result is a full copy.

SnapVX relink operations when adding source devices

The relink operation can only be used if a link exists on at least one of the targets. In Copy mode, if a link already exists for a particular target, the result is an incremental copy. If there is no existing link for a target, then the result is a full copy.

If relinking from a source device that has the selected snapshot and generation, but the target device does not have an existing link, a new link is created and the result is a full copy.

If relinking from a source device that does not have the selected snapshot and generation, the target device is marked NR. If the target has an existing link, it is unlinked.

If relinking from a source device that has the selected snapshot and generation, and the target device has a previous link, the relink results in an incremental copy.

Common uses for SnapVX snapshot configurations

This section describes commonly used SnapVX configurations, including:

- [Create targetless SnapVX snapshots and restore production volumes](#) on page 31
- [Refresh multiple test or development environments from a SnapVX linked target](#) on page 32
- [Provision test or development environments with cascading SnapVX snapshots](#) on page 33

Create targetless SnapVX snapshots and restore production volumes

In the following example, snapshots of all devices in a storage group are created and retained for 2 days. This provides for up to 2 days of snapshots without consuming any additional device numbers or the cache overhead.

To create snapshots, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -name snapshot establish -ttl -delta 2
```

To list snapshots, enter:

```
symsnapvx -sid 001 list -sg StorageGroup1 -snapshot_name snapshot -detail -GB
```

NOTE: In this example, to create snapshots every 15 minutes, use a script or schedule to run the symsnapvx establish command at 15 minute intervals.

Output:

```
Storage Group (SG) Name      : StorageGroup1
SG's Symmetrix ID           : 000196700001 (Microcode Version: 5977)
-----
```

Sym Dev	Snapshot Name	Gen	Total Flgs FLRG TSEB	Snapshot Timestamp	Deltas (Tracks)	Non-Shared (Tracks)	Expiration Date
00212	snapshot	0	....	Mon Jun 15 16:15:00 2015	142	11	Tue Jun 17 16:15:00 2015
	snapshot	1	....	Mon Jun 15 16:00:00 2015	222	11	Tue Jun 17 16:00:00 2015
	snapshot	2	....	Mon Jun 15 15:45:00 2015	272	0	Tue Jun 17 15:45:00 2015
					636	22	

Flags:

(F)ailed : X = General Failure, . = No Failure,
S = SRP Failure, R = RDP Failure,
(L)ink : X = Link Exists, . = No Link Exists
(R)estore : X = Restore Active, . = No Restore Active
(G)CM : X = GCM, . = Non-GCM
(T)ype : Z = zDP snapshot, . = normal snapshot
(S)ecured : X = Secured, . = No Secure
(E)xpanded : X = Source Device Expanded, . = Source Device Not Expanded
(B)ackground: X = Background define in progress, . = No Background define

NOTE: Data Protector for z Systems (zDP™) snapshots, created and managed through Mainframe Enabler products, are reported in Solutions Enabler by the flag (T) when issuing the `symsnapvx list` command. Automated zDP snapshots taken by Mainframe Enabler are reported with the snapshot name `_zDP_XYZ`, where XYZ is the internal zDP schedule id used by zDP for that snapshot.

Any of the snapshots created in the previous example can be used to restore the source volumes. Before issuing any restore, unmount the source volume from the application server to ensure that the data is fully refreshed on the host. Before issuing any restore, unmount the source volume from the application server to ensure that the data is fully refreshed on the host.

To restore directly to the production volumes from snapshot generation 2 taken at 15:45pm, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name snapshot -gen 2 restore

Execute Restore operation for Storage Group StorageGroup1 (y/[n]) ? y
Restore operation execution is in progress for the storage group StorageGroup1. Please
wait...
Polling for Restore.....Started.
Polling for Restore.....Done.
Restore operation successfully executed for the storage group StorageGroup1
```

When the restore command completes, the volumes are read/write accessible to the host and the restored data is instantly available to the host. Therefore, the production volumes can be remounted and used immediately, and copying of any remaining tracks, from the snapshot delta to the source volume, is done as a background task. The snapshot data is always preserved and can be used again for a future restore, if needed, so writing to the source volume while restore operation is still copying data does not affect the snapshots.

Typically the restore command completes in a few seconds, but the time to complete is dependent on the number of devices involved in the restore operation. Use the `verify` option to verify that all devices are restored.

To verify that the snapshot is restored, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name snapshot -gen 2 verify -restored

All of the devices are in the restored state
```

To terminate the restore session, enter:

```
symsnapvx -sid 001 -sg StorageGroup1 -snapshot_name snapshot -gen 2 terminate -restored

Execute Terminate operation for Storage Group StorageGroup1 (y/[n]) ? y
Terminate operation execution is in progress for the storage group StorageGroup1. Please
wait...
Polling for Terminate.....Started.
Polling for Terminate.....Done.
Terminate operation successfully executed for the storage group StorageGroup1
```

Refresh multiple test or development environments from a SnapVX linked target

SnapVX “links” enable access to point-in-time copies by linking snapshot data to a host mapped target device.

Use SnapVX to provision multiple test or development environments using linked snapshots. Each linked storage group can access the same snapshot or each can access a different snapshot version in either no copy or copy mode. Changes to the linked volumes do not affect the snapshot data. To roll back a test development environment to the original snapshot image, simply perform a relink operation.

NOTE: Target volumes must be unmounted before issuing the relink command to ensure that the host operating system is not caching any filesystem data. Once the relink is complete, volumes can be remounted. Snapshot data is unchanged by the linked targets, so it can also be used for restoring to production.

In the following figure, multiple servers/organizations link to snapshots for different uses. Each target is independent, and changes to one target does not affect the other targets.

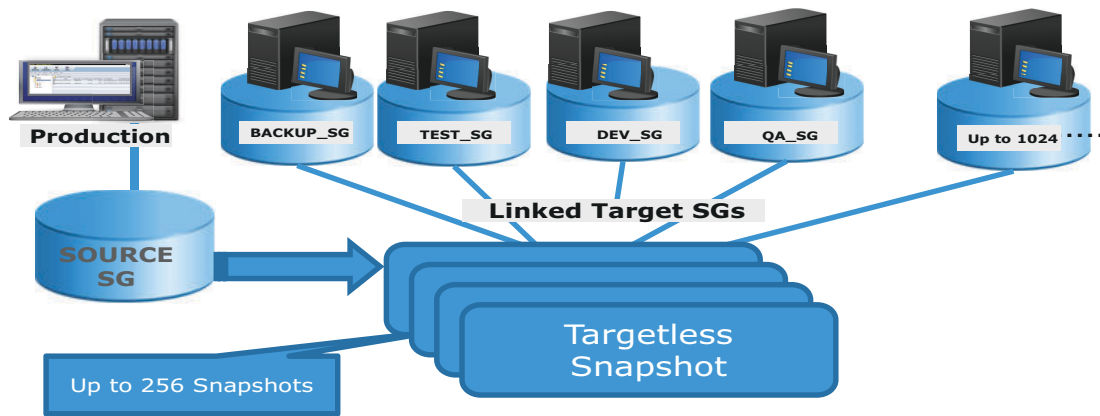


Figure 6. SnapVX targetless snapshots

Link snapshot `targetless_snapshot` to target devices shown in the above figure:

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg BACKUP_SG -snapshot_name targetless_snapshot link
```

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg TEST_SG -snapshot_name targetless_snapshot -gen 1 link
```

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg DEV_SG -snapshot_name targetless_snapshot -gen 2 link
```

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg QA_SG -snapshot_name targetless_snapshot -gen 3 link
```

Refresh (rollback) QA_SG target device to the original snapshot image:

```
symsnapvx -sid 001 -sg StorageGroup1 -lnsg QA_SG -snapshot_name targetless_snapshot -gen 3 relink
```

This process can be repeated for any of the other test environments.

Provision test or development environments with cascading SnapVX snapshots

When sensitive data needs to be presented to test or development environments, some data may require obfuscation to protect the data before presenting it to the test or development hosts. A cascading snapshot from a linked target and linking targets from the cascaded snapshot provides the obscured data environment.

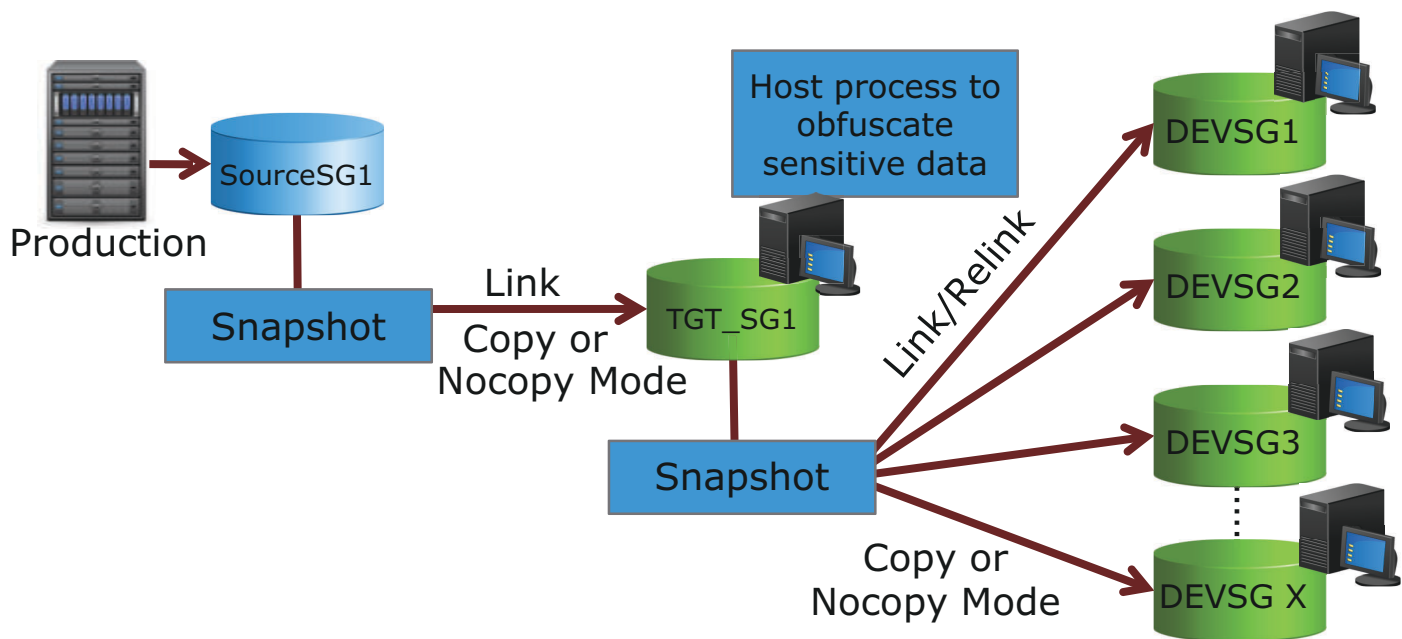


Figure 7. SnapVX cascaded snapshots

The cascading snapshot configuration, shown in the figure above, provides the following:

- Snapshots of production volumes can be linked to a target storage group which is part of a masking view for presenting to an interim host. The interim host processes the host data to obfuscate sensitive data such as social security numbers.
- A snapshot from the target storage group is linked to multiple environments, which see the snapshot image without security concerns.
- A relink operation can be performed at any stage on the target storage groups to roll back to a pristine snapshot image.
- At any point in the chain, linked snapshots can be converted to full independent copies if the first level linked copy needs to be refreshed with a newer snapshot image.
- When the test or development environments need to be refreshed, a new snapshot from the source LUN can be taken and relinked to the target storage group (TGT_SG).

Create original snapshot `src_snap`:

```
symsnapvx -sid 001 -sg SOURCESG1 -name src_snap establish
```

Link snapshot `src_snap` to `TGT_SG1`:

```
symsnapvx -sid 001 -sg SOURCESG1 -lnsg TGT_SG1 -snapshot_name src_snap link
```

At this point, `TGT_SG1` can be mounted and updated by host processes.

Create snapshot `obfuscated_snap` off of `TGT_SG1`:

```
symsnapvx -sid 001 -sg TGT_SG1 -name obfuscated_snap establish
```

Link `obfuscated_snap` to the multiple development target devices:

```
symsnapvx -sid 001 -sg TGT_SG1 -lnsg DEVSG1 -snapshot_name obfuscated_snap link
```

```
symsnapvx -sid 001 -sg TGT_SG1 -lnsg DEVSG2 -snapshot_name obfuscated_snap link
```

```
symsnapvx -sid 001 -sg TGT_SG1 -lnsg DEVSG3 -snapshot_name obfuscated_snap link
```

Any of the snapshots can be refreshed at any stage. For example, the following command reverts `DEVSG2` in the development environment back to it's original state when it was first linked:

 **NOTE:** Unmount the volumes at the host side prior to the relink.

```
symsnapvx -sid 001 -sg TGT_SG1 -lmsg DEVSG2 -snapshot_name obfuscated_snap relink
```

This process can be repeated to support multiple versions of the snapshots.

To terminate the snapshots in the previous example:

 **NOTE:** Terminating snapshots in cascaded configuration requires that child snapshots that have a dependency on a higher level snapshot must first be unlinked and terminated before the parent level can be terminated.

1. Unmount the DEVSG volumes on hosts.
2. Unlink the DEVSG storage groups from obfuscated_snap snapshot.
3. Terminate snapshot obfuscated_snap.
4. Terminate the original snapshot src_snap.
5. Remount DEVSG volumes on hosts.

TimeFinder SnapVX State Reference Rules

This chapter details the TimeFinder SnapVX operations supported for devices in various pair states.

Topics:

- Determine SnapVX states/SRDF and ORS operations interaction
- State rules for TimeFinder SnapVX operations with SRDF pair states
- TimeFinder SnapVX operations with ORS pair states
- State rules for source control operations with SnapVX and Clone source states

Determine SnapVX states/SRDF and ORS operations interaction

This section describes how SnapVX states are determined. This identifies SnapVX source device states and determines whether the device can be used with various SRDF and ORS operations.

Display examples for each active state are shown in [SnapVX State Determination Examples](#) on page 38.

TimeFinder SnapVX operations states

The following table describes the prerequisites, transient states, and final states for all SnapVX control operations.

Table 2. Prerequisites and states for SnapVX control operations.

Operation	Prerequisite	Transient State	Final State
Establish	None	Establish In Progress	Established
Restore	Established If the source device is a link target, it must be fully copied before initiating the restore operation.	Restore In Progress	Restored
Terminate	Established Establish In Progress Restore In Progress	Terminate in Progress	NA
Terminate with FLAG1_RESTORED	Restored	NA	NA
Setmode Copy	Linked NoCopy	Link Copy In Progress	Link Copied
Setmode NoCopy	Link Copy In Progress or Link Copied	NA	Linked
Set secure	Established If the snapshot is a secure snapshot either from a previous <code>set secure</code> or <code>establish -secure</code> operation, a subsequent <code>set secure</code> operation must set a time	NA	Secure snapshot

Table 2. Prerequisites and states for SnapVX control operations. (continued)

Operation	Prerequisite	Transient State	Final State
	greater than current expiration time setting.		
Set TTL	Established	NA	NA
Link	Established	NA	Linked
Link with FLAG1_COPY	Established	Link Copy In Progress	Link Copied
Unlink	Linked or Link Copied If the target is the source of another snapshot, the link must be fully copied.	NA	NA
Relink	Linked or Link Copied	NA	Linked
Relink with FLAG1_COPY	Linked or Link Copied	Link Copy In Progress	Link Copied
Rename	Established	NA	NA

Determine SnapVX states

The following table details the SnapVX CLIs that are used to determine SnapVX states.

Table 3. Determine SnapVX State

SnapVX State	SnapVX CLI	Determine State
Established	<code>symsnapvx list</code>	The flags field indicates: (F)ailed: = . for No Failure
Restore In Progress	<code>symsnapvx list -restored -detail</code>	The Done(%) field is not at 100%
Restored	<code>symsnapvx list -restored -detail</code>	The Done(%) field is at 100%
Terminate in Progress	<code>symsnapvx list</code>	The snapshot is still seen on the display.
Terminated	<code>symsnapvx list</code>	The snapshot is not seen on the display.
Failed	<code>symsnapvx list</code>	The flags field indicates: (F)ailed: <ul style="list-style-type: none"> • :X = General Failure • . = No Failure • :S = SRP Failure • :R = RDP Failure • :M = Mixed Failure
Link Copy In Progress	<code>symsnapvx list -link [-tgt] -detail</code>	The flags field indicates: (C)opy = I for CopyInProg The Done (%) field is not at 100%

Table 3. Determine SnapVX State (continued)

SnapVX State	SnapVX CLI	Determine State
		Using -tgt is optional.
Link Copied	symsnapvx list -link [-tgt] -detail	The flags field indicates: (C)opy = C for Copied or D for Copied/Destaged The Done (%) field is at 100% Using -tgt is optional.
Linked	symsnapvx list -linked	The flags field indicates : (C)opy = . for NoCopy Link
Secured	symsnapvx list -secured	Secured snapshots seen on the display

SnapVX State Determination Examples

Established

```
#> symsnapvx -cg Sparrow -snapshot_name Bailey list

Composite Group (CG) Name : Sparrow
CG's Type : ANY
Number of Symmetrix Units : 1
CG's Symmetrix ID : 000197300076 (Microcode Version: 5977)
-----
Sym                               Flags
Dev  Snapshot Name                Gen  FLRG TSEB Snapshot Timestamp
-----
000A0 Bailey                      1 .... Fri Oct 24 15:51:19 2014
000A1 Bailey                      1 .... Fri Oct 24 15:51:19 2014

Flags:

(F)ailed      : X = General Failure, . = No Failure,
                S = SRP Failure, R = RDP Failure,
(L)ink        : X = Link Exists, . = No Link Exists
(R)estore     : X = Restore Active, . = No Restore Active
(G)CM         : X = GCM, . = Non-GCM
(T)ype        : Z = zDP snapshot, . = normal snapshot
(S)ecured     : X = Secured, . = No Secure
(E)xpanded    : X = Source Device Expanded, . = Source Device Not Expanded
(B)ackground  : X = Background define in progress, . = No Background defined
```

Restore in Progress

```
#> symsnapvx -cg Sparrow -sna Bailey list -restored -detail

Composite Group (CG) Name : Sparrow
CG's Type : ANY
Number of Symmetrix Units : 1
CG's Symmetrix ID : 000197300076 (Microcode Version: 5977)
-----
Sym                               Flgs                               Remaining  Done
Dev  Snapshot Name                Gen  FDS   Snapshot Timestamp        (Tracks)  (%)
-----
000A0 Bailey                      0    ...   Fri Oct 24 15:51:18 2014  72206     47
000A1 Bailey                      0    ...   Fri Oct 24 15:51:18 2014   0         100

Flgs:
```

```

(F)ailed   : X = General Failure, . = No Failure,
              S = SRP Failure, R = RDP Failure, M = Mixed Failure
(D)efined  : X = All Tracks Defined, . = Define in progress
(S)napshot : X = Has snapshot waiting for define to complete
              . = No snapshot waiting for define to complete

```

Restored

```
#> symsnapvx -cg Sparrow -sna Bailey list -restored -detail
```

```

Composite Group (CG) Name : Sparrow
CG's Type                 : ANY
Number of Symmetrix Units : 1
CG's Symmetrix ID         : 000197300076   (Microcode Version: 5977)

```

Sym Dev	Snapshot Name	Gen	Flgs FDS	Snapshot Timestamp	Remaining (Tracks)	Done (%)
000A0	Bailey	0	...	Fri Oct 24 15:51:18 2014	0	100
000A1	Bailey	0	...	Fri Oct 24 15:51:18 2014	0	100

Flgs:

```

(F)ailed   : X = General Failure, . = No Failure,
              S = SRP Failure, R = RDP Failure, M = Mixed Failure
(D)efined  : X = All Tracks Defined, . = Define in progress
(S)napshot : X = Has snapshot waiting for define to complete
              . = No snapshot waiting for define to complete

```

Link Copy in Progress

```
#> symsnapvx -cg Sparrow -sna Bailey list -linked -detail
```

```

Composite Group (CG) Name : Sparrow
CG's Type                 : ANY
Number of Symmetrix Units : 1
CG's Symmetrix ID         : 000197300076   (Microcode Version: 5977)

```

Sym Dev	Snapshot Name	Gen	Link Dev	Flgs FCMDS	Snapshot Timestamp	Remaining (Tracks)	Done (%)
000A0	Bailey	0	000B0	.I...	Fri Oct 24 15:51:19 2014	118579	14
000A1	Bailey	0	000B1	.I...	Fri Oct 24 15:51:19 2014	128275	7

Flgs:

```

(F)ailed   : F = Force Failed, X = Failed, . = No Failure
(C)opy      : I = CopyInProg, C = Copied, D = Copied/Destaged, . = NoCopy Link
(M)odified  : X = Modified Target Data, . = Not Modified
(D)efined  : X = All Tracks Defined, . = Define in progress
(S)napshot : X = Has snapshot waiting for define to complete
              . = No snapshot waiting for define to complete

```

Link Copied

```
#> symsnapvx -cg Sparrow -sna Bailey list -linked -detail
```

```

Composite Group (CG) Name : Sparrow
CG's Type                 : ANY
Number of Symmetrix Units : 1
CG's Symmetrix ID         : 000197300076   (Microcode Version: 5977)

```

Sym Dev	Snapshot Name	Gen	Link Dev	Flgs FCMDS	Snapshot Timestamp	Remaining (Tracks)	Done (%)
000A0	Bailey	0	000B0	.D.X.	Fri Oct 24 15:51:18 2014	0	100
000A1	Bailey	0	000B1	.D.X.	Fri Oct 24 15:51:18 2014	0	100

Flgs:

```

(F)ailed      : F = Force Failed, X = Failed, . = No Failure
(C)opy        : I = CopyInProg, C = Copied, D = Copied/Destaged, . = NoCopy Link
(M)odified    : X = Modified Target Data, . = Not Modified
(D)efined     : X = All Tracks Defined, . = Define in progress
(S)napshot    : X = Has snapshot waiting for define to complete
                . = No snapshot waiting for define to complete

```

Linked

```
#> symsnapvx -cg Sparrow -sna Bailey list -linked
```

```
Composite Group (CG) Name : Sparrow
```

```
CG's Type          : ANY
```

```
Number of Symmetrix Units : 1
```

```
CG's Symmetrix ID      : 000197300076      (Microcode Version: 5977)
```

```

-----
Sym          Link  Flgs
Dev  Snapshot Name      Gen  Dev  FCMSD  Snapshot Timestamp
-----
000A0 Bailey          0 000B0 ..... Fri Oct 24 15:51:18 2014
000A1 Bailey          0 000B1 ..... Fri Oct 24 15:51:18 2014

```

```
Flgs:
```

```

(F)ailed      : F = Force Failed, X = Failed, . = No Failure
(C)opy        : I = CopyInProg, C = Copied, D = Copied/Destaged, . = NoCopy Link
(M)odified    : X = Modified Target Data, . = Not Modified
(D)efined     : X = All Tracks Defined, . = Define in progress
(S)napshot    : X = Has snapshot waiting for define to complete
                . = No snapshot waiting for define to complete

```

State rules for TimeFinder SnapVX operations with SRDF pair states

This section identifies the **symsnapvx** control operations that are available for SRDF pair states.

SRDF pair states

Certain TimeFinder copy operations are not allowed on devices that are SRDF protected, as these operations can conflict with each other. The availability of some actions depends on the current state of SRDF pairs. Refer to your product guide for details about supported features.

The following table provides a description the various SRDF pair states.

Table 4. SRDF pair states

State	Description
ActiveActive	<p>The R1 and the R2 are currently in the default SRDF/Metro configuration which uses a Witness array:</p> <ul style="list-style-type: none"> There are no invalid tracks between the two pairs. The R1 and the R2 are Ready (RW) to the hosts.
ActiveBias	<p>The R1 and the R2 are currently in an SRDF/Metro configuration using bias:</p> <ul style="list-style-type: none"> The user could have specified “use bias” during the establish/restore action or the Witness array is not available. There are no invalid tracks between the two pairs. The R1 and the R2 are Ready (RW) to the hosts.

Table 4. SRDF pair states (continued)

State	Description
Consistent	The R2 mirrors of SRDF/A devices are in a Consistent state. Consistent state signifies the normal state of operation for device pairs operating in asynchronous mode.
Failed Over	The R1 is currently Not Ready or write disabled and operations have been failed over to the R2.
Invalid	The default state when no other SRDF state applies. The combination of R1, R2, and SRDF link states and statuses do not match any other pair state. This state may occur if there is a problem at the disk director level.
Mixed	A composite device group SRDF pair state. There exists different SRDF pair states within a device group.
Partitioned	Solutions Enabler is currently unable to communicate through the corresponding SRDF path to the remote array. Partitioned may apply to devices within an RA group. For example, if Solutions Enabler is unable to communicate to a remote array via an RA group, devices in that RA group will be marked as being in the Partitioned state.
R1 Updated	The R1 is currently Not Ready or write disabled to the host, there are no local invalid tracks on the R1 side, and the link is Ready or write disabled.
R1 UpdInProg	The R1 is currently Not Ready or write disabled to the host, there are invalid local (R1) tracks on the source side, and the link is Ready or write disabled.
Split	The R1 and the R2 are currently Ready to their hosts, but the link is Not Ready or write disabled.
Suspended	The SRDF links have been suspended and are Not Ready or write disabled. If the R1 is Ready while the links are suspended, any I/O will accumulate as invalid tracks owed to the R2.
Synchronized	The R1 and the R2 are currently in a Synchronized state. The same content exists on the R2 as the R1. There are no invalid tracks between the two pairs.
SyncInProg	A synchronization is currently in progress between the R1 and the R2. There are existing invalid tracks between the two pairs and the logical link between both sides of an SRDF pair is up.
Transmit Idle	The SRDF/A session cannot push data in the transmit cycle across the link because the link is down.

TimeFinder SnapVX R1 source

The following table identifies the SnapVX control operations that are allowed on R1 source device while SRDF is in various pair states.

Table 5. SnapVX control operations allowed on R1 source by SRDF state

SnapVX Control Operation:	SRDF State:													
	Sync in Prog	Synchronized	Split	Suspended	Failed over	Partitioned 1	Partitioned 2	R1 updated	R1 updinprog	Invalid	Consistent	Transmitidle	ActiveActive	ActiveBias
Establish	Y ^{ab}	Y	Y ^b	Y ^b	Y ^b	Y ^b	N	Y	N	N	Y ^{ab}	Y	Y	Y
Restore	Y ^{acd}	Y ^c	Y	Y	N	Y	N	N	N	N	Y ^{ac}	Y ^{ac}	N	N
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y=Yes

N=No

a = Action not allowed if there are local invalids on the R1side or remote invalids on the R2 side.

b = Not allowed on both sides of operation.

c = The remote option (-remote) must be applied.

d = Not allowed if the device is part of a SRDF/Metro configuration.

Note: The Partitioned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

The Partitioned2 pair state indicates the remote array is not in the SYMAPI database and was not discovered, or was removed from this database.

TimeFinder SnapVX R2 source

The following table identifies the SnapVX control operations that are allowed on R2 source device while SRDF is in various pair states.

Table 6. SnapVX control operations allowed on R2 source by SRDF state

SnapVX Control Operation:	SRDF State:													
	Sync in Prog	Synchronized	Split	Suspended	Failed over	Partitioned 1	Partitioned 2	R1 updated	R1 updinprog	Invalid	Consistent	Transmitidle	ActiveActive	ActiveBias
Establish	N	Y ^a	Y ^{b,c}	Y ^c	Y ^c	Y ^c	N	Y ^c	Y ^c	N	Y ^c	N	Y	Y
Restore	N	N	Y ^b	Y ^b	Y ^b	Y ^b	N	N	N	N	N	N	N	N
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y=Yes

N=No

a = Not allowed if Adaptive Copy.

b = Not allowed if target device is an R2 larger than the R1.

c = Not allowed on both sides operation.

Note: The Partitioned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

The Partitioned2 pair state indicates the remote array is not in the SYMAPI database and was not discovered, or was removed from this database.

TimeFinder SnapVX R1 target

The following table identifies the SnapVX control operations that are allowed on R1 target device while SRDF is in various pair states.

Table 7. SnapVX control operations allowed on R1 target by SRDF state

SnapVX Control Operation:	SRDF State:													
	Sync in Prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
Link/Relink	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Link/Relink Copy	Y ^{abc}	Y ^b	Y	Y	N	Y	N	N	N	N	Y ^{ab}	Y ^{ab}	N	N
Unlink	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y=Yes

N=No

a = Action not allowed if there are local invalids on the R1 side or remote invalids on the R2 side

b = The remote option (-remote) must be applied

c = Not allowed if the device is part of a SRDF/Metro configuration

Note: The Partitioned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

The Partitioned2 pair state indicates the remote array is not in the SYMAPI database and was not discovered, or was removed from this database.

TimeFinder SnapVX R2 target

The following table identifies the SnapVX control operations that are allowed on R2 target device while SRDF is in various pair states.

Table 8. SnapVX control operations allowed on R2 target by SRDF state

SnapVX Control Operation:	SRDF State:													
	Sync in Prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
Link/Relink Copy	N	N	Y ^b	Y ^b	Y ^{ab}	Y ^b	N	N	N	N	N	N	N	N
Unlink	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y=Yes

N=No

a = Not allowed if Async.

b = Not allowed if target device is an R2 larger than the R1.

Note: The Partitioned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

The Partitioned2 pair state indicates the remote array is not in the SYMAPI database and was not discovered, or was removed from this database.

TimeFinder SnapVX operations with ORS pair states

Only the SnapVX `terminate` command is allowed on the SnapVX source or target device that has ORS `rcopy` push or pull sessions. The `rcopy` operation can be in the following states:

- None
- Create in prog
- Created
- Copy in progress
- Copy on write
- Copied
- Recreate in progress
- Recreated
- Terminate in Progress
- Failed
- Invalid
- Verify in progress
- Restore in progress
- Restored
- Precopy
- Sync in prog
- Synchronized
- Stopped

State rules for source control operations with SnapVX and Clone source states

This section identifies the source control operations that are available for SnapVX and TimeFinder/Clone source states.

TimeFinder/Clone operations on a SnapVX source

The following table identifies the allowable TimeFinder/Clone operations (A->B) of SnapVX Source (A).

Allowed operations are noted by Ys.

Table 9. Allowed TimeFinder/Clone operations (A->B) of SnapVX Source (A)

Clone Source Control Operations (A -> B)	SnapVX Source States (A)						
	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
Create	Y		Y				Y
Recreate	Y		Y				Y
Activate	Y		Y				Y
Full Establish	Y		Y				Y
Incremental Establish	Y		Y				Y

Table 9. Allowed TimeFinder/Clone operations (A->B) of SnapVX Source (A) (continued)

Clone Source Control Operations (A -> B)	SnapVX Source States (A)						
	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
Set Mode Copy	Y		Y				Y
Set Mode Nocopy	Y		Y				Y
Set Mode Precopy	Y		Y				Y
Full Restore	Y		Y				Y
Incremental Restore	Y		Y				Y
Split	Y		Y				Y
Terminate	Y	Y	Y	Y	Y	Y	Y

SnapVX source operations off Clone source

The following table identifies the allowable SnapVX Source (A) operations off Clone Source (A).

Allowed operations are noted by Ys.

Table 10. Allowed SnapVX Source (A) operations off Clone Source (A)

SnapVX Source Control Operation (A-B):	Clone Source Pair States (A->B)															
	No session	Create in prog	Created	Recreated	Restored	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
Establish	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y					
Restore	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y					
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rename	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Set secure/TL	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Link/Relink	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Unlink	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Set Mode	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			

VP Snap operations on a SnapVX source

The following table identifies the allowable VP Snap operations (A->B) of SnapVX Source (A).

Allowed operations are noted by Ys.

Table 11. Allowed VP Snap operations (A->B) of SnapVX Source (A)

VP Snap Source - Target Operations (A -> B)	SnapVX Source States (A)						
	No session	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
Create	Y		Y				Y
Recreate	Y		Y				Y
Activate	Y		Y				Y
Full Establish	Y		Y				Y
Incremental Establish	Y		Y				Y
Incremental Restore	Y		Y				Y
Terminate	Y	Y	Y	Y	Y	Y	Y

SnapVX operations on a VP Snap source

The following table identifies the allowable SnapVX Source (A) operations off VP Snap Source (A).

Allowed operations are noted by Ys.

Table 12. Allowed SnapVX Source (A) operations off VP Snap Source (A)

Snapvx Source Control Operation (A):	VP Snap Source->Target States (A->B)								
	No session	Created	Recreated	Copied	Copy on write	Restored	Restore in prog	Invalid	Failed
Establish	Y	Y	Y	Y	Y				
Restore	Y	Y	Y	Y	Y				
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rename	Y	Y	Y	Y	Y	Y			
Set secure/TTL	Y	Y	Y	Y	Y	Y			
Link/Relink	Y	Y	Y	Y	Y	Y			
Unlink	Y	Y	Y	Y	Y	Y	Y	Y	Y
Set Mode	Y	Y	Y	Y	Y	Y			

TimeFinder/Mirror operations on a SnapVX source

The following table identifies the allowable TimeFinder/Mirror operations (A->B) on SnapVX Source (A).

Allowed operations are noted by Ys.

Table 13. Allowed TimeFinder/Mirror operations (A->B) on SnapVX Source (A)

TimeFinder/Mirror STD->BCV Operations (A -> B)	SnapVX Source States (A)						
	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
Full Establish	Y		Y				Y
Incremental Establish	Y		Y				Y
Split	Y		Y				Y
Full Restore	Y		Y				Y
Incremental Restore	Y		Y				Y
Cancel	Y	Y	Y	Y	Y	Y	Y

SnapVX operations on a TimeFinder/Mirror source

The following table identifies the allowable SnapVX Source (A) operations off TimeFinder/Mirror Source (A).

Allowed operations are noted by Ys.

Table 14. Allowed SnapVX Source (A) operations off TimeFinder/Mirror Source (A)

Snapvx Source Control Operatio n (A):	TimeFinder/Mirror STD->BCV Pair States (A->B)									
	Never Established	Sync in prog	Synchronized	Restore in prog	Restored	Split no incremental	Split in prog	Split	Split before sync	Split before restore
Establish	Y							Y		
Restore	Y							Y		
Terminat e	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rename	Y							Y		
Set secure/T TL	Y							Y		
Link/ Relink	Y							Y		
Unlink	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Set Mode	Y							Y		

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